Definitions

Note: The standards referred to hereunder are the latest editions of IEC 60099-4 and ANSI/ IEEE C62.11

Maximum system voltage (U_m)
The maximum voltage between phases during normal service.

Nominal discharge current (IEC)
The peak value of the lightning current impulse which is used to classify the arrester.

Lightning classifying current (ANSI/IEEE)
The designated lightning current used to perform the classification tests.

Rated voltage (U_r)
An arrester fulfilling the IEC standard must withstand its rated voltage (U_r) for 10 s after being preheated to 60 °C and subjected to energy injection as defined in the standard. Thus, U_r shall equal at least the 10-second TOV capability of an arrester. Additionally, rated voltage is used as a reference parameter.

> Note! TOV capability of EXLIM and PEXLIM arresters exceeds the IEC requirements.

Duty-cycle voltage rating (ANSI)
The designated maximum permissible voltage between its terminals at which an arrester is designed to perform its duty cycle.

Continuous operating voltage
It is the maximum permissible r.m.s. power frequency voltage that may be applied continuously between the arrester terminals. This voltage is defined in different ways (verified by different test procedures) in IEC and ANSI.

IEC (U_c)
IEC gives the manufacturer the freedom to decide U_c. The value is verified in the operating duty test. Any uneven voltage distribution in the arrester shall be accounted for.

ANSI (MCOV)
ANSI lists the maximum continuous operating voltage (MCOV) for all arrester ratings used in a table. The value is used in all tests specified by ANSI. MCOV is less stringent as regards uneven voltage distribution in an arrester.

Temporary overvoltages (TOV)
Temporary overvoltages, as differentiated from surge overvoltages, are oscillatory power frequency overvoltages of relatively long duration (from a few cycles to hours).

The most common form of TOV occurs on the healthy phases of a system during an earth-fault involving one or more phases. Other sources of TOV are load-rejection, energisation of unloaded lines etc.

The TOV capability of the arresters is indicated with prior energy stress in the relevant catalogues.

Residual voltage/ Discharge voltage
This is the peak value of the voltage that appears between the terminals of an arrester during the passage of discharge current through it. Residual voltage depends on both the magnitude and the waveform of the discharge current. The voltage/current characteristics of the arresters are given in the relevant catalogues.

Energy capability
Standards do not explicitly define energy capability of an arrester. The only measure specified is the Line Discharge Class in IEC. Often, this is not enough information to compare different manufacturers and, therefore, ABB presents energy capability also in kJ/kV (U_r). This is done in 3 different ways:

Two impulses as per IEC clause 7.5.5.
This is the energy that the arrester is subjected to in the switching surge operating duty test (clause 7.5.5.) while remaining thermally stable thereafter against the specified TOV and U_c.

Routine test energy
This is the total energy that each individual block is subjected to in our production tests.

Single-impulse energy
This is the maximum permissible energy, which an arrester may be subjected to in one single impulse of 4 ms duration or longer and remain thermally stable against specified TOV and U_C.

> Note! Corresponding values based on U_C are obtained by multiplying the catalogue values by the ratio U_r/U_C.

Short-circuit capability
This is the ability of an arrester, in the event of an overload due to any reason, to conduct the resulting system short-circuit current without violent shattering which may damage nearby equipment or injure personnel. After such an operation, the arrester must be replaced.

The system short-circuit current may be high or low depending on the system impedance and earthing conditions. Hence short-circuit capability is verified at different current levels.

External insulation withstand strength
It is the maximum value of the applied voltage (of a specified wave shape) which does not cause the flashover of an arrester. Unlike other equipment, arresters are designed to discharge internally and the voltage across the housing can never exceed the protective levels. Thus, the external insulation is self-protected if its withstand strength is higher than the protective levels corrected for installation altitude. The standards specify additional safety factors, exclusive of correction for altitude, as under:

- IEC: 15% for short impulses and 10% for long impulses (at sea level)
- ANSI: 20% for short impulses and 15% for long impulses (at sea level)

> Note! The altitude correction factors are 13% per 1 000 m (IEC) and 10% per 1000 m (ANSI).

All EXLIM and PEXLIM arresters fully comply with IEC and ANSI standards for installations up to 1 000 m, often with a large margin.

Pollution performance
IEC 60815 defines four levels of pollution (from light to very heavy) and stipulates the required creepage for porcelain housings as indicated in the table here.

Pollution level	Specific creepage in mm/kV (U_m)
Light (L)	16
Medium (M)	20
Heavy (H)	25
Very Heavy (V)	31

In the absence of similar standards for polymeric housings, the table also applies at present to such housings.

The creepage distance is the length measured along the housing's external profile and serves as a measure of the arrester performance in polluted environments with respect to the risk of external flashover.

Since the mean diameter for all the standard arresters is less than 300 mm, the specific creepage distance is the same as the nominal creepage distance.

Definitions — Transmission Line Arresters

Backflashover
Occurs when lightning strikes the tower structure or overhead shield wire. The lightning discharge current, flowing through the tower and tower footing impedance, produces potential differences across the line insulation.

If the line insulation strength is exceeded, flashover occurs i.e. a backflashover. Backflashover is most prevalent when tower footing impedance is high.

Compact insulation lines
Transmission lines with reduced clearances between phases and between phase and earth and with lower insulation level withstand than for normal lines for the same system voltage.

Coupling factor
is the ratio of included surge voltage on a parallel conductor to that on a struck conductor. This factor is determined from the geometric relationships between phase and ground (or protected phase conductors). A value often used for estimation purposes is 0.25.

Energy capability
The energy that a surge arrester can absorb, in one or more impulses, without damage and without loss of thermal stability. The capability is different for different types and duration of impulses.

Isokeraunic level
Number of annual thunderstorm days for a given region.

Shielding
Protection of phase conductors from direct lightning strokes; generally, by means of additional conductor(s) running on the top of the towers and grounded through the tower structures.

Shielding angle
The included angle, usually between 20 to 30 degrees, between shield wire and phase conductor.

Shielding failure
Occurs when lightning strikes a phase conductor of a line protected by overhead shield wires.

TLA
Transmission Line Arresters.

Tower footing impedance
The impedance seen by a lightning surge flowing from the tower base to true ground. The risk for backflashover increases with increasing footing impedance.

Travelling waves
Occur when lightning strikes a transmission line span and a high current surge is injected on to the struck conductor.

The impulse voltage and current waves divide and propagate in both directions from the stroke terminal at a velocity of approximately 300 meters per microsecond with magnitudes determined by the stroke current and line surge impedance.