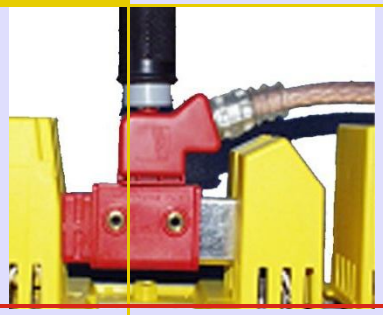
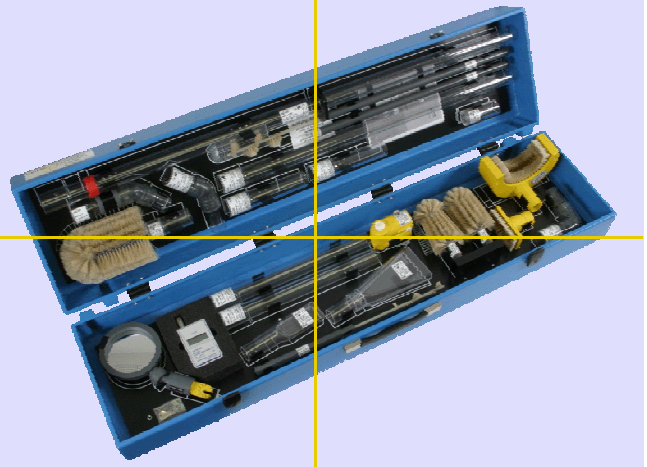
DEHN Safety Equipment

Earthing and Short-circuiting Devices



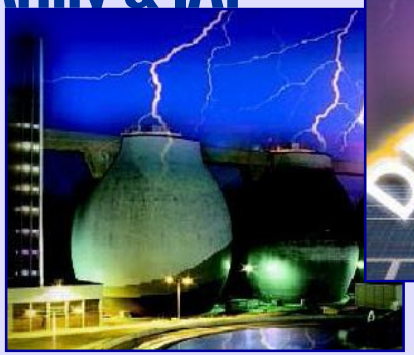
Voltage Detectors Phase Comparators

Switching Rods



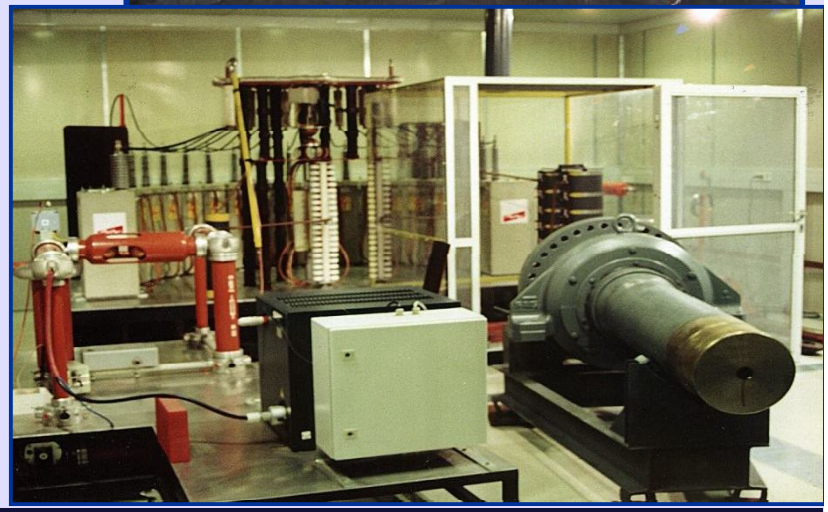
Indian Reference / Presence

- Telecom – BSNL, Indus Towers, Bharti Infratel
- Wind Energy – Suzlon, Enercon, Vestas, Regen Powertech, Leitner, RRB Energy, Gamesa, Win WinD
- Solar – Solar Semiconductor, Lanco Solar, GMR, Tata, Indu projects, Juwi ....
- Process / Oil & Gas – IOCL, BPCL, IGL, GAIL ....
- Railways – Indian Railways & Metro
- Defense – Indian Army & IAF



DEHN Test Facility

- **DEHN Germany has one of the most advanced Test Lab for "Lightning Test Facility" in the world.**
- **With Lightning Impulse Current Generator up to 200 KA at 10/350 µsec & 8/20 µsec.**
- **And Follow Current capability up to 100 KA.**



About Company

•DEHN + SÖHNE is a family owned company, established in 1910.

•Specifically engaged in Lightning Protection and Safety devices.

•Present in more than 80 countries including 11 subsidiary and approx 1500 employees.

•Has one of the most advanced Test Lab on “Lightning Test Facility” in the world, with 250KA 10/350 Microsec Generator.

•“DEHN India Pvt Ltd” is the Indian subsidiary at Plot No 346, Udyog Vihar Ph II, Gurgaon.

Myths & Open Questions

•Barriers, UPS, Isolation Transformer are sufficient to offer Isolation & Lightning Surge Protection !!

•External Lightning Protection may also ATTRACT LIGHTNING !! OR only tall structures are hit by Lightning strikes

•If External Lightning Protection is there, NO NEED of Internal Protections !!

•How we can connect DC, AC OR Electrical & Electronic Earth !! / How to achieve Equipotential Bonding

•How to select & implement the RIGHT Surge Protection solution

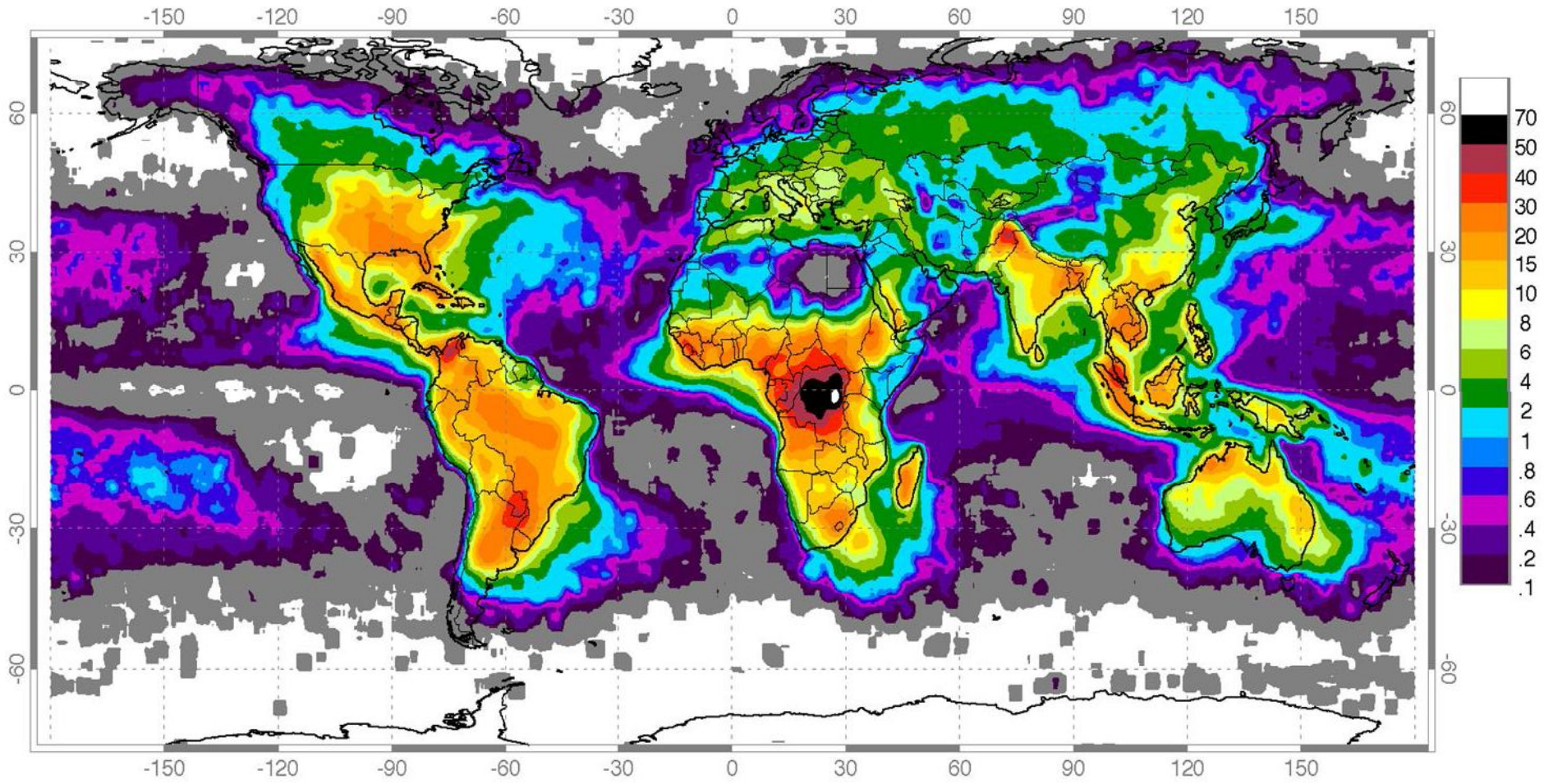
Lightning & Surges may affect

- Filed Devices – Pressure Transmitters, Flow Meters
- I/O Cards OR sometimes even the Power supply
- Load Cells , Digitizer of the Weigh Bridges
- Process loop, Communication & IT network, Gas Analyzers, Surveillance Camera etc
- FIRE in Tank Farms

Introduction to Lightning

- Lightning Facts
- Strikes the Earth @ 100 times every second.
- Each flash can be upward of 1 billion volts.
- Temperature can reach up to 5x sun's surface – 50,000 Degrees Celsius.
- Strikes over 1000 people/year.
- Kills nearly 100 people/year in SAARC Countries.
- Property / Infrastructure damage in the Crores.

Ground Flast Density – Flashes / km2 / Yr.



Indian Lightning Data

Average Number of Thunderstorm days in India
Delhi – 30, Mumbai – 18, Kolkota- 70, Chennai – 47, Bangalore – 45, Bhopal – 44, Jaipur – 39, Cochin – 63, Port Blair 62

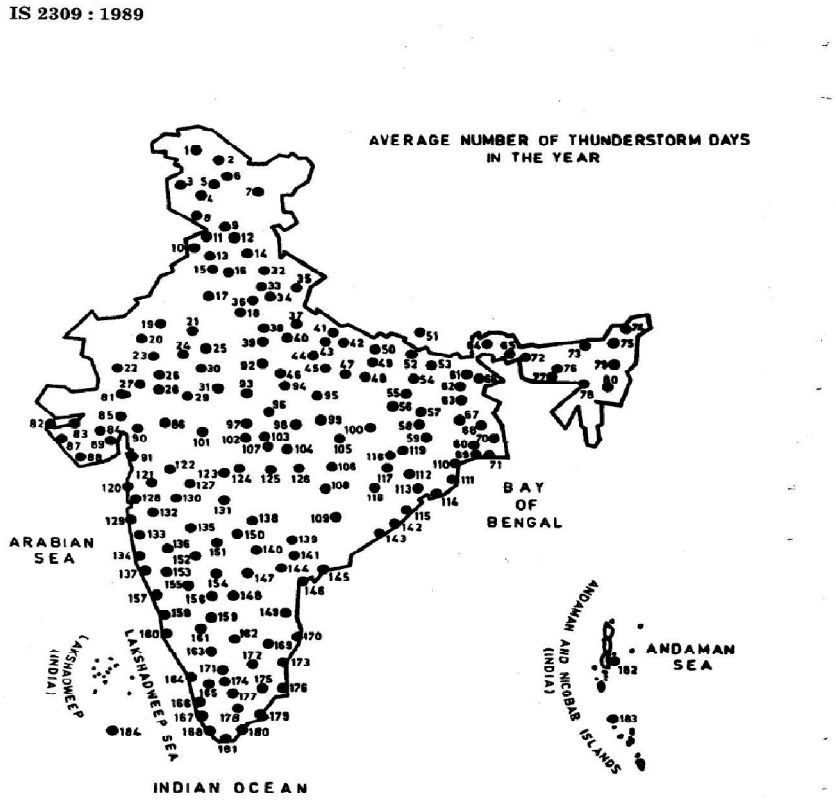
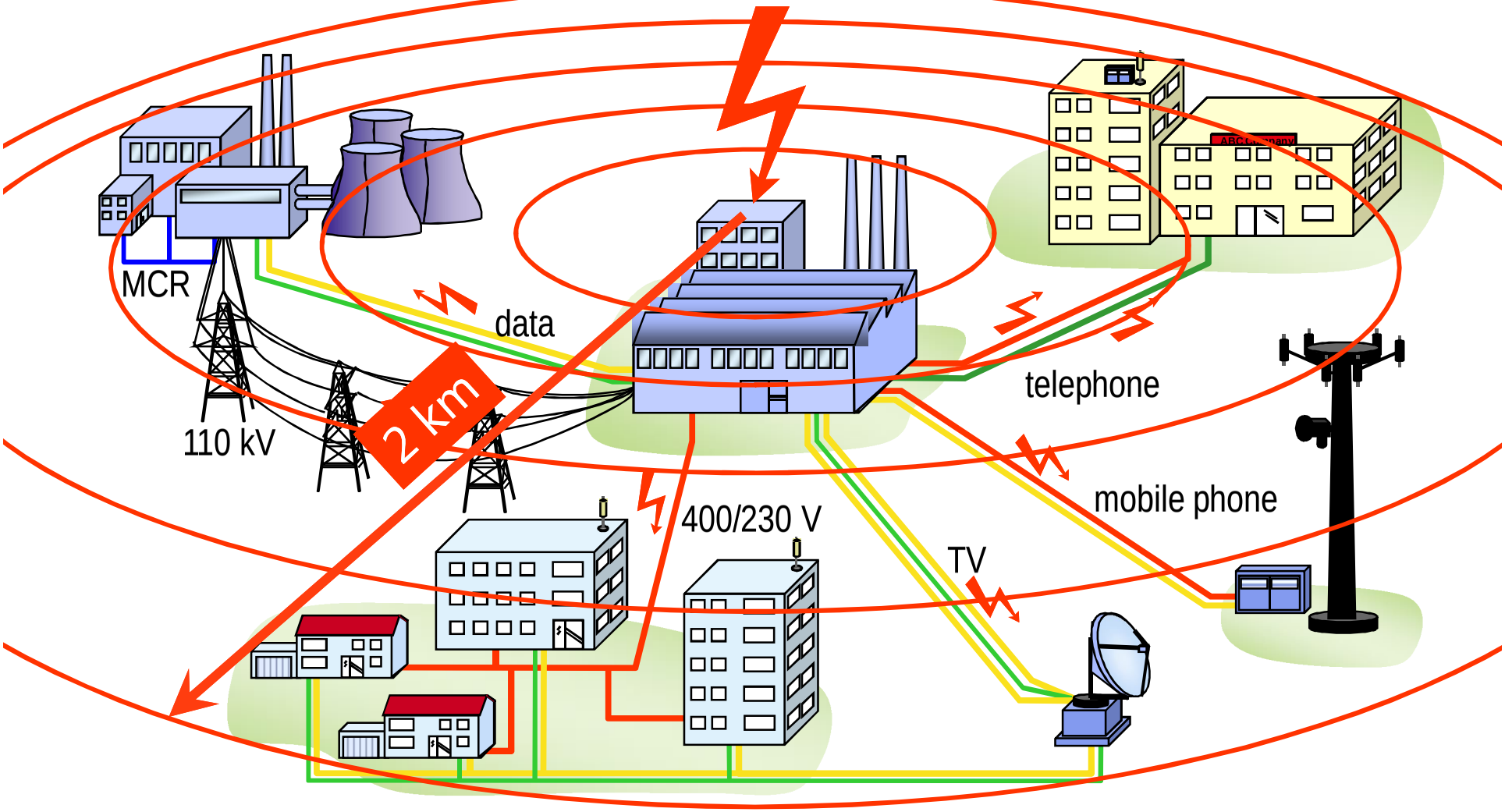


FIG. 1

Thunderstorm Days per year	Lightning Flashes per km²/year	
	Mean	Limits
5	0.2	0.1 - 0.5
10	0.5	0.15 - I
20	1.1	0.3 - 3
30	1.9	0.6 - 5
40	2.8	0.8 - 8
50	3.7	1.2 - 10
60	4.7	1.8 - 12
80	6.9	3 - 17
100	9.2	4 - 20

Lightning may travel

Approx. 10-40 Lightning strikes Per sqkm per Year in India



*Ref.: BLIDS, Siemens AG, Analysis of 2001 - 2005

Lightning Incidents in India

1. May 01, 2012 at 11:49am IST 16 killed in lightning strikes in six districts May 01,

HYDERABAD: Sixteen people were killed in lightning strikes in six districts as heavy thunder showers accompanied by gales created havoc in the coastal districts of the state on Sunday..

2. 30 Apr 2012, Howrah (W.B)

Howrah (WB), Apr 30: Ten persons were killed and ten others got burns when lightning struck a temple, in which these persons were taking shelter from rains on Sunday. The incident took place in Panchrola village, when 22 persons after immersing the goddess' idol were returning home, when they were caught in the downpour. Nine persons died on the spot, while another succumbed to injuries in hospital.

3. Nine died in lightning strikes (Ranchi)

Aug 1 2011 (TNN)GARHWA/SINDRI/LATEHAR: Nine persons were killed after being struck by lightning in Palamu, Latehar and Garwah districts in the past 24 hours, police said on Sunday.

7 tanks hit by a Lightning strike
Oil refinery Pertamina, Cilacap/Java, 1995

Floating Roof Tanks - Tank fire caused by a lightning strike into the Trzebinia refinery, Poland

Recent Fire at Venezuela Plant

Lightning strike sparks fire at Venezuela plant

EL PALITO: Fire and smoke rises from fuel tanks at the El Palito refinery in Carabobo state yesterday. — AP

CARACAS: A lightning strike ignited a fire at a Venezuela oil refinery, officials said Wednesday, less than a month after an explosion at the country's biggest refinery killed 42 people. "The fire is under control and in just a matter of hours we will extinguish it completely" with the help of 120 firefighters, said Asdrubal Chavez, vice president of Venezuela's state oil company PDVSA, in a television interview. The official said the lightning struck two gasoline storage tanks overnight in the El Palito refinery, in Puerto Cabello in the northern state of Carabobo. Chavez said the fire was out in one tank and the other was still burning.

El Palito has a capacity of refining 140,000 barrels of crude oil a day, according to PDVSA's website. Last month, a gas leak at the Amuay refinery triggered an explosion that killed 20 members of a national guard unit assigned to protect the facility, along with some members of their families. The fire spread to three storage tanks before being brought under control three days later. The refinery, Venezuela's biggest, had resumed operations by the end of that week. President Hugo Chavez has ordered an investigation into the causes of the massive explosion—the worst in the history of Venezuela's oil industry while rejecting opposition accusations of declining maintenance and safety at the plant. Venezuela has the largest oil reserves in the world. Its reserves, which the government estimates at 297.57 billion barrels, surpass those of Saudi Arabia, which has the biggest refining capacity. — AFP

Read by: 1567

Protection Against Lightning

Complete Lightning Protection will have..

1. External Lightning Protection

2. Internal Lightning Surge Protection

3. Grounding & Equipotential Bonding

IEC 62305 International Lightning Protection standard

IEC 62305-1	General Principles
IEC 62305-2	Risk Management
IEC 62305-3	Physical Damage to Structures and Life Hazard
IEC 62305-4	Electrical and Electronic Systems

External Lightning Protection

- As per IEC Standard - Air Termination Rod / Franklin Rod

- Standard applicable- IEC 62305, EN 62305, NFPA 780 (USA), UL 96(Installation standard), IS 2309, National Electrical Code, LPI 175 (Australian Installation guide lines), OISD GDN 180

Internal Lightning Surge Protection

Internal Protection is achieved by

1.Power Line Protection –
Standard applicable- IEC 62305, EN 62305,
IEC 61643, IEC 60364-5-53, EN 61643,
UL 1449, **National Electrical Code of India**

2. Control & Data Line Protection - IEC 62305,
EN 62305, IEC 61643, EN 61643, UL 1449,
National Electrical Code of India

Grounding & Bonding

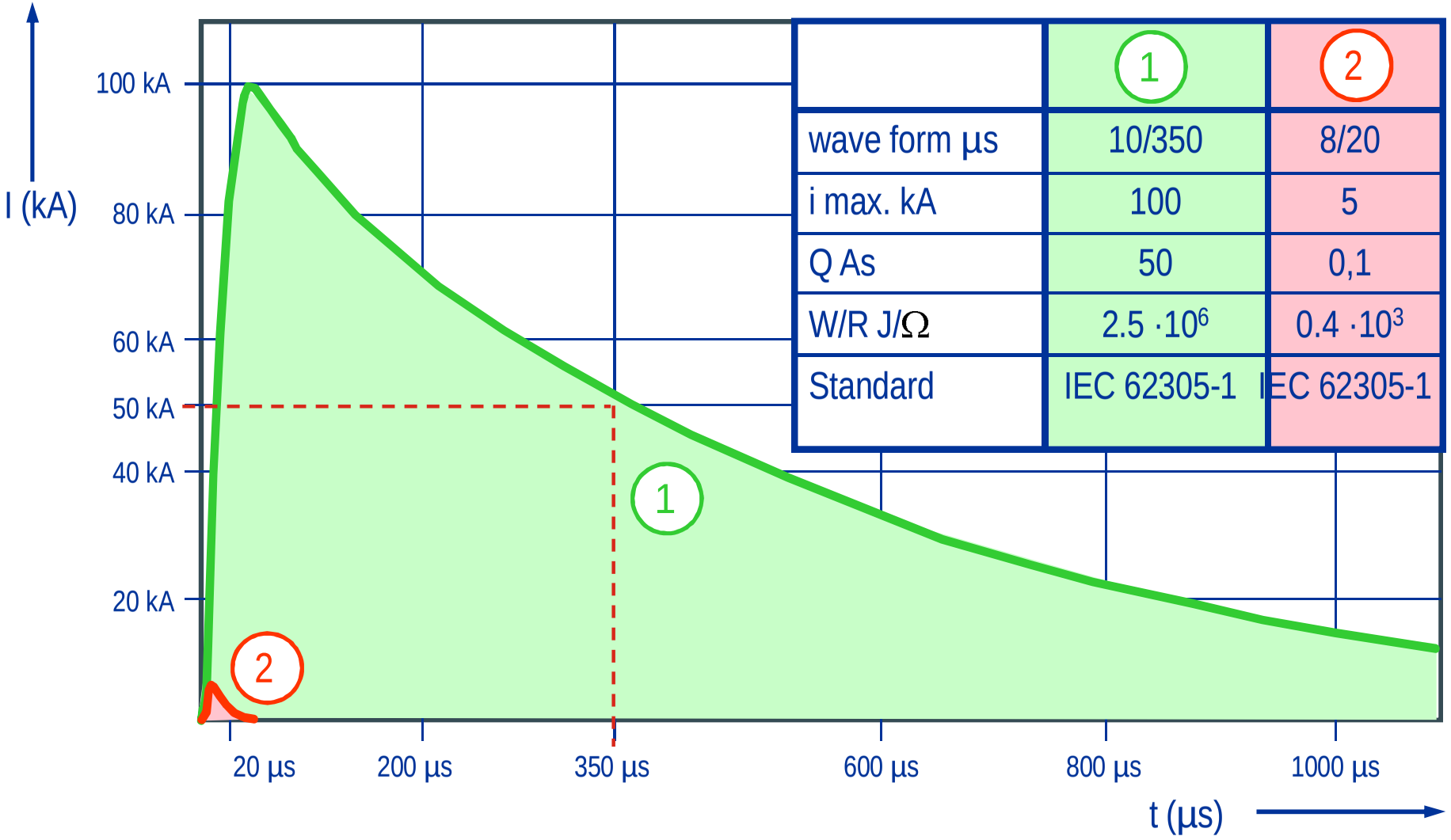
1.Grounding Solution –

Standard applicable- IEC 62305, EN 62305, IS 3043, NFPA 70, IEEE, National Electrical Code 1956

2.Bonding of all Site Earth for Equipotential (using Isolating Spark Gap solution)

Standard applicable - IEC 62305, EN 62305, IEEE guide lines on Earthing, NFPA 70 (USA).

Lightning & Surge Waveform



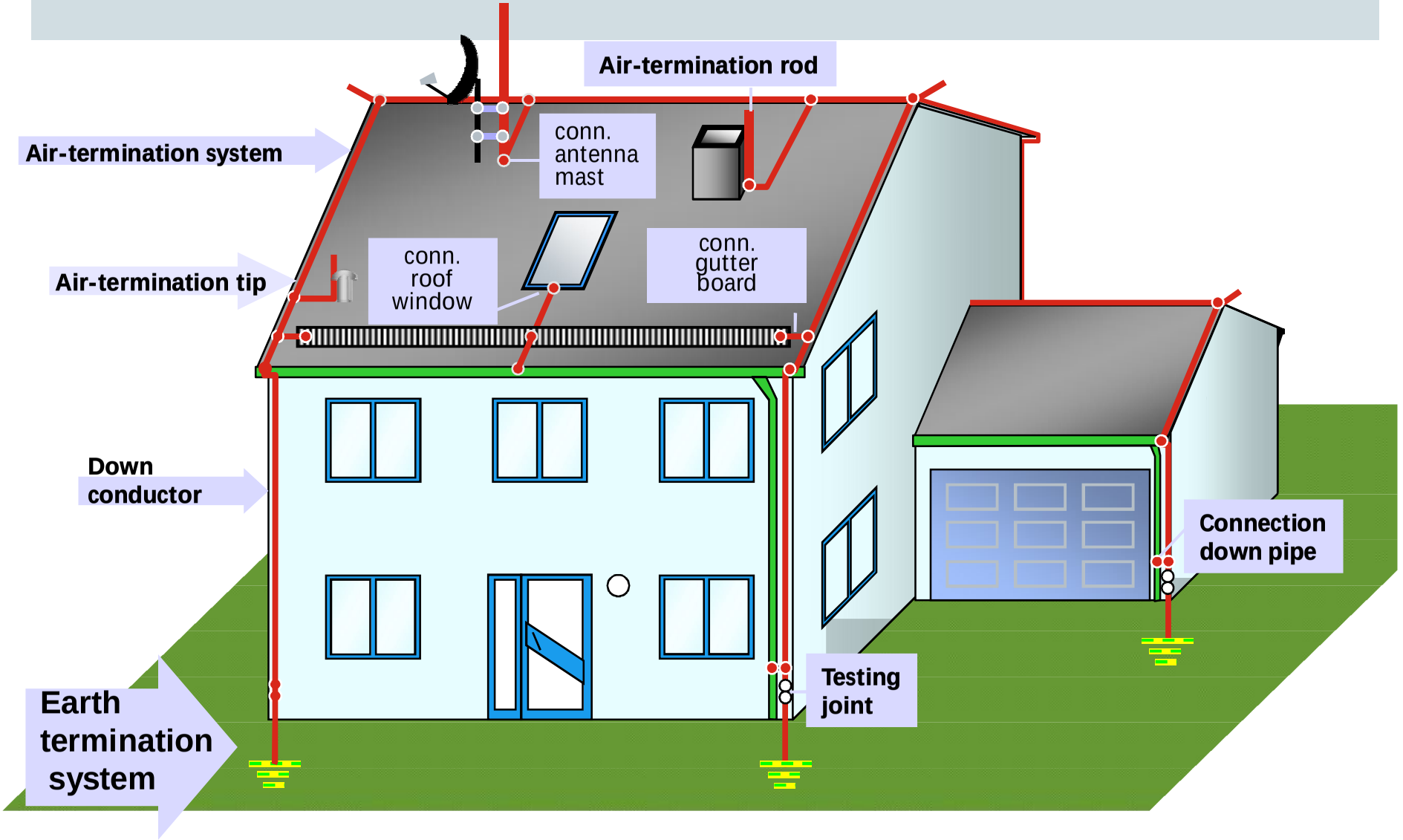
	1	2
wave form µs	10/350	8/20
i max. kA	100	5
Q As	50	0,1
W/R J/Ω	$2.5 \cdot 10^6$	$0.4 \cdot 10^3$
Standard	IEC 62305-1	IEC 62305-1

Maximum values of lightning parameters according to LPL as per IEC 62305

First short stroke Current parameters	Lightning protection level LPL		
	I	II	III-IV
Peak current I (kA)	200	150	100
Spec. energy W/R (MJ/Ω)	10	5.6	2.5
Charge Q short (C)	100	75	50
Time parameters T_1/T_2 (µs/µs)	10/350		

Ref.: IEC 62305-1 , Table 5

Layout of External Protection



External lightning protection system / Air-termination systems

IEC 62305-3

Air-termination components installed on a structure shall be located at corners, exposed points and edges (especially on the upper level of any facades) in accordance with one or more of the following methods.

Acceptable methods to be used in determining the position of the air-termination system include:

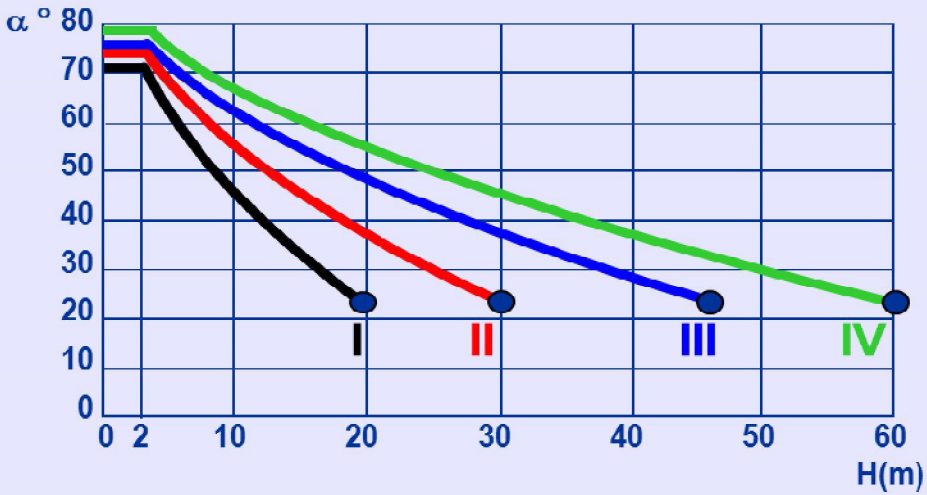
- the protection angle method;
- the rolling sphere method;
- the mesh method.

The rolling sphere method is suitable in all cases.

The protection angle method is suitable for simple-shaped buildings but it is subject to limits of air-termination height.

The mesh method is a suitable form of protection where plane surfaces are to be protected.

External Lightning Protection Methods

Class of LPS	Rolling sphere radius r (m)	Protection angle α°	Mesh size W (m)
I	20		5 x 5
II	30		10 x 10
III	45		15 x 15
IV	60		20 x 20

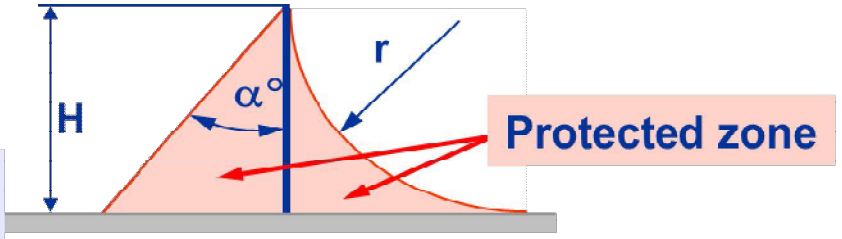
Calculation :Rolling Sphere (Rp)

$Rp = 10 \times I^{0.65}$.

I :Minimum current intensity in KA.

H : Height of the air-termination system above ground

r : Radius of the "rolling sphere" α :Protection angle

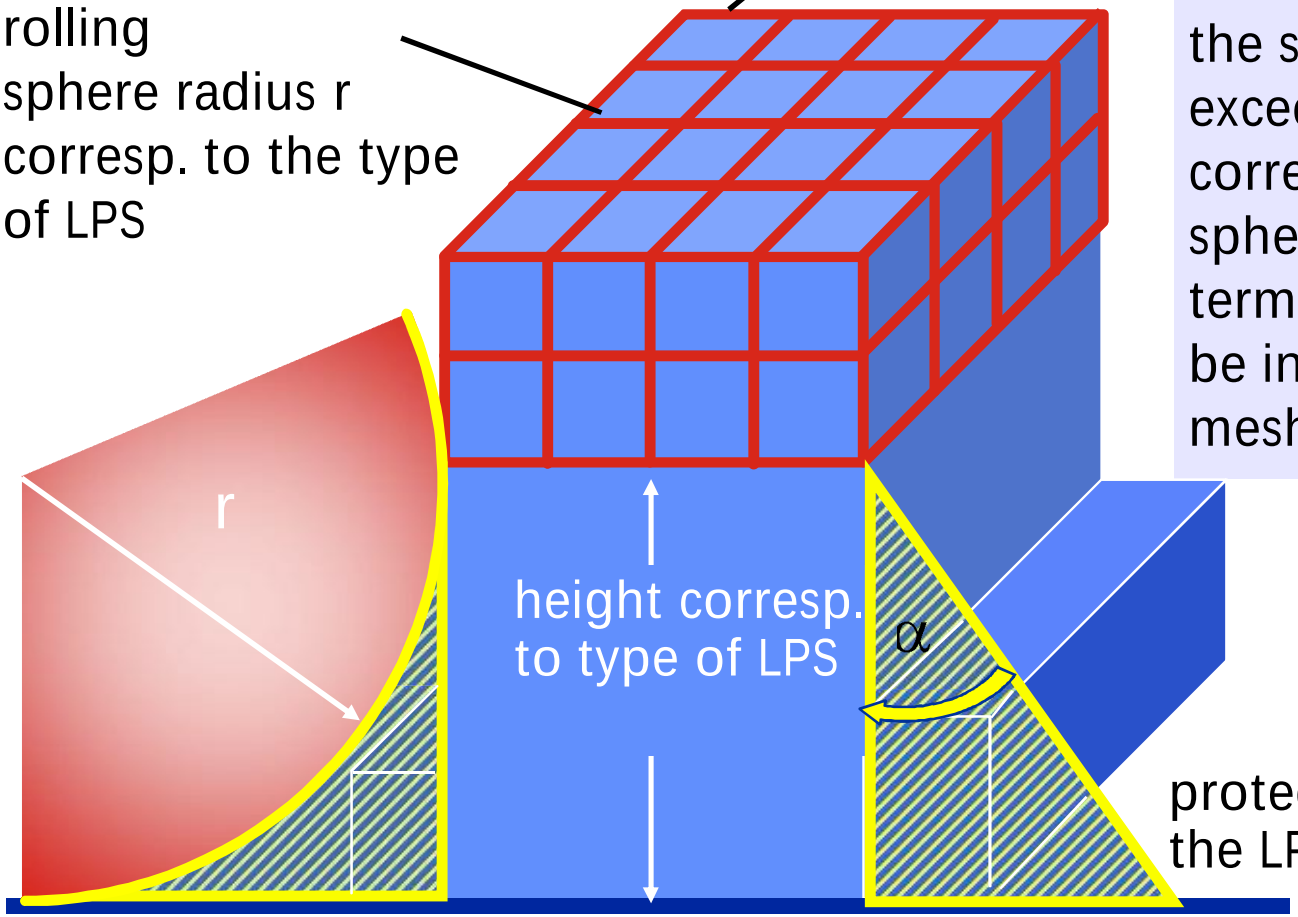


Ref.: IEC 62305-3, subclause 5.2.2 + table 2

External Lightning Protection Methods

mesh size and rolling sphere radius r corresp. to the type of LPS

air-term. system

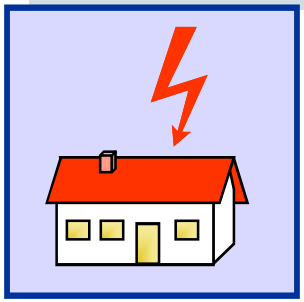


If there are external areas of the structure in heights exceeding the radius of the corresponding rolling sphere (Table 3), an air-termination system has to be installed applying e.g. the mesh method.

protective angle corresp. to the LPS

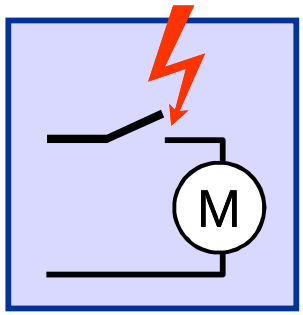
Installation of External Lightning Protection

Influences on Electrical Installation
Causes of Surges



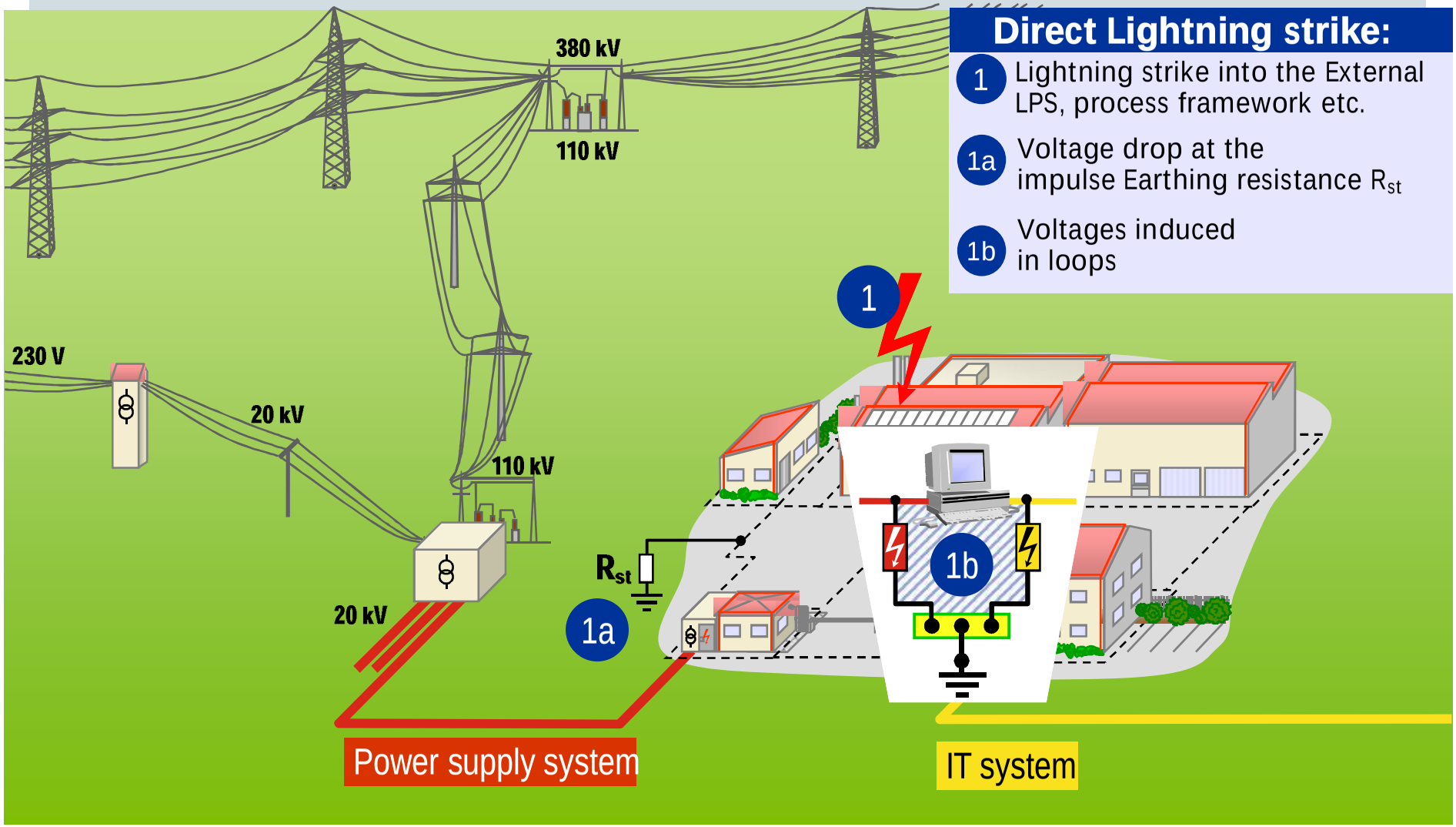
Direct lightning strike (LEMP)
- Galvanic coupling
- Inductive / Capacitive coupling

Indirect lightning strike
- Conducted partial lightning currents
- Inductive / Capacitive coupling



Surges (SEMP)
- Switching operations
- Earth faults / Short circuits
- Tripping fuses
- Parallel installation of power and IT conductor systems

Causes of Overvoltage in case of Lightning discharge in power supply system



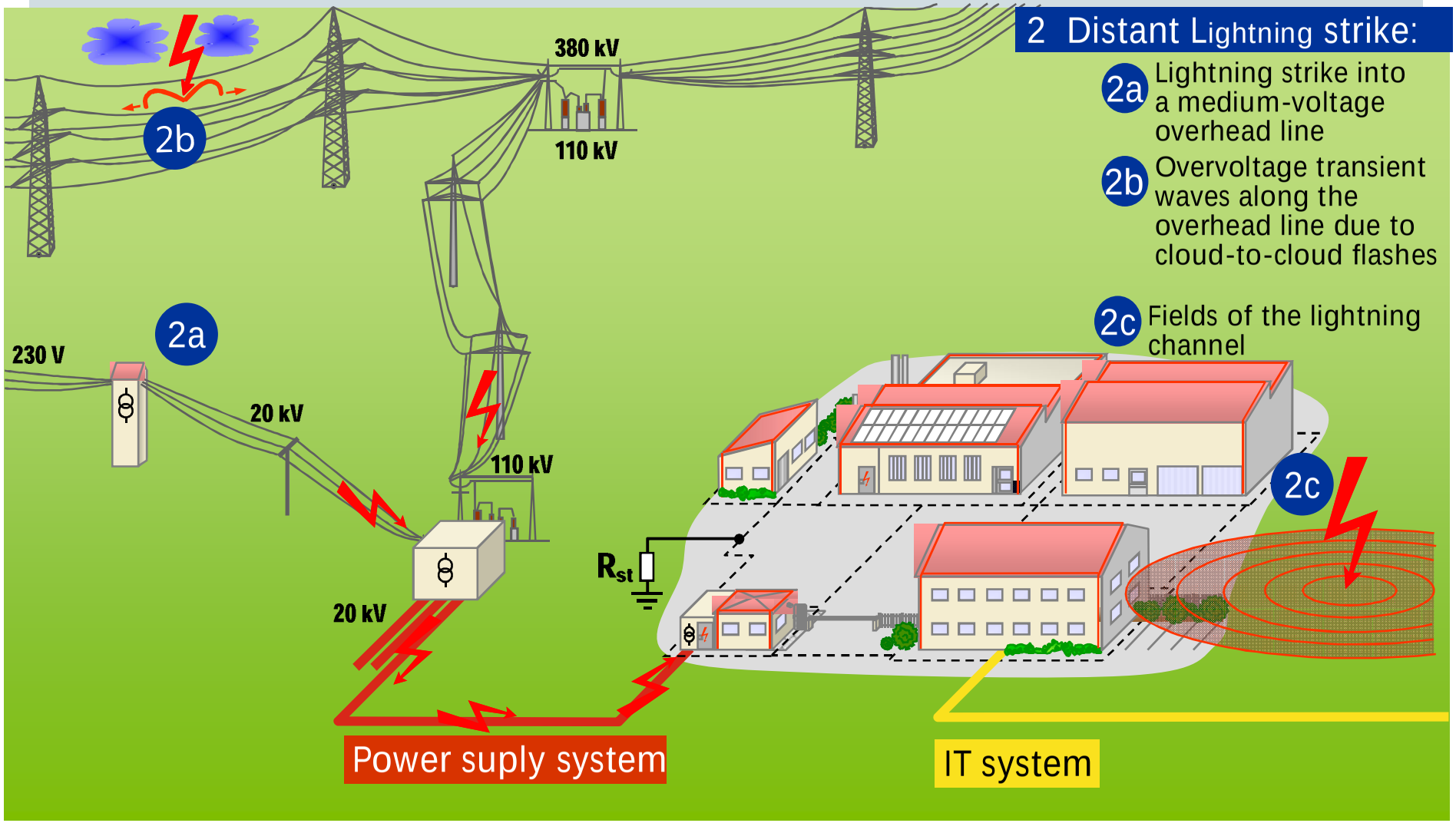
Direct Lightning strike:

1. Lightning strike into the External LPS, process framework etc.

1a. Voltage drop at the impulse Earthing resistance R_{st}

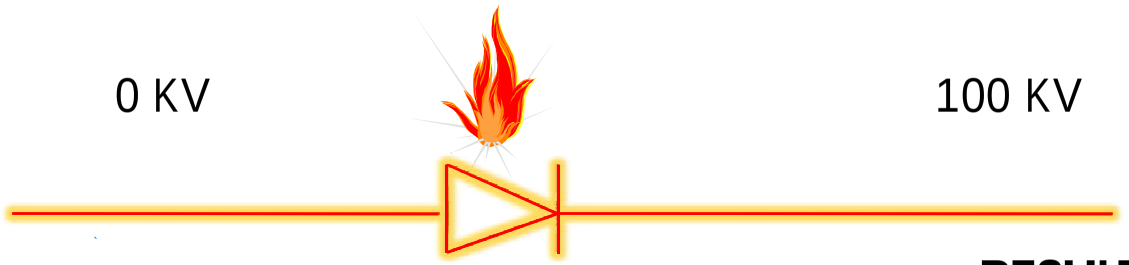
1b. Voltages induced in loops

Causes of Overvoltage in case of Lightning discharge in power supply system



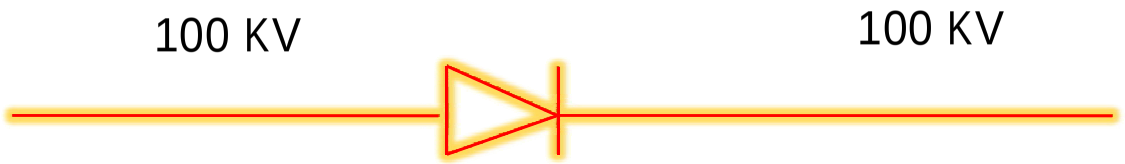
Potential is Dangerous OR Potential Diff. - Equipotential Bonding Concept

CASE 1



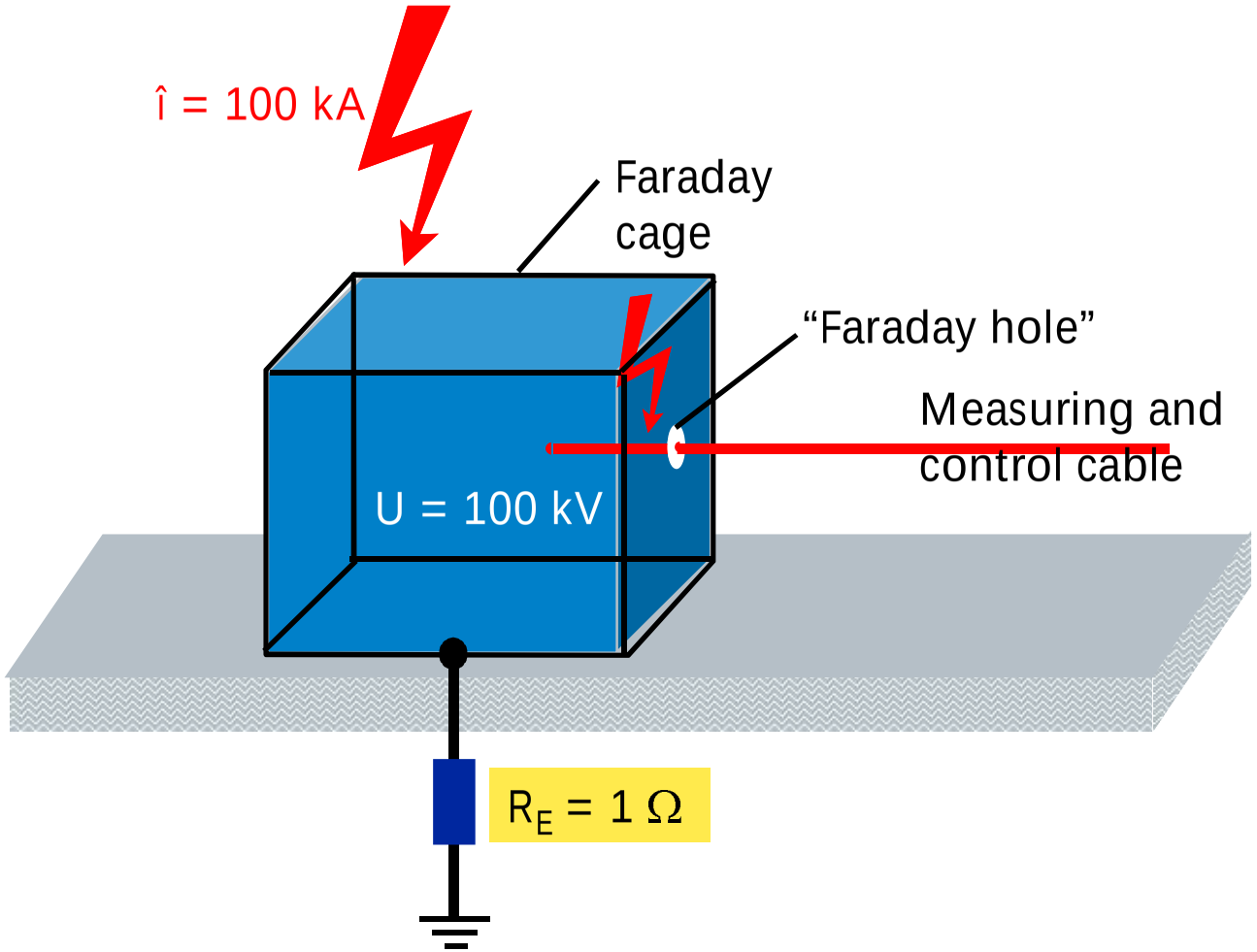
RESULTS - ?

CASE 2



RESULTS - ?

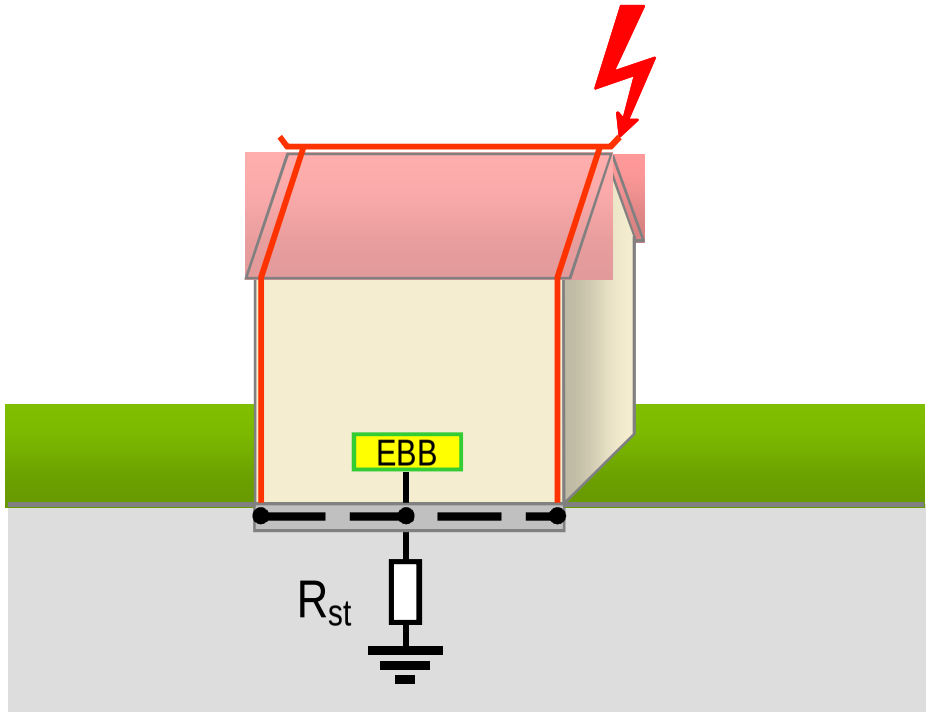
Lightning strike into "Faraday cage" causes flashover into the incoming cable "Faraday hole"



Galvanic Coupling

Lightning Prot. Level	Current amplitude kA
I	200
II	150
III - IV	100

Ref.: IEC 62305

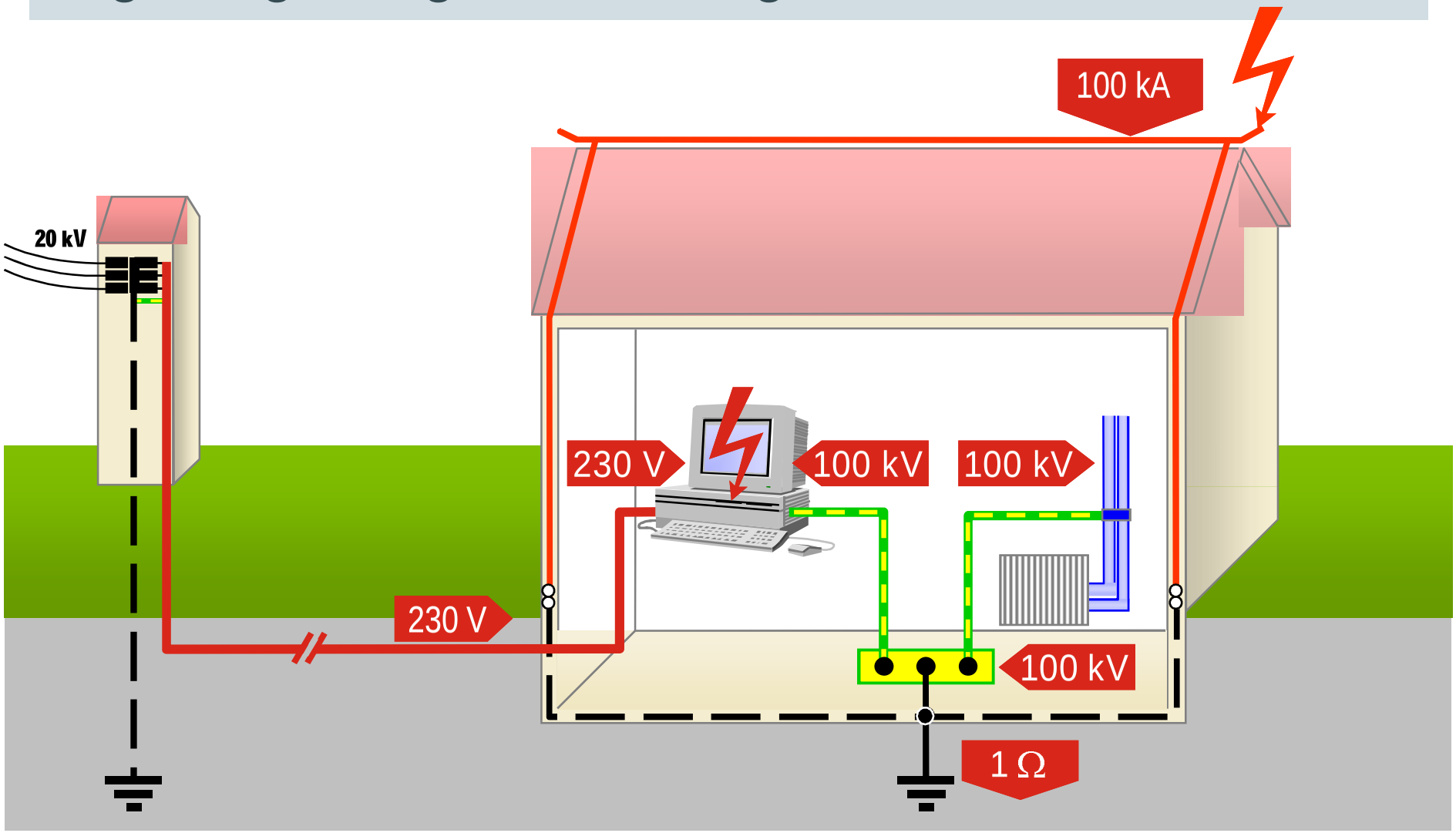


$$\hat{u}_E = \hat{i} \cdot R_{st}$$

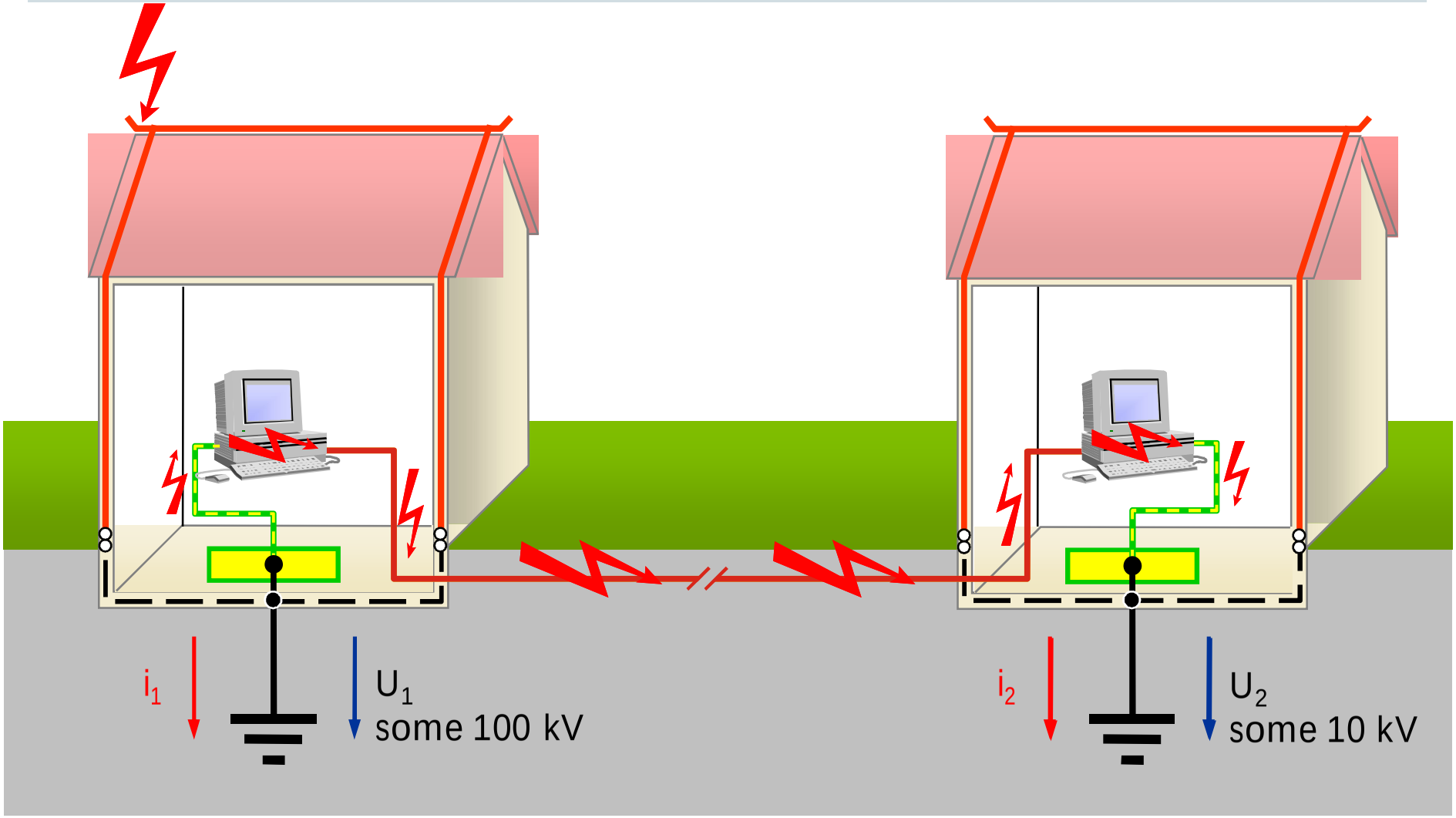
Example:

$\hat{u}_E = 100\ kA \cdot 1\ \Omega = 100\ kV$

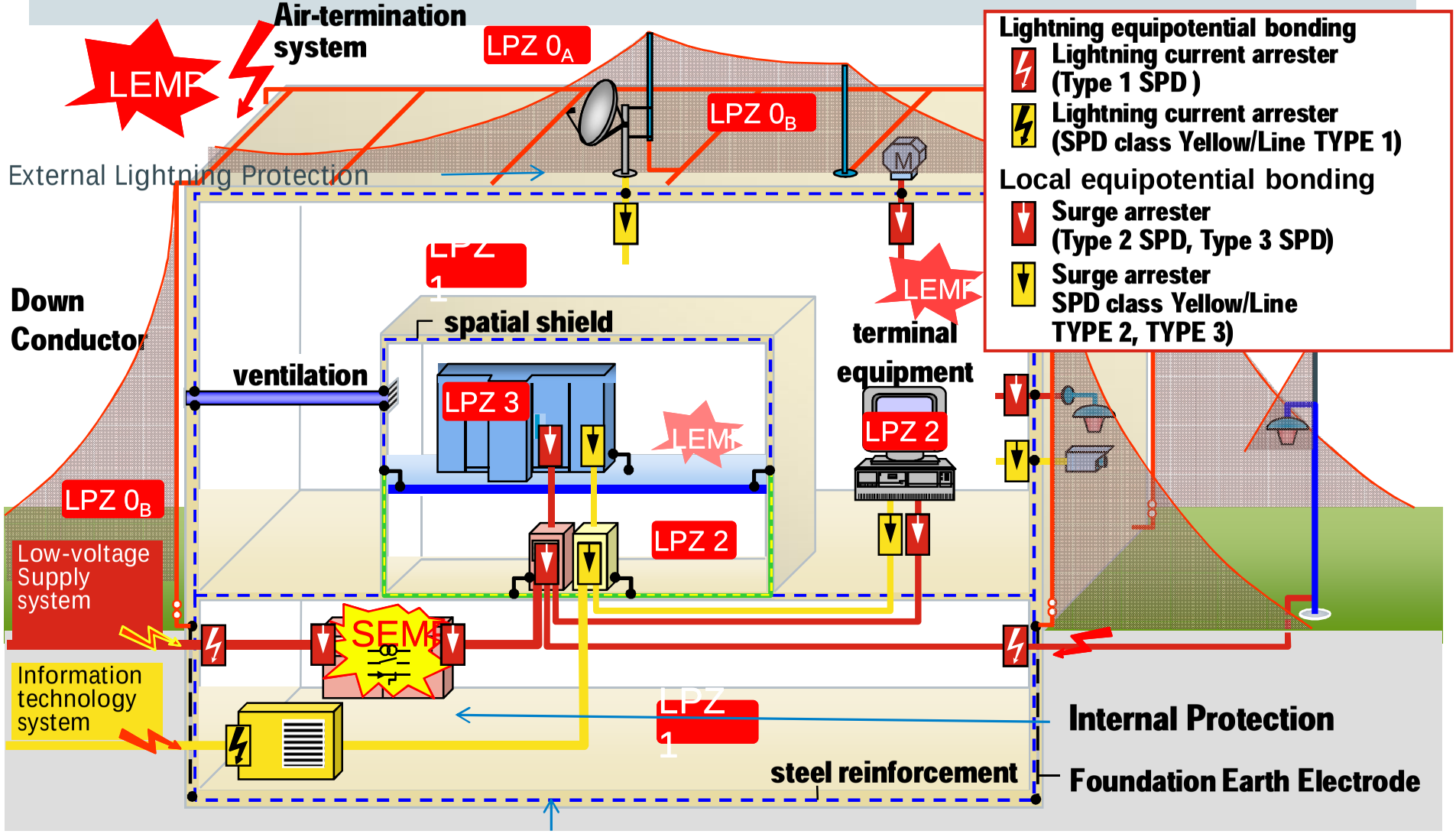
Galvanic coupling
Lightning voltage in a building



Strike into building 1
Surge damage in building 1 and 2

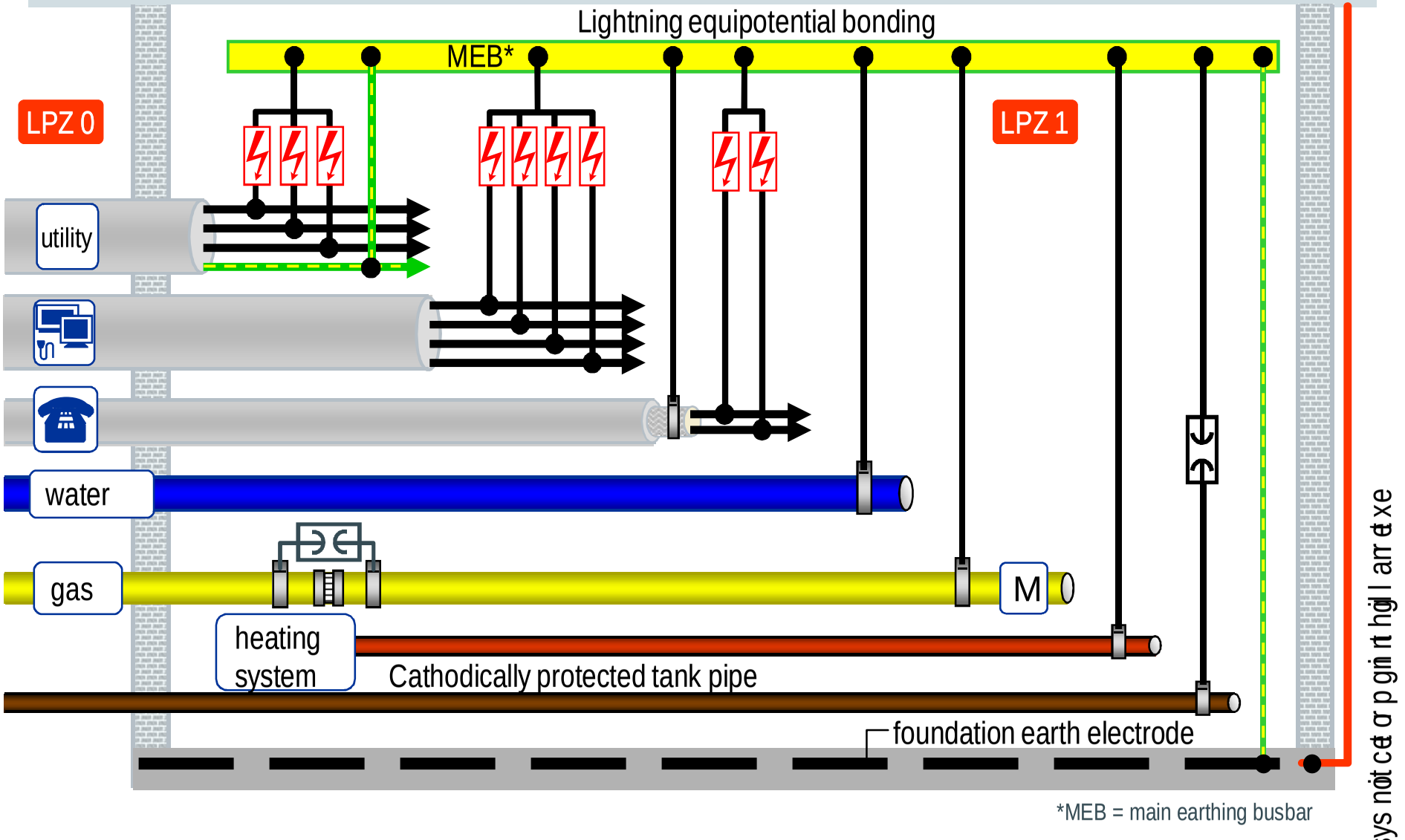


Complete Protection Zone Concept as per IEC 62305

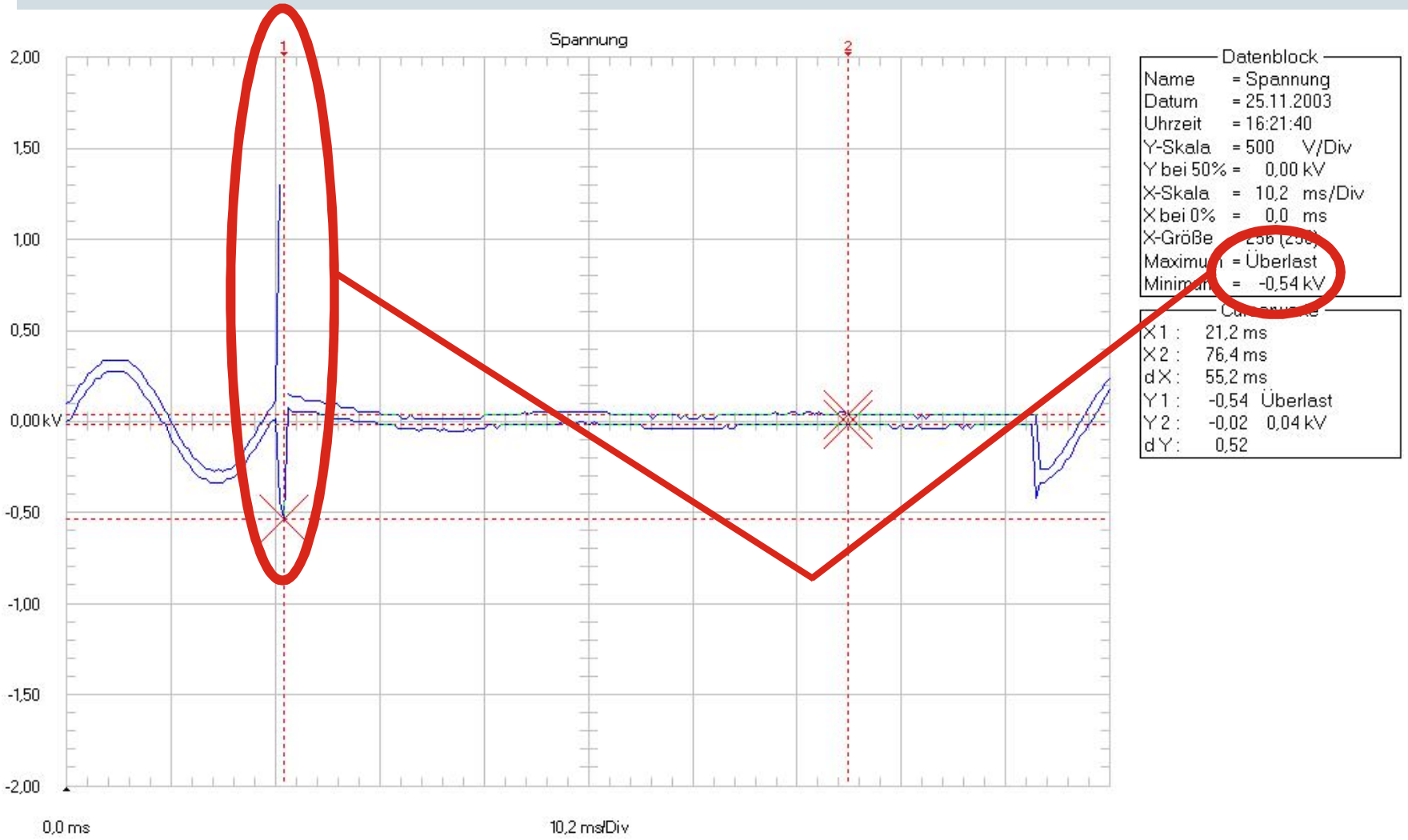


Earthing & Equipotential Bonding

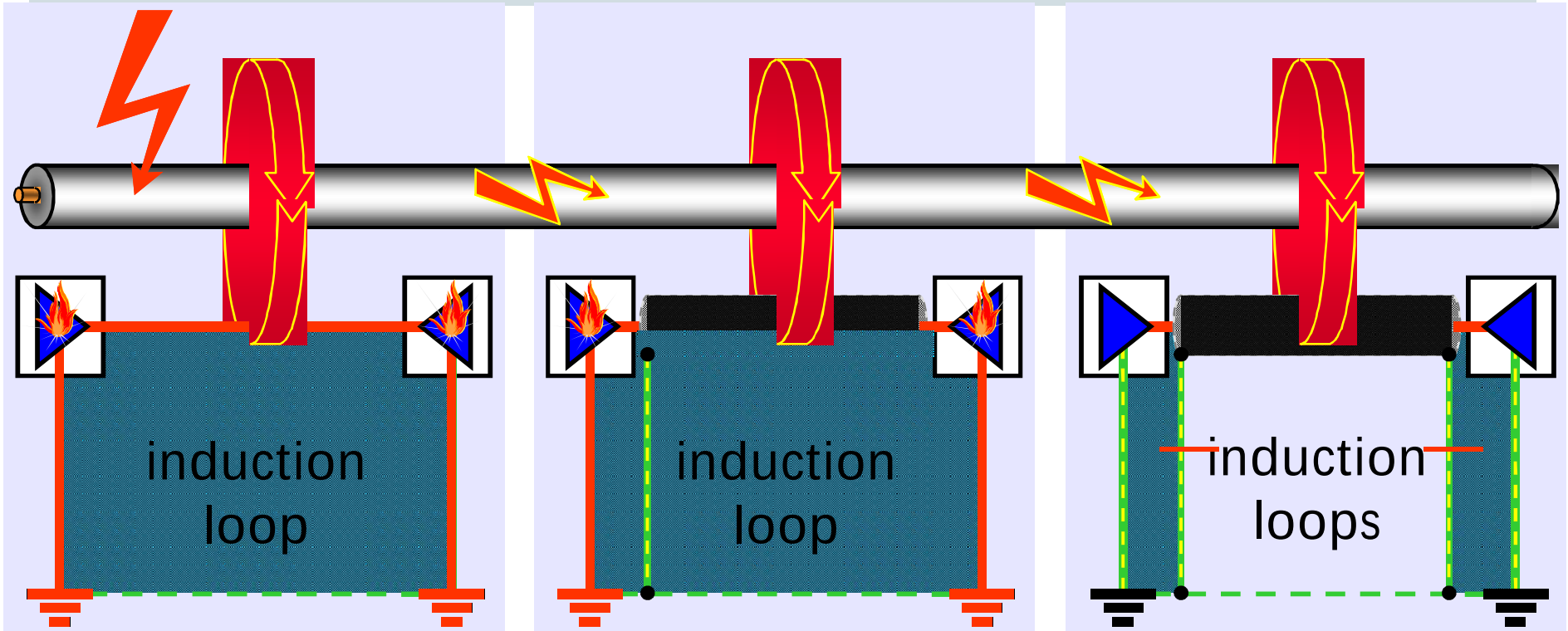
Lightning equipotential bonding for incoming lines



Surges when switching off a Ventilator



Inductive Coupling
(Indirect Lightning Interferences, Switching Operations)



no shield, large coupling surface

single-ended shield earthing, large coupling surface

double-ended shield earthing, reduced coupling surface

Selection of Power Supply SPD as per IEC 61643, 60364-5-53

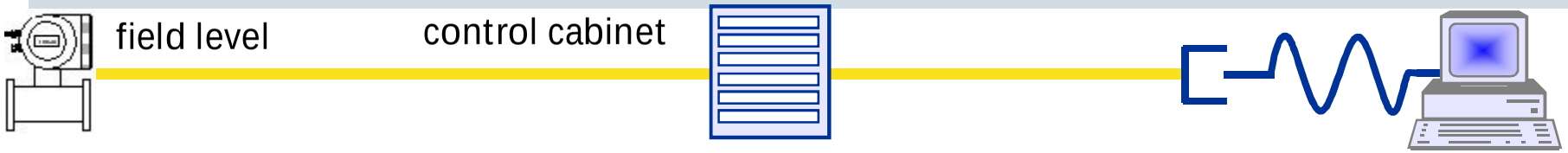
- Discharging of lightning currents several times without desctruction of the equipment.
  = Discharge capacity 100 kA at 10/350 µs & 8/20 µs

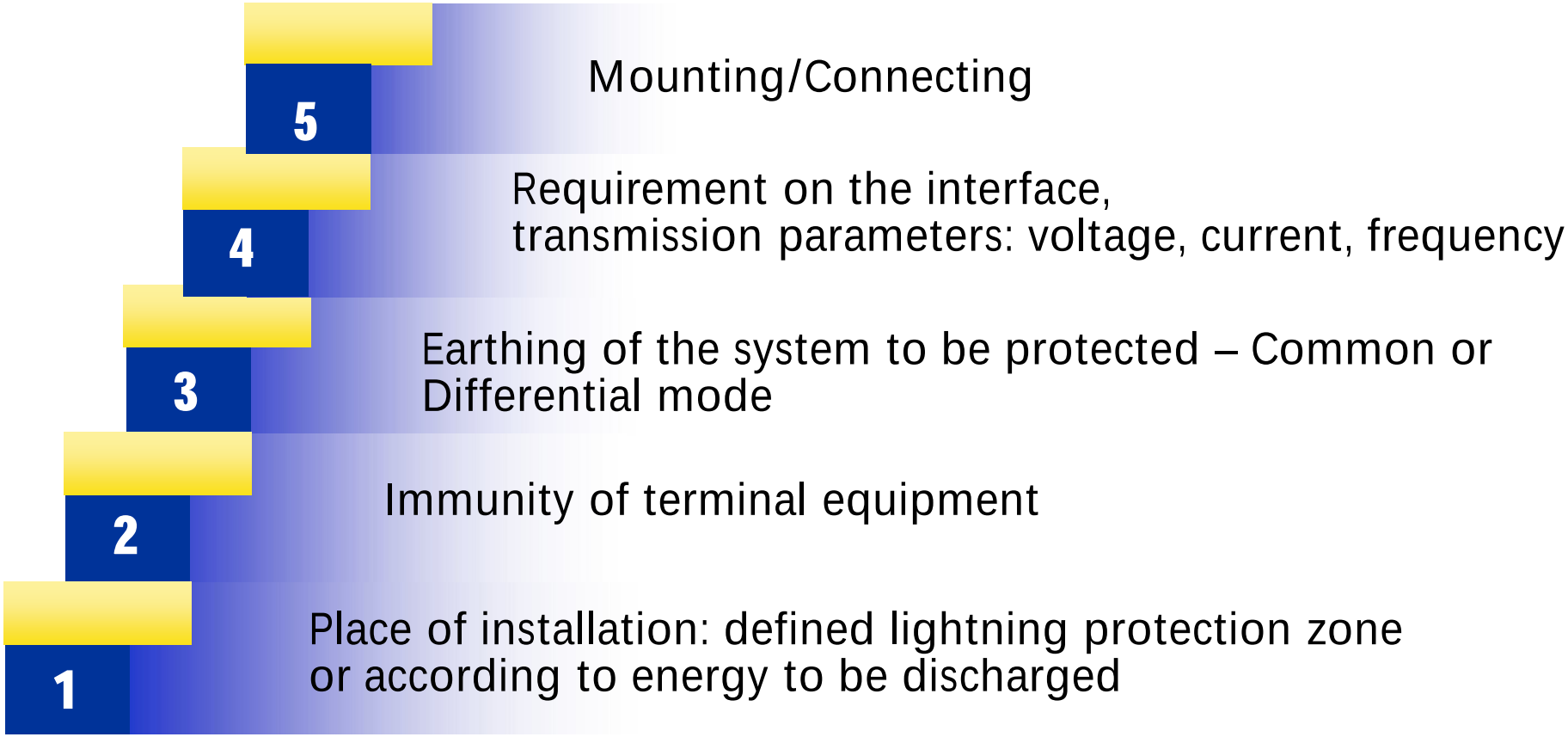
- Providing of a lower voltage protection level than the voltage strength (Uw) of the downstream installation.

- Extinguishing or limiting of mains follow currents.

- Ensuring of the energy coordination to downstream surge protective devices and/or terminal equipment.

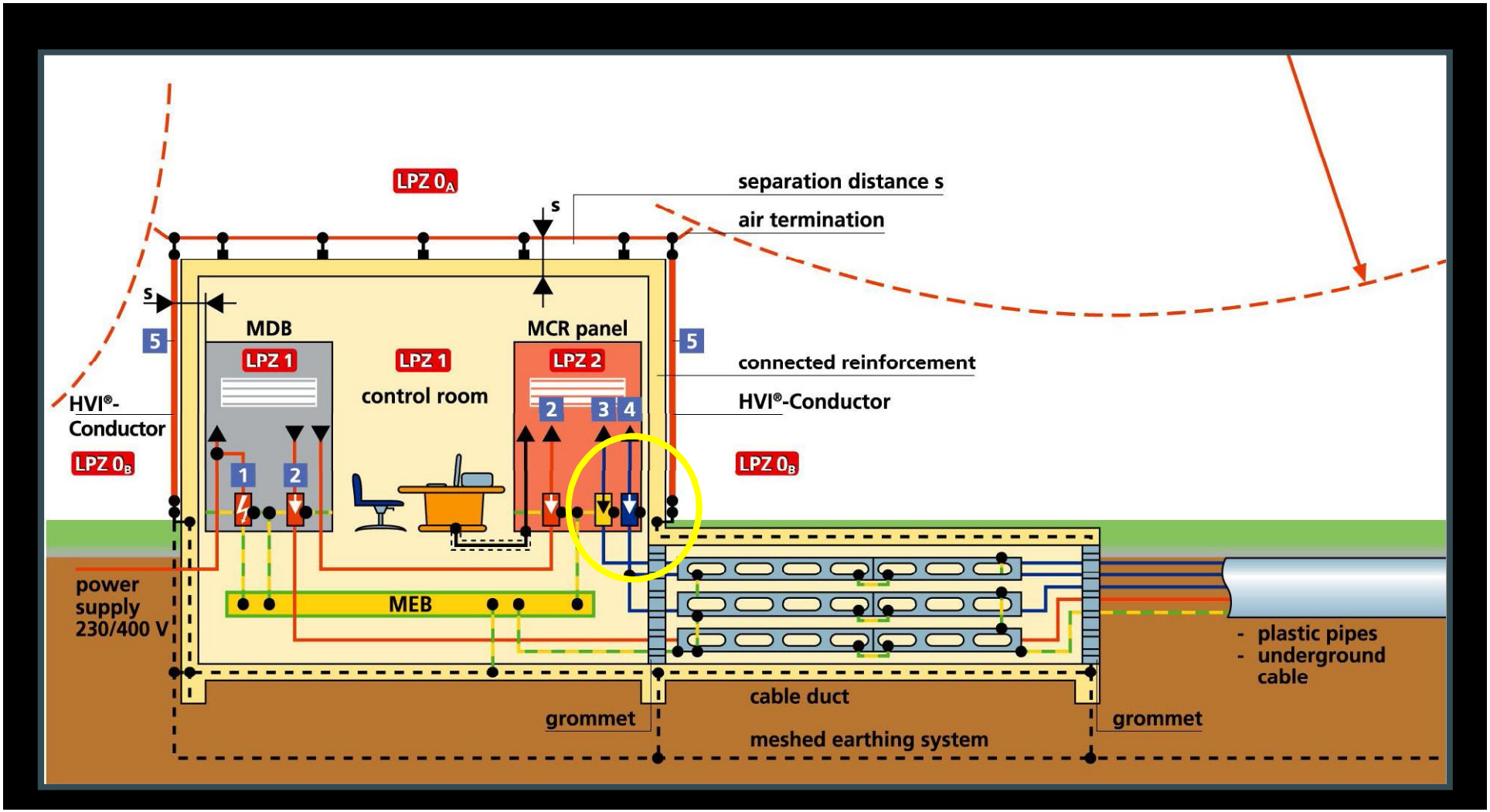
Selection of Control /Data Line Surge Protection as per IEC 61643-21





SPDs Installation for Power Supply System / AC 230-400 V Supply Low-voltage main distribution board

Protection of the Control Room / Ex(i) - circuits

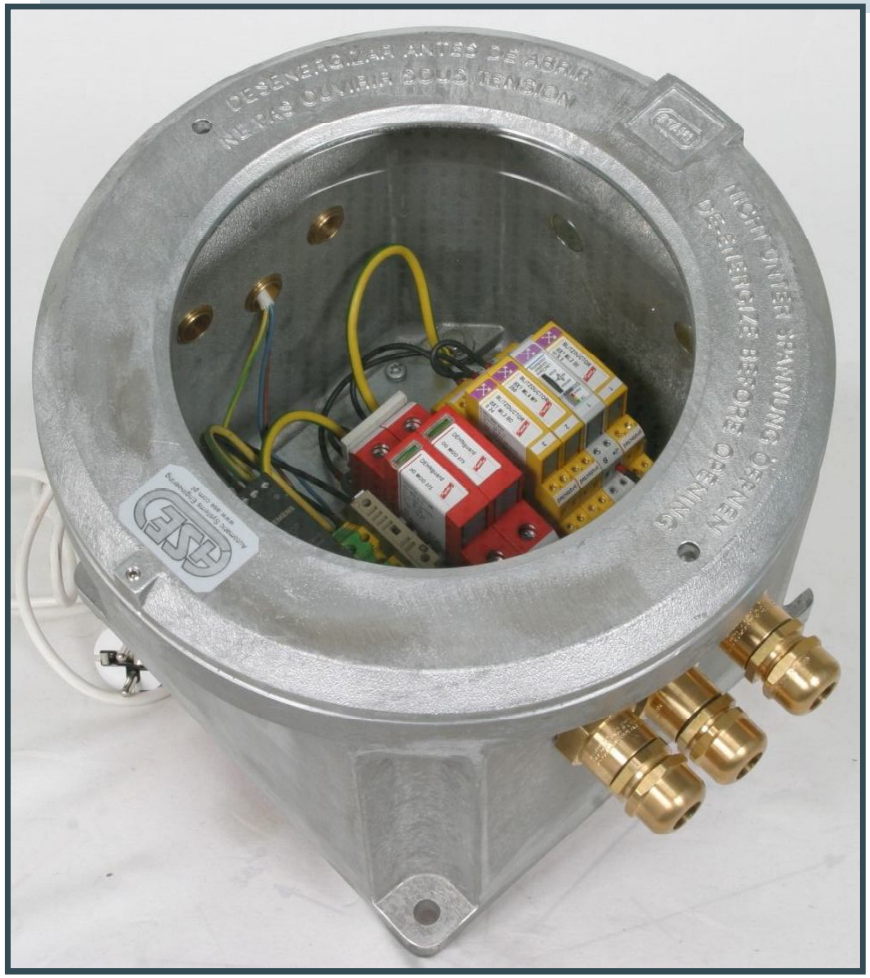


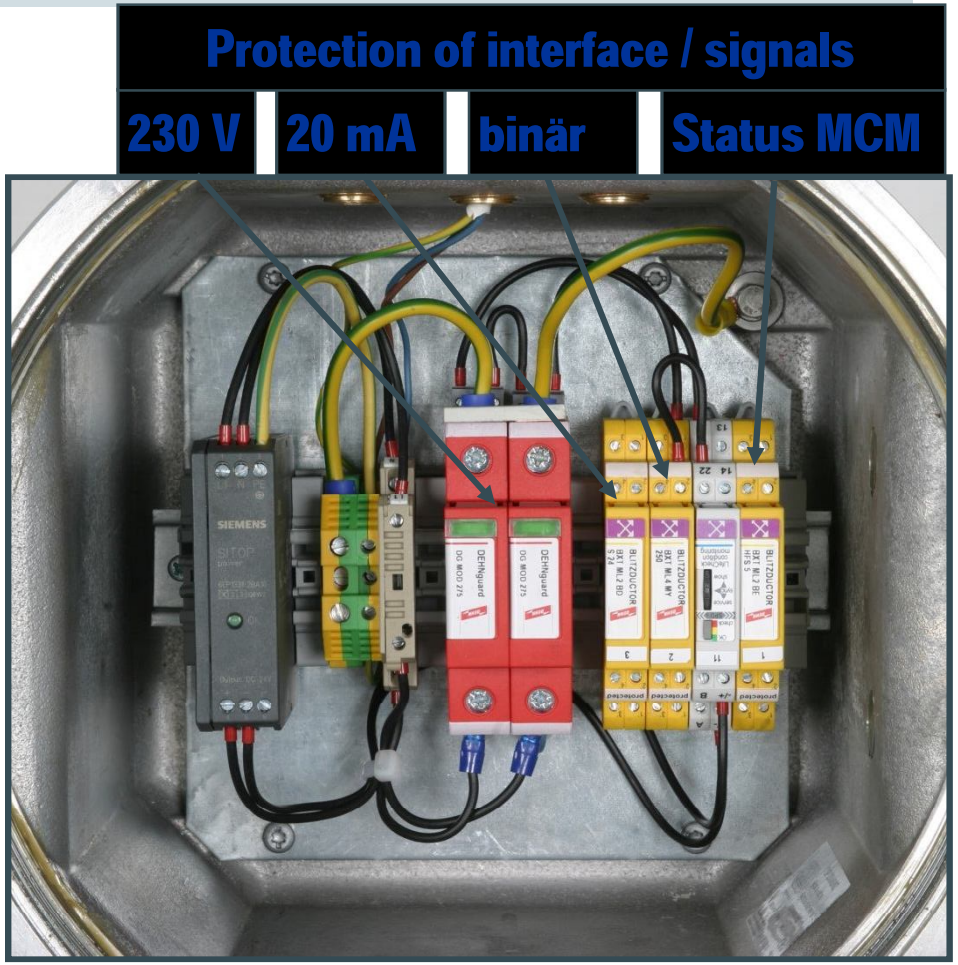
Isolating spark gap solution – For Pipe lines & Grounding

Source: Schwelm Anlagentechnik GmbH, Austria

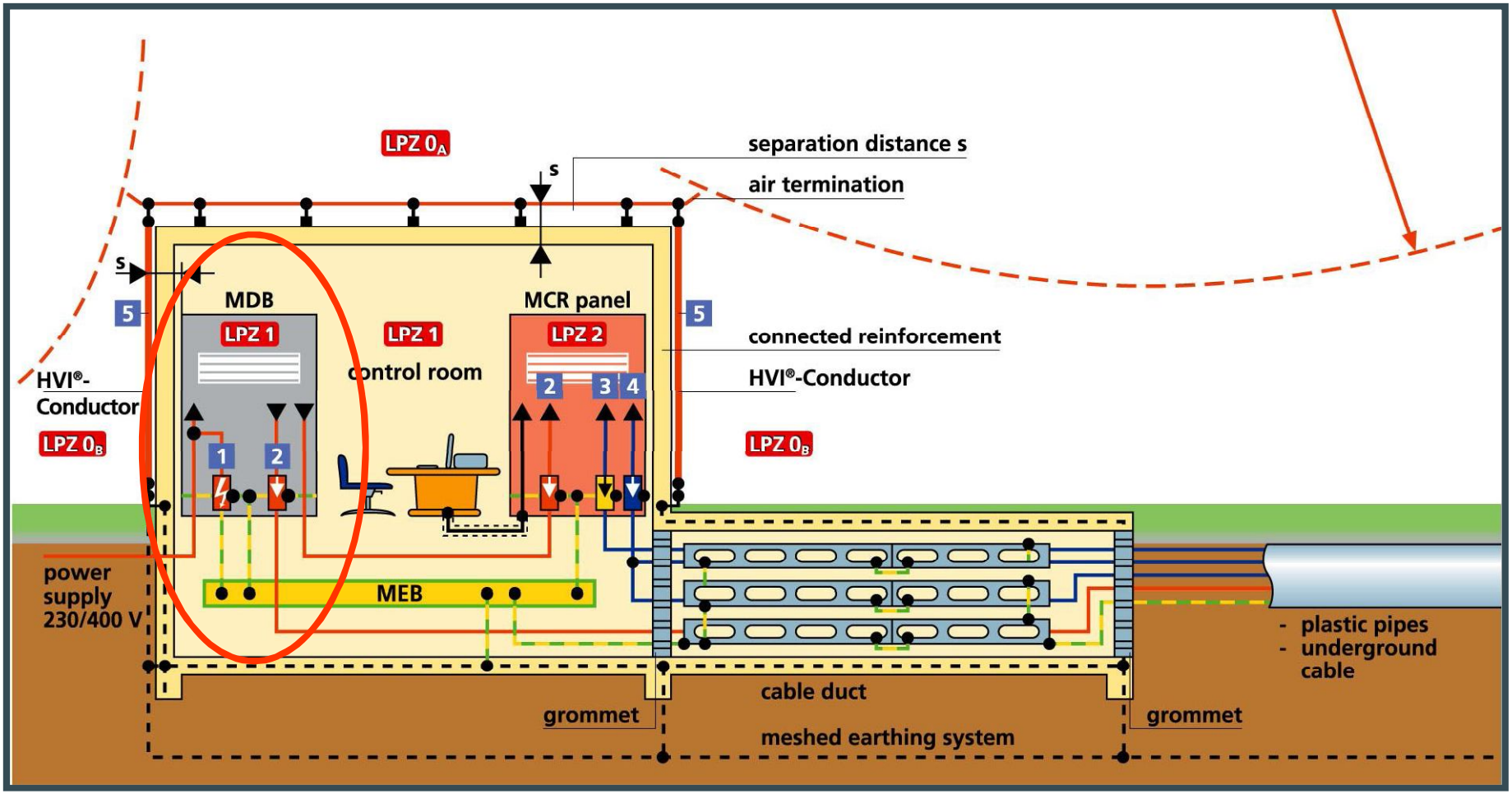
Protection of electrical devices
M&C cabinet, in an intrinsically safe circuit

SPDs in Exd-enclosure to protect electronic equipment in Ex-Zone 1



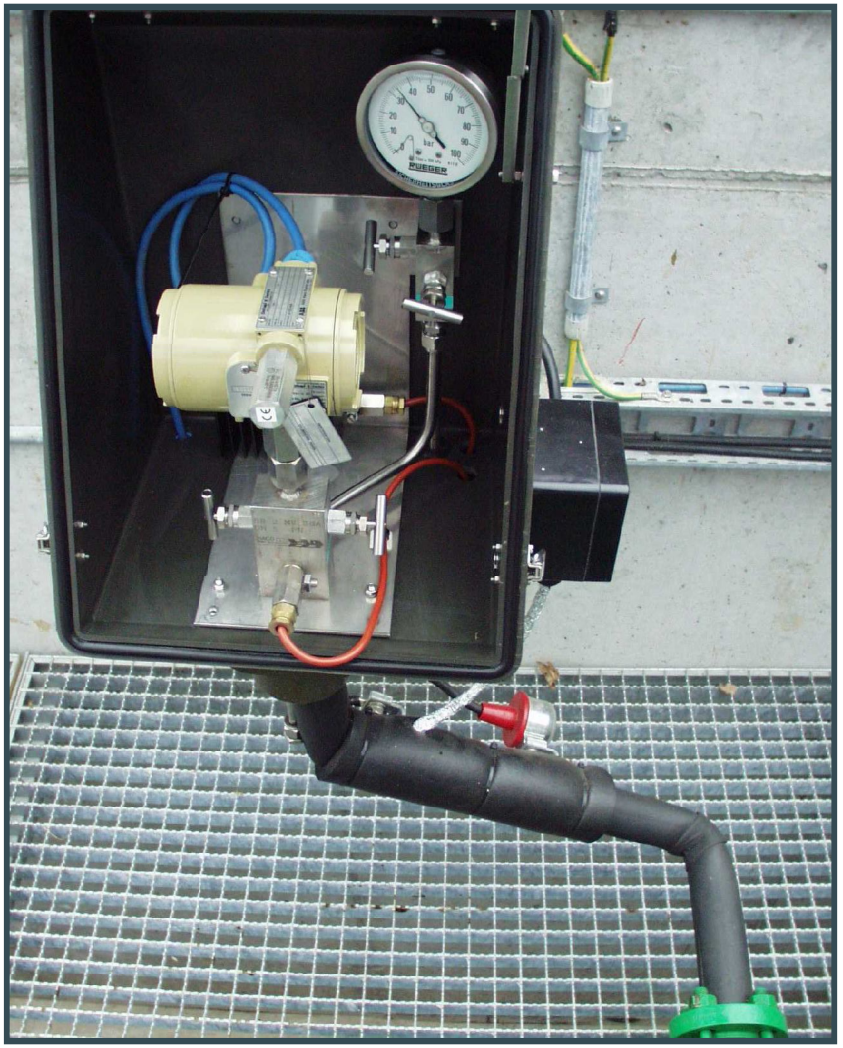


Compressor station - Protection concept

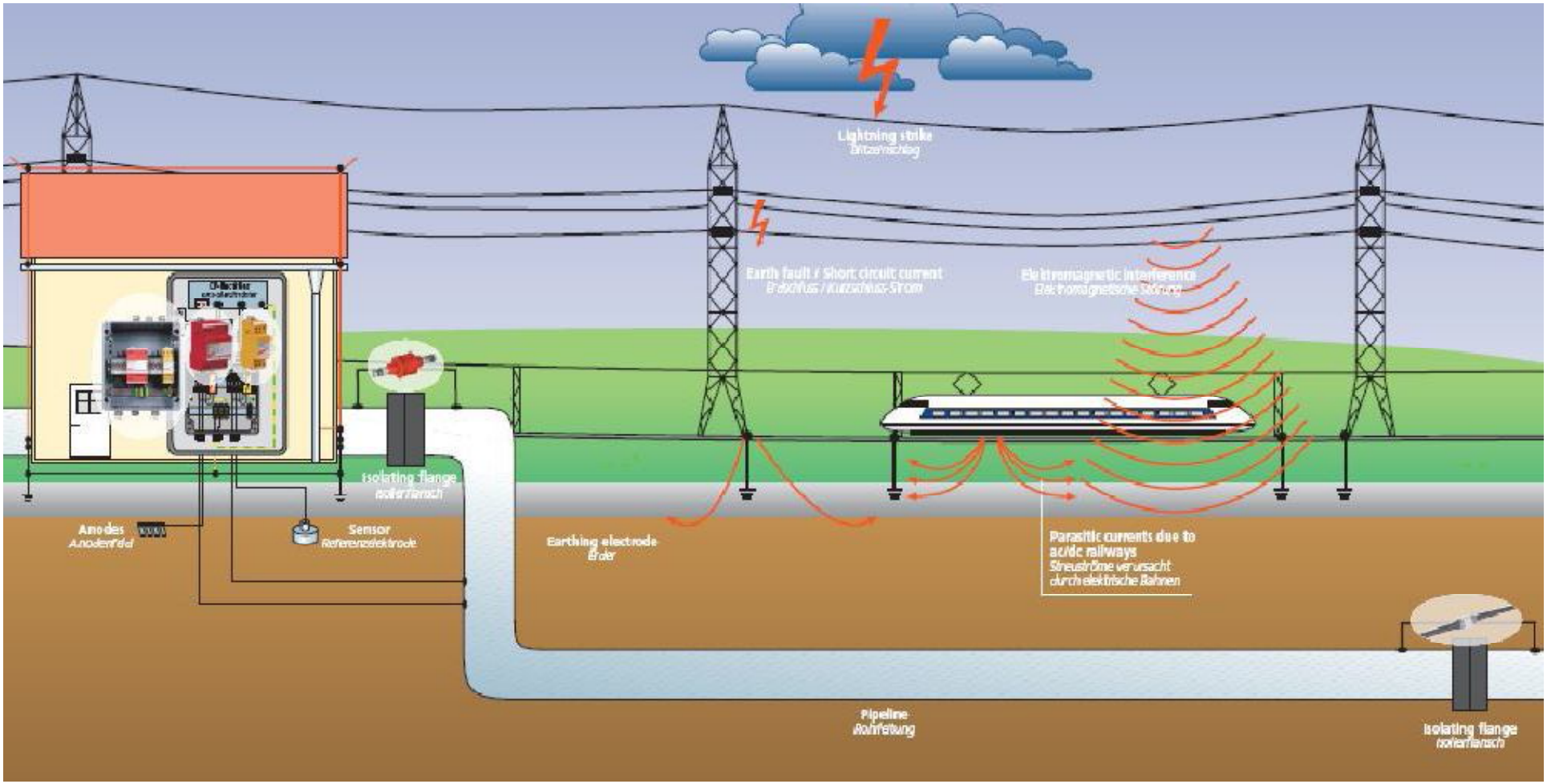


Compressor station - Measuring and control cabinet, in a non-intrinsically safe circuit

Compressor Station
Ex i circuits, protection of field devices



Lightning and surge protection of CP system - principle



Solution with us

- Consultancy on Complete Protection Solution.
- Risk Assessment as per IEC 62305, IS 2309.
- Site Survey & Design Solution as per IEC 62305, IS 2309, National Electrical code of India

- External Lightning Components –Tested clamps (Natural weather Condition)
- Internal Lightning Surge Protection – KEMA, Vde certified
- Earthing & Bonding solutions – UL listed products
- Safety devices – Human safety

- Installation, Testing & Commissioning of our products


Thank you for your attention
Ex
www.dehn.in

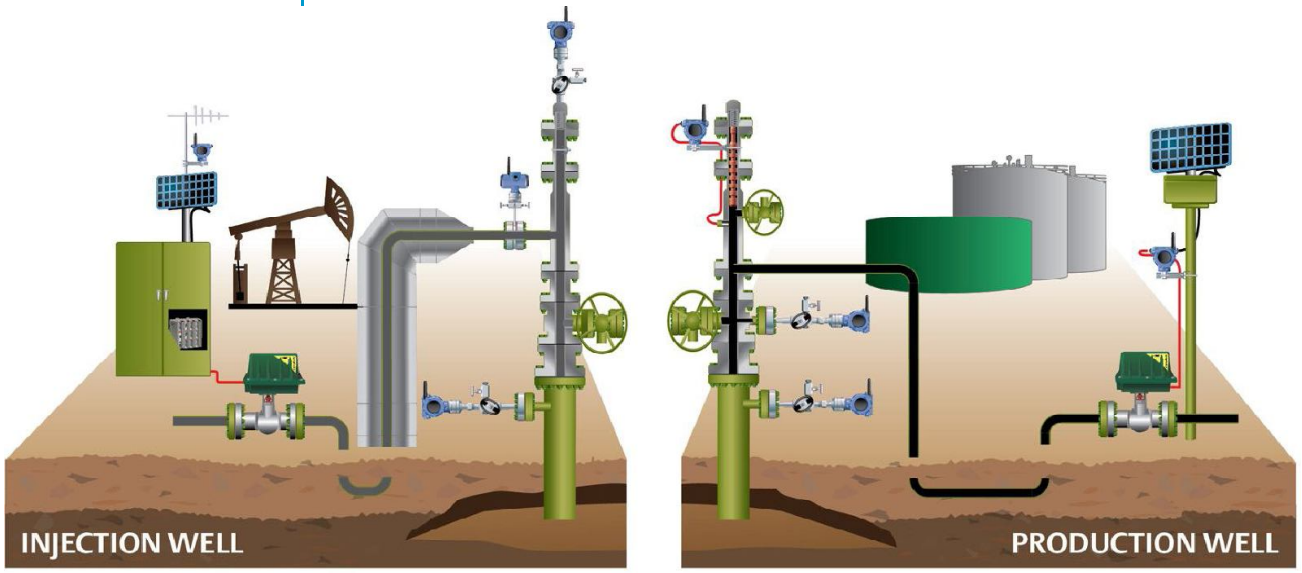
Thank you

For Queries, please contact

Brijesh Malik

Mobile: 8860005902
Email: info@dehn.in / brijesh.malik@dehn.in

Wireless Solutions for Upstream Oil and Gas Production



EMERSON.
Process Management

Agenda

- Oil and Gas Challenges and The Intelligent Field
- How Wireless Addresses Oil and Gas Business Challenges
- Wireless Applications for the Oil and Gas Industry
- Wireless in Action

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Process Management

Oil and Gas Challenges and the Intelligent Field