More than 50 years offering integral protection against lightning

Calculus software

- It allows us to determine the necessity of lightning protection
- Supported standards:
  - IEC 62305-2
  - UNE 21186
  - NF C 17-102
- Free software
- http://calculus.ingesco.com

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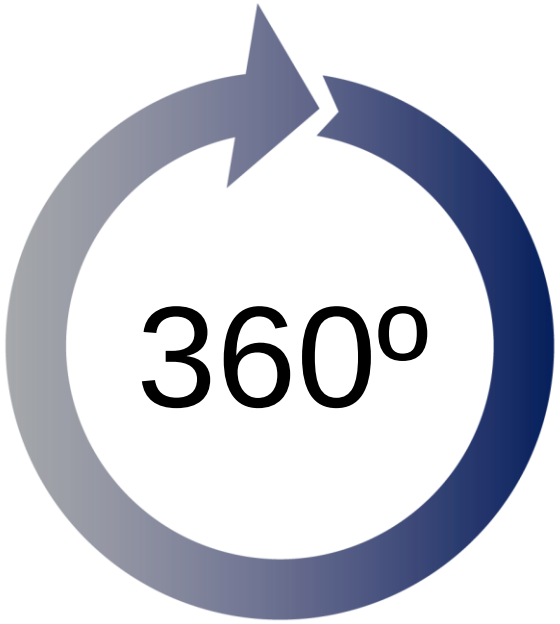
What is INGESCO?

360° vision



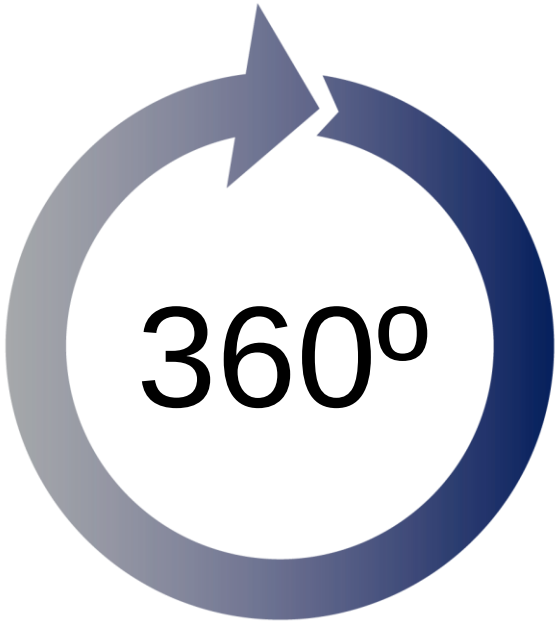
Integral protection

360° vision


Manufacturing
Distribution
Investigation
Installation
Inspection
Maintenance

What is INGESCO?

360° vision



Integral protection

Integral protection

External protection

Preventive systems

Grounding systems

Internal protection

Control systems

Introduction to Calculus

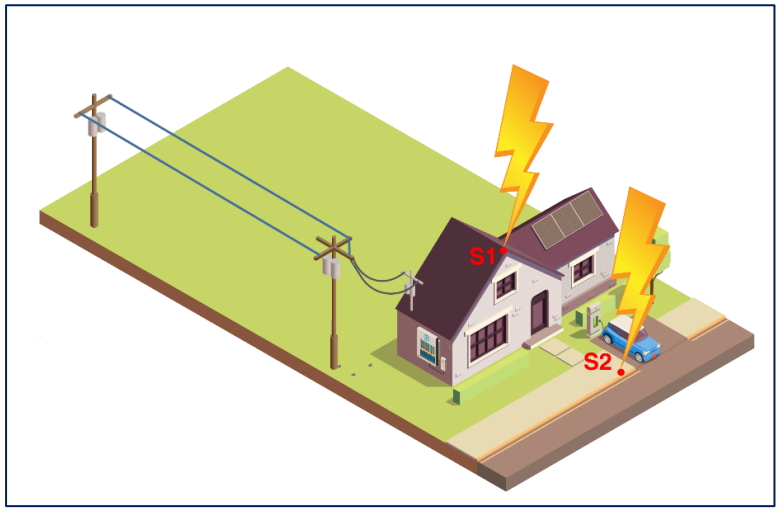
How do we define the protection against lightning?

- IEC 62305-2:2010 - Protection against lightning - Risk management
- Reduce the losses caused by the lightning strikes
  - Damage in the structure and its interior
  - Failure of the electrical and electronic systems
  - Damage to people
- Risk assessment
  - Risk is the annual average probable loss due to lightning strikes
  - Nº of annual strikes in the structure
  - Probability of the damage due to a lightning strike
  - Average cost of the losses

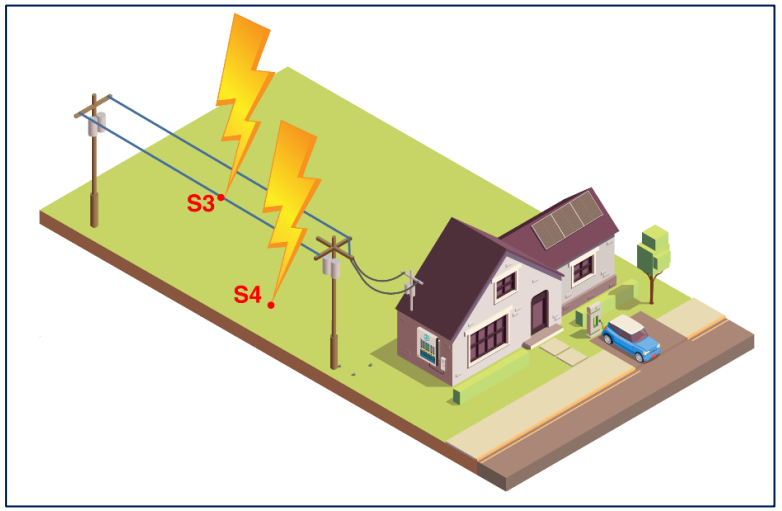
Source of losses

4 types of source losses

- **S1:** Direct strike in the structure
- **S2:** Strike near the structure
- **S3:** Direct strike in a line
- **S4:** Strike near a line



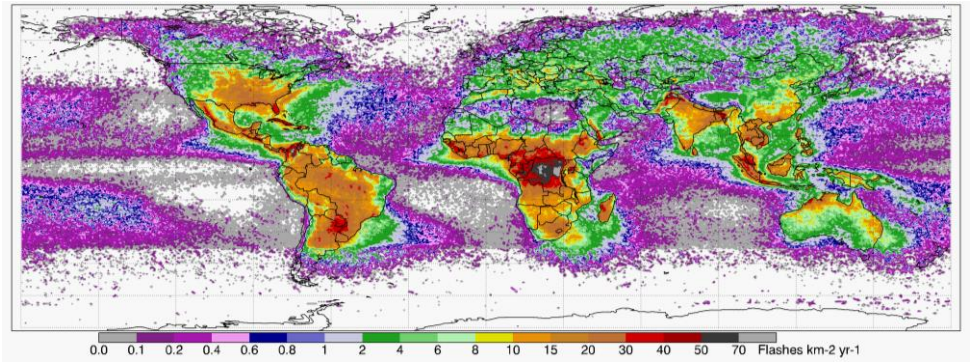
Strike in the structure



Strike in the line

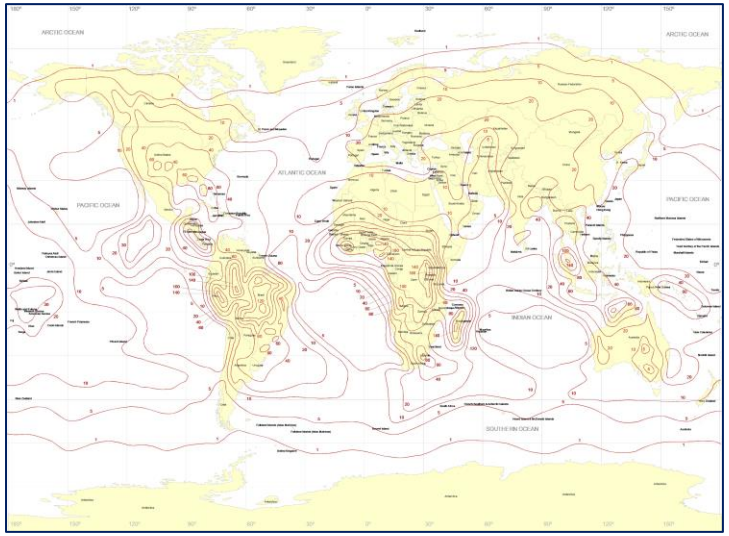
Define the structure to protect

- Dimensions
- Structure characteristics
  - Risk of fire
  - Type of building
- Environmental influences
  - Isokeraunic levels: Map that determines de strike risk
  - T_D = storm days / year
- Lines characteristics



Optical flashes map (N_t)

Different types of buildings



Keraunic map (T_D)

Risks and structure operation

4 types of risks

- R_1: Risk of human life loss
- R_2: Risk of public service loss
- R_3: Risk of cultural heritage loss
- R_4: Risk of economic loss

$R \leq R_T$

- R: Structure risk (R_1, R_2, R_3 and R_4)
- R_T: Tolerable risk

Risk of human life loss

Risk of public service loss

Risk of cultural heritage loss

Risk of economic loss

Selection of the protection measures

When $R > R_T$

- Measures against lightning should be taken
  - External protection
  - Internal protection (SPD)
  - Measures against fire
  - Electrical shielding
  - Additional measures
    - Thunderstorm warning systems (TWS)
    - Electrical isolation
    - Ground equipotentialization

INGESCO® PDC 6.4

TWS: Previstorm®

SPD: SLS-B+C100/3+1

Protection level

Protection level

Structure characteristics	Protection level	Probability P_B IEC 62305-2	PDC Efficiency
Structure protected by PDC	Level 1	0,02	98%
	Level 2	0,05	95%
	Level 3	0,1	90%
	Level 4	0,2	80%
NON protected structure	-	1	-

- Protection level
  - Safety factor
  - 1 lightning rod → All protection levels
  - Protection ↑ → Design protection volume ↓
  - Maximum level: **1**
- Protection efficiency
  - Protection ↑ → Efficiency ↑

Let’s try it

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