

## 3 External influences (IEC 60364-5-51)

External influences shall be taken into account when choosing:

- The appropriate measures to ensure the safety of persons (in particular in special locations or electrical installations)
- The characteristics of electrical equipment, such as degree of protection (IP), mechanical withstand (IK), etc.

If several external influences appear at the same time, they can have independent or mutual effects and the degree of protection must be chosen accordingly

### 3.1 Definition and reference standards

Every electrical installation occupies an environment that presents a variable degree of risk:

- For people
- For the equipment constituting the installation

Consequently, environmental conditions influence the definition and choice of appropriate installation equipment and the choice of protective measures for the safety of persons.

The environmental conditions are referred to collectively as "external influences". Many national standards concerned with external influences include a classification scheme which is based on, or which closely resembles, that of international standard IEC 60364-5-51.

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### 3.2 Classification

Each condition of external influence is designated by a code comprising a group of two capital letters and a number as follows:

#### First letter (A, B or C)

The first letter relates to the general category of external influence :

- A = environment
- B = utilisation
- C = construction of buildings

#### Second letter

The second letter relates to the nature of the external influence.

#### Number

The number relates to the class within each external influence.

#### Additional letter (optional)

Used only if the effective protection of persons is greater than that indicated by the first IP digit.

When only the protection of persons is to be specified, the two digits of the IP code are replaced by the X's.

Example: IP XXB.

#### Example

For example the code AC2 signifies:

A = environment

AC = environment-altitude

AC2 = environment-altitude > 2,000 m

### 3.3 List of external influences

Figure E46 below is from IEC 60364-5-51, which should be referred to if further details are required.

Code	External influences		Characteristics required for equipment
<b>A - Environment</b>			
<b>AA</b>	<b>Ambient temperature (°C)</b>		Specially designed equipment or appropriate arrangements
	Low	High	
AA1	- 60 °C	+ 5 °C	Normal (special precautions in certain cases)
AA2	- 40 °C	+ 5 °C	
AA3	- 25 °C	+ 5 °C	
AA4	- 5 °C	+ 40 °C	
AA5	+ 5 °C	+ 40 °C	Normal
AA6	+ 5 °C	+ 60 °C	Specially designed equipment or appropriate arrangements
AA7	- 25 °C	+ 55 °C	
AA8	- 50 °C	+ 40 °C	

Fig. E46 : List of external influences (taken from Appendix A of IEC 60364-5-51) (continued on next page)

## E - Distribution in low-voltage installations

Code	External influences						Characteristics required for equipment
<b>A - Environment</b>							
<b>AB Atmospheric humidity</b>							
	Air temperature °C		Relative humidity %		Absolute humidity g/m <sup>3</sup>		
	Low	High	Low	High	Low	High	
AB1	- 60 °C	+ 5 °C	3	100	0.003	7	Appropriate arrangements shall be made
AB2	- 40 °C	+ 5 °C	10	100	0.1	7	
AB3	- 25 °C	+ 5 °C	10	100	0.5	7	
AB4	- 5 °C	+ 40 °C	5	95	1	29	Normal
AB5	+ 5 °C	+ 40 °C	5	85	1	25	Normal
AB6	+ 5 °C	+ 60 °C	10	100	1	35	Appropriate arrangements shall be made
AB7	- 25 °C	+ 55 °C	10	100	0.5	29	
AB8	- 50 °C	+ 40 °C	15	100	0.04	36	
<b>AC Altitude</b>							
AC1	≤ 2000 m						Normal
AC2	> 2000 m						May necessitate precaution (derating factors)
<b>AD Presence of water</b>							
AD1	Negligible		Outdoor or non-weather protected locations			IPX0	
AD2	Free-falling drops					IPX1 or IPX2	
AD3	Sprays					IPX3	
AD4	Splashes					IPX4	
AD5	Jets		Locations where hose water is used regularly			IPX5	
AD6	Waves		Seashore locations (piers, beaches, quays...)			IPX6	
AD7	Immersion		Water 150 mm above the highest point and equipment not more than 1m below the surface			IPX7	
AD8	Submersion		Equipment is permanently and totally covered			IPX8	
<b>AE Presence of foreign solid bodies</b>							
			Smallest dimension	Example			
AE1	Negligible					IPOX	
AE2	Small objects		2.5 mm	Tools		IP3X	
AE3	Very small objects		1 mm	Wire		IP4X	
AE4	Light dust					IP5X if dust penetration is not harmful to functioning	
AE5	Moderate dust					IP6X if dust should not penetrate	
AE6	Heavy dust					IP6X	
<b>AF Presence of corrosive or polluting substances</b>							
AF1	Negligible					Normal	
AF2	Atmospheric					According to the nature of the substance	
AF3	Intermittent, accidental					Protection against corrosion	
AF4	Continuous					Equipment specially designed	
<b>AG Mechanical stress impact</b>							
AG1	Low severity					Normal	
AG2	Medium severity					Standard where applicable or reinforced material	
AG3	High severity					Reinforced protection	
<b>AH Vibrations</b>							
AH1	Low severity		Household or similar			Normal	
AH2	Medium severity		Usual industrial conditions			Specially designed equipment or special arrangements	
AH3	High severity		Severe industrial conditions				
<b>AJ Other mechanical stresses</b>							
<b>AK Presence of flora and/or mould growth</b>							
AH1	No hazard					Normal	
AH2	Hazard						
<b>AL Presence of fauna</b>							
AH1	No hazard					Normal	
AH2	Hazard						
<b>AM Electromagnetic, electrostatic or ionising influences / Low frequency electromagnetic phenomena / Harmonics</b>							
AM1	Harmonics, interharmonics					Refer to applicable IEC standards	
AM2	Signalling voltage						
AM3	Voltage amplitude variations						
AM4	Voltage unbalance						
AM5	Power frequency variations						
AM6	Induced low-frequency voltages						
AM7	Direct current in a.c. networks						
AM8	Radiated magnetic fields						
AM9	Electric field						
AM21	Induced oscillatory voltages or currents						

Fig. E46 : List of external influences (taken from Appendix A of IEC 60364-5-51) (continued on next page)

# 3 External influences (IEC 60364-5-51)

Code	External influences	Characteristics required for equipment
<b>A - Environment</b>		
AM22	Conducted unidirectional transients of the nanosecond time scale	Refer to applicable IEC standards
AM23	Conducted unidirectional transients of the microsecond to the millisecond time scale	
AM24	Conducted oscillatory transients	
AM25	Radiated high frequency phenomena	
AM31	Electrostatic discharges	
AM41	Ionisation	
<b>AN Solar radiation</b>		
AN1	Low	Normal
AN2	Medium	
AN3	High	
<b>AP Seismic effect</b>		
AP1	Negligible	Normal
AP2	Low severity	
AP3	Medium severity	
AP4	High severity	
<b>AQ Lightning</b>		
AQ1	Negligible	Normal
AQ2	Indirect exposure	
AQ3	Direct exposure	
<b>AR Movement of air</b>		
AQ1	Low	Normal
AQ2	Medium	
AQ3	High	
<b>AS Wind</b>		
AQ1	Low	Normal
AQ2	Medium	
AQ3	High	
<b>B - Utilization</b>		
<b>BA Capability of persons</b>		
BA1	Ordinary	Normal
BA2	Children	
BA3	Handicapped	
BA4	Instructed	
BA5	Skilled	
<b>BB Electrical resistance of human body</b>		
<b>BC Contact of persons with earth potential</b>		
BC1	None	Class of equipment according to IEC61140
BC2	Low	
BC3	Frequent	
BC4	Continuous	
<b>BD Condition of evacuation in case of emergency</b>		
BD1	Low density / easy exit	Normal
BD2	Low density / difficult exit	
BD3	High density / easy exit	
BD4	High density / difficult exit	
<b>BE Nature of processed or stored materials</b>		
BE1	No significant risks	Normal
BE2	Fire risks	
BE3	Explosion risks	
BE4	Contamination risks	
<b>C - Construction of building</b>		
<b>CA Construction materials</b>		
CA1	Non combustible	Normal
CA2	Combustible	
<b>CB Building design</b>		
CB1	Negligible risks	Normal
CB2	Propagation of fire	
CB3	Movement	
CB4	flexible or unstable	

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Fig. E46 : List of external influences (taken from Appendix A of IEC 60364-5-51) (concluded)

### 3.4 Protection provided for enclosed equipment: codes IP and IK

#### IP code definition (see Fig. E47)

The degree of protection provided by an enclosure is indicated in the IP code, recommended in IEC 60529.

Protection is afforded against the following external influences:

- Penetration by solid bodies
- Protection of persons against access to live parts
- Protection against the ingress of dust
- Protection against the ingress of liquids

**Note:** the IP code applies to electrical equipment for voltages up to and including 72.5 kV.

#### Elements of the IP Code and their meanings

A brief description of the IP Code elements is given in the following chart (see Fig. E48).

Element	Numerals or letters	Meaning for the protection of equipment	Meaning for the protection of persons
<b>Code letters</b>	<b>IP</b>		
<b>First characteristic numeral</b>	<p><b>0</b> (non-protected)</p> <p><b>1</b> ≥ 50 mm diameter</p> <p><b>2</b> ≥ 12.5 mm diameter</p> <p><b>3</b> ≥ 2.5 mm diameter</p> <p><b>4</b> ≥ 1.0 mm diameter</p> <p><b>5</b> Dust-protected</p> <p><b>6</b> Dust-tight</p>	<b>Against ingress of solid foreign objects</b>	<b>Against access to hazardous parts with</b> (non-protected) Back of hand Finger Tool Wire Wire Wire
<b>Second characteristic numeral</b>	<p><b>0</b> (non-protected)</p> <p><b>1</b> Vertically dripping</p> <p><b>2</b> Dripping (15° tilted)</p> <p><b>3</b> Spraying</p> <p><b>4</b> Splashing</p> <p><b>5</b> Jetting</p> <p><b>6</b> Powerful jetting</p> <p><b>7</b> Temporary immersion</p> <p><b>8</b> Continuous immersion</p>	<b>Against ingress of water with harmful effects</b>	
<b>Additional letter (optional)</b>	<b>A</b> <b>B</b> <b>C</b> <b>D</b>		<b>Against access to hazardous parts with</b> back of hand Finger Tool Wire
<b>Supplementary letter (optional)</b>	<b>H</b> <b>M</b> <b>S</b> <b>W</b>	<b>Supplementary information specific to:</b> High-voltage apparatus Motion during water test Stationary during water test Weather conditions	

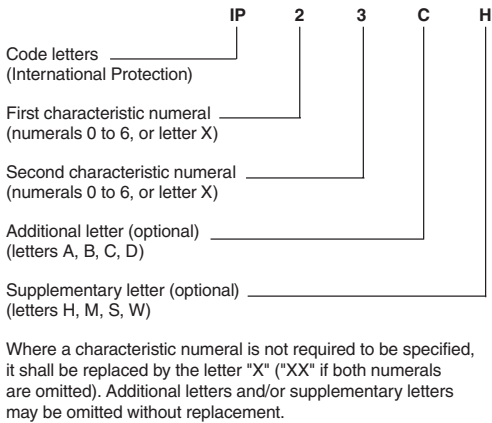


Fig. E47 : IP Code arrangement

Fig. E48 : Elements of the IP Code

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## IK Code definition

Standard IEC 62262 defines an IK code that characterises the aptitude of equipment to resist mechanical impacts on all sides (see Fig. E49).

IK code	Impact energy (in Joules)	AG code
00	0	
01	≤ 0.14	
02	≤ 0.20	AG1
03	≤ 0.35	
04	≤ 0.50	
05	≤ 0.70	
06	≤ 1	
07	≤ 2	AG2
08	≤ 5	AG3
09	≤ 10	
10	≤ 20	AG4

Fig. E49 : Elements of the IK Code

## IP and IK code specifications for distribution switchboards

The degrees of protection IP and IK of an enclosure must be specified as a function of the different external influences defined by standard IEC 60364-5-51, in particular:

- Presence of solid bodies (code AE)
- Presence of water (code AD)
- Mechanical stresses (no code)
- Capability of persons (code BA)
- ...

Prisma Plus switchboards are designed for indoor installation.

Unless the rules, standards and regulations of a specific country stipulate otherwise, Schneider Electric recommends the following IP and IK values (see Fig. E50 and Fig. E51 )

### IP recommendations

IP codes according to conditions		
Normal without risk of vertically falling water	Technical rooms	30
Normal with risk of vertically falling water	Hallways	31
Very severe with risk of splashing water from all directions	Workshops	54/55

Fig. E50 : IP recommendations

### IK recommendations

IK codes according to conditions		
No risk of major impact	Technical rooms	07
Significant risk of major impact that could damage devices	Hallways	08 (enclosure with door)
Maximum risk of impact that could damage the enclosure	Workshops	10

Fig. E51 : IK recommendations

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