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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SYC LVDC

Terms used by the SyC LVDC

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INTRODUCTION

AC technology has evolved to become the dominant technology when it comes to power distribution. The use of AC terms has become commonplace within the industry. With DC technology now being considered for power distribution, there is an emerging need to provide information on DC technology, starting with terminology, so that experts working on AC can transition to DC and those willing to get started can find this document a useful reference which will point to other sources of information for expanding their knowledge

There is already some excellent work that is done in JW9 and the technical report IEC TR 63282 is already published. Most of the relevant DC terms are already provided therein with a deeper discussion of some of the terms.

The intent of this document is not to differ with the excellent work that is being done in IEC and other standardisation agencies. This document will collate the terms related to DC contained in multiple publications. The intent of this document is to expose the reader to common jargon used in the IEC publications and it is hoped that this document will encourage readership of the actual standards and gravitate towards greater participation in standardisation activity. The definitions try to offer an intuitive and practical perspective, instead of rigor.

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SYC LVDC

Terms used by the SyC LVDC

1 Scope

This document provides a one-stop reference for DC terms. Along with the definition, it will also provide the basic source for the definition and direct the interested reader to other sources that might provide greater information

This document provides terms already defined in the IEV with in some case modification of the term definition or terms which are not included in the IEV

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Terms defined in the IEV

3.1.1
Direct current
electric current that is time-independent or, by extension, periodic current the direct component of which is of primary importance

Note – For the qualifier DC, see IEC 60050-151, 151-15-02.

[SOURCE: IEC 60050-131:2002,121-11-22]

3.1.2
DC, qualifier
pertaining to time-independent electric quantities such as voltage or current, to devices operated with direct voltage and current, or to quantities associated with these devices

Note 1 – The notation "DC" is preferred in English to the notation "d.c." which is an abbreviation of "direct current".

Note 2 – French language uses also the expression "courant continu" with an appropriate preposition such as "en", "de", "à" or "pour", or only the adjective "continu".

Note 3 – For the marking of electric equipment, either the notation DC or the appropriate graphical symbol may be used. Example: DC 500 V.

Note 4 – According to ISO 31-0 and IEC 60027-1, unit names and unit symbols shall not be qualified by "DC" as an attachment. Example: UDC = 500 V is correct, U = 500 VDC or U = 500 V DC are incorrect.

[SOURCE: IEC 60050-151:2001,151-15-02]

AC EQUIVALENCE

AC power has several definitions for power – Active (Real) Power, Apparent Power, Reactive power. In the case of DC, there is only one power which corresponds to Real power in an AC system

3.1.3
DC Power
the product of the direct voltage and the direct current (mean values)

[SOURCE: IEC 60050-551:1998,551-17-09]

3.1.4
nominal value
value of a quantity used to designate and identify a component, device, equipment, source, installation or system

Note 1 to entry – The nominal value is generally a rounded value.

[SOURCE: IEC 60050-151:2001,151-16-09, modified – add source, installation]

NOTE 1 to entry: For sources, systems and installations, nominal “voltage” is often used. For example, a DC source such as a battery may have a nominal voltage of 12V, a system or installation may have a nominal voltage of 48V

CONTEXT

The use of the term “nominal” stems from the fact that the quantity may vary over a range of values in practice both spatially and temporally. The “nominal” value is representative of the most probable value

Note 2 to entry: this term definition describes also Nominal DC Voltage, Nominal voltage of a DC system, Nominal voltage of a DC installation.

3.1.5
Rated value
value of a quantity used for specification purposes, established for a specified set of operating conditions of a component, device, equipment, or system

[SOURCE: IEC 60050-151:2001,151-16-08]

CONTEXT

The rated value is a specification provided by the manufacturer beyond which operation is not guaranteed. Rated value may have both upper and lower bounds, establishing a requirement for operation within the bounds.

3.1.6
DC ripple factor
ratio of half the difference between the maximum and minimum value of a pulsating direct current to the mean value of this current

Note – With low values of the DC ripple factor this quantity is approximately equal to the ratio of the difference to the sum of the maximum and the minimum values.

[SOURCE: IEC 60050-551:1998,551-17-29]

OR

ripple
set of unwanted periodic deviations with respect to the average value of the measured or supplied quantity, occurring at frequencies which can be related to that of the mains supply, or of some other definite source, such as a chopper

Note – Ripple is determined under specified conditions and is a part of PARD.

[SOURCE: IEC 60050-317:2001,317-07-02]

3.1.7
Over-voltage
voltage the value of which exceeds a specified limiting value

[SOURCE: IEC 60050-151:2001,151-15-27]

OR

Voltage greater than the upper bound specification of rated voltage

OR

Voltage between line conductors having a peak value exceeding the amplitude of the highest voltage of the system

[SOURCE: IEC 60050-614:2016,614-03-10, modified – Delete the first dash]

3.1.8
under-voltage
voltage the value of which is lower than a specified limiting value

[SOURCE: IEC 60050-151:2001,151-15-29]

OR

Voltage lesser than the lower-bound specification of rated voltage

3.1.9
DC voltage dip
a sudden reduction of the voltage at a point in an electrical system followed by voltage recovery after a short period of time from a few cycles to a few second

[SOURCE: IEC 60050-161:1990,161-08-10- modified add DC in the term]

AC EQUIVALENCE

In AC systems, sag (dip) is a decrease in rms voltage between 0.1% to 0.9% of nominal value at the power (mains) frequency durations of 0.5 to 1 minute

CONTEXT

Voltage sag in DC systems stems from the power quality requirements of AC systems. Sag is a short-duration phenomena where the envelope of the AC waveform decreases. In the case of DC, the envelope may be considered as the nominal DC voltage. The limits in both amplitude and time that are defined in AC are yet to be defined for DC

3.1.10
DC voltage surge

a transient voltage wave propagating along a line or a circuit and characterized by a rapid increase followed by a slower decrease of the voltage

[SOURCE: IEC 60050-161:1990,161-08-10- modified add DC in the term]

OR

Abrupt change in the DC nominal voltage value followed by a slower decrease of the voltage

AC EQUIVALENCE

Voltage surges in AC systems typically occur over durations less than a cycle of the AC waveform and rms voltage measurements is not applicable for surges

CONTEXT

Voltage surges occur over time-scales much less than voltage swells or voltage dips, and can be greater than the nominal voltage or lesser than the nominal voltage

3.2 Terms defined in the IEV where a modification of the term definition is needed

3.2.1 DC Power Supply

electric energy converter which draws electric energy from a source and supplies it in a specified form to a load

NOTE 1 to entry: The input/source for a DC power supply may be AC or DC. The output is DC.

[SOURCE: IEC 60050-151:2001,151-13-76, modified – Add DC in the term and add the note 1 to entry: The input/source for a DC power supply may be AC or DC. The output is DC.]

3.2.2
DC Load

device intended to absorb power supplied by another device or an electric power system

[SOURCE: IEC 60050-151:2001,151-13-76, modified – Add DC in the term]

AC EQUIVALENCE

AC loads absorb AC power similar to the DC case. However, DC loads and AC loads are not interchangeable

3.2.3
DC system

set of interrelated elements considered in a defined context as a whole and separated from their environment

[SOURCE: IEC 60050-151:2001,151-11-27, modified – Delete Note 1 to Note 4]

Or

A set of interrelated elements that are engaged in the supply of DC power and its consumption through a network of wires that deliver power from source of supply to the consumption at the load.

Note 1 to entry: A DC system must have one source and one load

Note 2 to entry: DC power is transferred from source to load using wires. A system may utilise two wires or three wires to transfer DC power. In the case of three wires, a mid-point reference is used and the other two lines have voltages that are equal and opposite in polarity.

[SOURCE: IEC 60050-151:2001,151-11-27, modified – Delete Note 1 to Note 4 and replace considered in a defined context as a whole and separated from their environment by that are engaged in the supply of DC power and its consumption through a network of wires that deliver power from source of supply to the consumption at the load.]

AC EQUIVALENCE

The transfer of power in AC and DC have certain differences, eventhough the number of lines required to carry may be the same in some practical situations. DC is required to observe polarity requirements for current to flow. AC does not have any polarity related constraints

3.2.4
DC Voltage Deviation
difference between the supply voltage at a given instant and the declared supply voltage

[SOURCE: IEC 60050-614:2016,614-01-03]

OR

The difference between the nominal dc voltage and the actual dc voltage at a given instant

3.2.5
DC Voltage Unbalance
Condition in bi-polar system in which line to mid-point voltages are not equal

SOURCE IEC TR63282:2000

AC EQUIVALENCE

The DC definition is based on a similar unbalance defined for a 3 phase AC system condition in a polyphase system in which the rms values of the phase element voltages (fundamental component), or the phase angles between consecutive phase element voltages, are not all equal

[SOURCE: IEC 60050-614:2016,614-01-32]

3.3 Terms not defined in the IEV

3.3.1
DC Current
Flow of electric charge that does not change direction

SOURCE Encyclopedia Britannica

AC EQUIVALENCE

AC is an acronym for Alternating Current, which is defined as “flow of electric charge that periodically reverses”

CONTEXT

A current that exhibits reversal of direction but does not exhibit periodicity is not considered to be AC current.

Perhaps the most important differences between AC current and DC current are the following. The understanding of the differences can throw further light on DC current

AC current is periodic – AC current value changes monotonically, most often exhibiting a sine-wave characteristic even though sine-wave characteristic not strictly necessary for current to be considered AC

Reversal of current is a necessary condition for AC current. AC must pass through zero at a time instant during each period

3.3.2
DC Voltage
Source of DC current. The value of DC voltage is an average value defined over a specified interval of time

SOURCE: IEC TR 63282:2000, modified

AC EQUIVALENCE

In AC, rms voltage is used, since the average value of AC is zero.

3.3.3
DC source
Any element that can supply DC power

Note: In almost all practical cases, DC sources deliver constant voltage, while the current through the sources may vary depending upon the need. Therefore, DC Source often refers to a DC Voltage source.

EXAMPLES: Batteries, Photo Voltaic Systems, Wind Turbines.

3.3.4
Unipolar DC System
DC system comprising of two lines to transfer DC power

SOURCE IEC TR63282:2000 modified

3.3.5
Bipolar DC System
DC system for transfer of power comprising positive, midpoint and negative lines

SOURCE IEC TR63282:2000 modified

CONTEXT

Bipolar DC system has two voltage sources, and, in some cases, the two voltage sources may be derived from a single unipolar source. The two voltage sources are required to be equal in amplitude for most applications

3.3.6
DC Voltage Swell
Increase in nominal DC voltage for a short duration of time

[SOURCE: IEEE 1159 modified]

AC EQUIVALENCE

In AC systems, swell is an increase in rms voltage between 1.1% to 1.8% of nominal value at the power (mains) frequency durations of 0.5 to 1 minute

CONTEXT

Voltage swell in DC systems stems from the power quality requirements of AC systems. Swell is a short-duration phenomena where the envelope of the AC waveform increases. In the case of DC, the envelope may be considered as the nominal DC voltage. The limits in both amplitude and time that are defined in AC are yet to be defined for DC

3.3.7
Electronic Circuit
An electronic circuit is composed of individual electronic components, such as resistors transistors, capacitors, inductors and diodes, connected by conductive wires or traces through which electric current can flow

SOURCE: Wikipedia

OR

electronic output circuit
output circuit that uses electronic components, for example transistors, thyristors or opto-couplers

[SOURCE: IEC 60050-447:2020, 447-04-02]

Context: An electronic circuit is a self-contained unit meant to serve a specific purpose. Examples are amplification, power-conversion, etc…

3.3.8
DC-DC converter
An electronic device that converts DC Voltage from one value to another value

OR

(electric energy) converter
device for changing one or more characteristics associated with electric energy

Note 1 to entry: Characteristics associated with energy are for example voltage, number of phases and frequency including zero frequency.

[SOURCE: IEC 60050-151:2001,151-13-36]

3.3.9
Linear DC-DC converter
A DC-DC converter where the same current flows through the input and output

OR

linear conversion
conversion for which the quotient of each change in the output value by the corresponding change in the input value is intended to be constant

[SOURCE: IEC 60050-314:2001, 314-02-04]

Context: A linear DC-DC converter is also called a linear regulator and the conversion can be done only to a lower voltage

3.3.10
Low-Voltage Direct current
LVDC
electric current that is time-independent or, by extension, periodic current the direct component of which is of primary importance where protection against electric shock is ensured by basic protection and in general also fault protection.

Note 1 to entry: the voltage limits for Low-Voltage is 1500 V DC (see IEC 61140)

3.4 Terms not needed (to be removed from the document)

3.4.1
LVDC Limit
DC Voltage less than 750V between the lines in a unipolar system and between a line to mid-point in a bipolar system

See the definition of LVDC in this document.

3.4.2
ELVDC
Acronym for Extra Low Voltage Direct Current

No need to define an acronym.

3.4.3
ELVDC Limit
DC Voltage less than 110V between the lines in a unipolar system and between a line to mid-point in a bipolar system

Giving a value for a limit is not a definition but a requirement and therefore shall be included in a term definition.

3.4.4
SELV
Acronym for Safety Extra Low Voltage

No need to define an acronym.

3.4.5
SELV DC Limit
60V DC

Giving a value for a limit is not a definition but a requirement and therefore shall be included in a term definition.

4 General

The objective of this document is to collect terms which can be used for addressing the LV DC.

Terms are Classified in 3 categories:

- Terms defined in the IEV having a relevant term definition for LVDC (see 3.1)

- Terms defined in the IEV needing a modification of term definition for LVDC (see 3.2)

- Terms not defined in the IEV (see 3.3)

5 Final proposal

Most the general terms used for LVDC are already defined in the IEV with a relevant term definition (as in 3.1) or with a term definition which can be improved in accordance with 3.2.

Terms defined in 3.3 are too general or are probably used only in some specific publication and be therefore defined in the document and there is no need for being defined in the IEV.

6 Credits

This work started out of a reading of several DC based standards published by the IEC. The terms that have been used in those standards and the definitions given there were studied and modified to fit the context.

The coverage of the document so far has dealt with basic terms and the imperfections of sources, and as a result this revision has majority of terms taken from IEC TR 63282:2000. This Technical Report is highly recommended.

Future revisions of this standard will include terms from other publications related to DC work, and the immediate focus will be on the work done by TC64 and TC82.

This document is expected to be evolving all the time, as new DC standards get published and there is a need to keep the document constantly updated and current.

Bibliography