Technical Information:

Calculation of the current's intensity:

The following formulas should be used in order to calculate the intensity of the electrical current:

Single-phase power:	Three-phase power:
$I = \frac{P}{V * cos\varphi} = \frac{S}{V}$ (1)	$I = \frac{P}{\sqrt{3} * V * cos\varphi} = \frac{S}{\sqrt{3} * V}$ (2)
Where: I: Line's Current intensity [A] P: Active Power [W] Φ: Phase angle between voltage and current S: Apparent power [VA] V: Phase-neutral voltage [V]	Where: I: Line's Current intensity [A] P: Active Power [W] Φ: Phase angle between voltage and current S: Apparent power [VA] V: Phase-phase voltage [V]

Calculation of the section considering voltage drop:

To calculate the gauge of a cable, the material of the conductor to be used and the power factor must be considered based on table 9 of the NFPA-70 National Electrical Code (NEC-2017), where the different gauges for the various values of effective impedance. The following formulas should be used to calculate the effective impedance:

Single-phase power:	Three-phase power:
$Z = \frac{5 * \%V * V}{I * L}$ (3)	$Z = \frac{10 * \%V * V}{\sqrt{3} * I * L}$ (4)
Where: L: Line length [m] I: Line's Current intensity [A] V: Maximum allowable voltage drop [V] %V: Percentage of voltage drop [%] Z: Effective impedance [Ω/km]	

Conductivity constants:

The following table displays the conductivity constants for each of the metals used:

Metal conductor	Conductivity
Copper	100%
Aluminum 1350	61,20%
Aluminum 6201	52,50%
Aluminum S-8000	61%

Fault current calculations according to NEC 2017:

Short circuit in copper conductors:	Short circuit in aluminum conductors
$\left(\frac{I^2}{A^2}\right) t = 0.0297\, log_{10} \frac{T_2 + 234}{T_1 + 234}$ (5)	$\left(\frac{I^2}{A^2}\right) t = 0.0125\, log_{10} \frac{T_2 + 228}{T_1 + 228}$ (6)
Where: I: Short circuit current [A] A: Area of conductor [kcmil] t: Duration of short circuit [s] T_1: Initial temperature of conductor [°C] T_2: Final temperature of conductor [°C]	

T2 values:

Tipo of insulation for copper or aluminum conductors:	T_2
Paper, rubber, varnished fabric	200
Thermoplastic	150
Cross-linked polyethylene	250
Ethylene propylene rubber	250

Calculations of economic and CO_2 emission savings:

According to Joule's law, the amount of energy transmitted by a conductor can be calculated using the following formula:

$$E_P = R * I^2 * t \ [J] \quad (7)$$

If more than one conductor should be considered, the previous formula should be modified and expressed as:

$$E_P = n * R * L * I^2 * \frac{t}{1000} \quad (8)$$

Where:

E_P: Energy lost within the line [kWh]

n: Number of charged conductors (2 in single-phase and 3 in three-phased)

R: Conductor's resistance per kilometer [Ω/km]

L: Longitude of the line [km]

I: Electrical current [A]

t: Time [h]

Therefore, the following formula can be used to calculate the energy that can be saved if a smaller conductor is installed:

$$E_A = \frac{n}{c} * (R_1 - R_2) * L * (I)^2 * \frac{t}{1000} \quad (S_2 > S_1) \quad (9)$$

In this formula, S corresponds to the area of the cable's cross-section and c to the number of parallel conductors in each phase.

Once the energy reductions are calculated, it is possible to estimate subsequent economical savings considering specific electricity rates. Similarly, the CO_2 emissions savings can be determined entering data regarding CO_2 emissions per generated kWh. The predetermined values for these variables can be modified by the user in "Settings".

Examples:

1. The user wants to calculate the economical and ecological savings in a 120 meters three-phase 2/0 AWG copper conductor in a PVC conduit that carries a continuous load of 10 A and a noncontinuous load of 105 A.

Solution:

The current is calculated per:

$$I = (noncontinuous\ load) + 1.25 * (continuous\ load) \quad (10)$$

It can be concluded that the total electric current can be calculated as follows:

$$I = (105) + 1.25 * (10) = 117.5\ A \quad (11)$$

Additionally, it is known that the line is installed for a year; hence the total time in hours is equal to:

$$t = 365 * 24 = 8760\ hours \quad (12)$$

A larger conductor size or a conductor with a larger area of cross-section must be considered in order to estimate the possible economical and ecological savings. This example will consider a 2/0 AWG and 3/0 AWG conductors, which would have the following equivalencies in mm^2.

Calibre	mm2	S	R
1/0 AWG	53.5	S1	R1=0.39
2/0 AWG	67.4	S2	R2=0.33
3/0 AWG	85.0	S3	R3=0.253

Yearly Savings

Initially, the recommended conductor size was 1/0 AWG. If a 2/0 AWG is considered instead (which would have a larger cross-section), the result would be:

$$E_A = \frac{3}{1} * (0.39 - 0.33) * 0.12 * (1 * 117.5)^2 * \frac{8760}{1000} = 2612.36\ kWh \quad (13)$$

In the app, you can set the rates for CO2 emissions and economic expenses, this is different for each country, in this case the values set by default in the CableApp will be used, which are 0.15 US$/kWh and 0.40 kg CO2/kWh. Furthermore, if you want to change the value for the percentage of current due to the Joule effect, it is possible to do in “Advanved Calculations”. As an example, in the case of Costa Rica, the data can be found on the Instituto Meteorológico Nacional website, at the link: FactoresEmision-GEI-2020.indd (imn.ac.cr).

Economical savings:

$$A_\$ = 2612.36\ kWh * 0.15 US\$/kWh = 391.85\ US\$ \quad (14)$$

CO_2 emission savings:

$$A_{CO2} = 2612.36\ kWh * \frac{0.40 kgCO_2}{kWh} = 1044.94\ kgCO_2 \quad (15)$$

Further Yearly Savings Using a Larger Cross-Section

The following equations compare an even larger conductor size (3/0 AWG) to the results obtained with a 2/0 AWG:

$$E_A = \frac{n}{c} * (R_2 - R_3) * L * I^2 * \frac{t}{1000} \quad (S_3 > S_2) \quad (16)$$

$$E_A = \frac{3}{1} * (0.33 - 0.253) * 0.12 * (1 * 117.5)^2 * \frac{8760}{1000} = 3352.53\ kWh \quad (17)$$

Economical savings:

$$A_\$ = 3352.53\ kWh * 0.15 US\$/kWh = 502.88\ US\$ \quad (18)$$

CO_2 emission savings:

$$A_{CO2} = 3352.53\ kWh * \frac{0.40 kgCO_2}{kWh} = 1341.01\ kgCO_2 \quad (19)$$

2. Calculate the savings if you have the same data from the previous example, except that the current intensity due to the Joule effect is 60%.

Solution:

It is known from the above problem that:

$$I = 117.5\ A$$

$$t = 8760\ hours$$

Yearly Savings

Initially, the recommended conductor size was 1/0 AWG. If a 2/0 AWG is considered instead (which would have a larger cross-section), the result would be:

$$E_A = \frac{3}{1} * (0.39 - 0.33) * 0.12 * (0.6 * 117.5)^2 * \frac{8760}{1000} = 940.45\ kWh \quad (20)$$

Economical savings:

$$A_\$ = 940.45\ kWh * 0.15 US\$/kWh = 141.07\ US\$ \quad (21)$$

CO_2 emission savings:

$$A_{CO2} = 940.45\ kWh * \frac{0.40 kgCO_2}{kWh} = 376.18\ kgCO_2 \quad (22)$$

Further Yearly Savings Using a Larger Cross-Section

The following equations compare an even larger conductor size (3/0 AWG) to the results obtained with a 2/0 AWG:

$$E_A = \frac{n}{c} * (R_2 - R_3) * L * I^2 * \frac{t}{1000} \quad (S_3 > S_2) \quad (23)$$

$$E_A = \frac{3}{1} * (0.33 - 0.253) * 0.12 * (0.6 * 117.5)^2 * \frac{8760}{1000} = 1206.91\ kWh \quad (24)$$

Economical savings:

$$A_\$ = 1206.91\ kWh * 0.15 US\$/kWh = 181.04\ US\$ \quad (25)$$

CO_2 emission savings:

$$A_{CO2} = 1206.91\ kWh * \frac{0.40 kgCO_2}{kWh} = 482.76\ kgCO_2 \quad (26)$$

GLOSSARY OF DEFINITIONS

A	
Ampere	It is the base unit of measurement for electrical currents in the International System of Units. The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed one metre apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newtons per metre of length. It is represented with the symbol A in honor of André-Marie Ampère.
C	
Cable	A collection of one or several insulated conductors, bedding, wire armoring and an outer jacket. It can have one or more non-insulated conductors.
Circuit	Set of electrical materials (conductors, equipment, etc.) of different phases or polarities, powered by the same energy source and protected against an overcurrent by the same protection device(s). The circuits that are part of the utilization devices or receivers are not included in this definition.
Conductor	A material that can conduct or transmit electricity. Cables that contain conductive materials are also commonly referred to as conductors.
Continuous load	Load whose maximum current is expected to circulate for three hours or more.
Correction Factor	The result of a fit test which is used to correct ampacities depending on the number of conductors.
D	
Demand Factor	The relationship between the maximum demand of a system under study and the total load that is connected to it.

Demand Factor		
Type of Facility	Load to which the demand factor will be applied (VA)	Demand Factor (%)
Housing units	Less than or equal to 3,000	100
	3,001-120,000	35
	More than 120,000	25
Hospitals	Less than or equal to 50,000	40
	More than 50,000	20
	Less than or equal to 20,000	50

Hotels and motels, apartments without a kitchen	20,001-100,000	40
	More than 100,000	30
Storage warehouse	Less than or equal to 12,500	100
	More than 12,500	50
Other	Total volt-amperes	100

Duct	Conduit, gutter or pipeline in which the cables are placed.
	E
Electric current intensity	The amount of electric charge that passes through a cross section of the conductor per second.
Electric tray	Channeling formed by a unit or set of units, made up of a continuous base, elevated and uncovered sides, together with their ironwork and accessories, which form a structural system used to securely hold and support cables, pipes and other conduits.
Electrical installation	A set of electrical devices and circuits that are joint with the purpose of producing, converting, transforming, distributing or using electrical energy.
Extrusion	Procedure used to create objects with a fixed cross-sectional figure. In the case of this industry, it is used to apply the chosen cable insulation.
	G
Ground	Earth's conductive mass which conventionally is said to have an electric potential equal to cero at each of its points.
Grounding	The connection of an exposed energized conductor to a non-energized point. Usually this point can be the ground on which the building or construction is located.
	I
Impedance	Quotient of the voltage at the terminals of a circuit divided by the current that flows between them. This definition only applies to sinusoidal currents.
Inductance	The property possessed by a circuit in which a magnetic field is established in function of the current that flows within it. The coefficient of self-induction L is the measurement of this property and it is quantified as the ratio between the self-induction electromotive force and the change in the current over time. A Henry (H) is the unit for inductance used by the International System of Units. A circuit that has an inductance of one Henry when varying the current at a rate of one Ampere per second produces an electromotive force of inductance that is equal to one Volt.
Insulation	Material with a high electrical resistance that covers the conductors with the objective of avoiding electrical discharges between themselves and/or against any other surface

	that conventionally has zero electric potential (devices, facilities or people). There are two types: thermoplastic and thermoset.
J	
Jacket	A continuous and uniform tubular lining of generally extruded metallic or non-metallic material.
M	
Multiconductor	An electrical cable that is formed by a set of smaller cables.
N	
Nominal power of a motor	The mechanical power available on a motor's axis. Generally expressed in Watt or kilowatt.
Noncontinuous load	Load where the waveform of the steady state current does not follow the waveform of the applied voltage.
O	
Ohm	The unit of electrical resistance used by the International System of Units. One Ohm is the value of resistance that a conductor has on the passage of an electric current, equal to one Ampere, when the potential difference between its ends is one Volt. It is represented by the Greek letter Ω. It is name in honor of Georg Simon Ohm.
P	
Power Factor	The relationship between the power in watts and the product of the effective values of voltage and current. For sinusoidal waveforms, it is equal to the cosine of the phase difference between the voltage and current.
Predicted or installed power	Maximum amount of power that an installation can supply to the equipment and devices connected to it, either by design or execution.
R	
Raceways	Set consisting of one or more electrical conductors and the elements that ensure their fixation and mechanical protection.
S	
Short-Circuit Current	Symmetrical fault current at nominal voltage, to which an appliance or a system can be connected without suffering damage that exceeds the defined acceptance criteria.
Short-Circuit	An accidental or intentional connection of two or more points of a circuit with different voltages by means of a resistance or an impedance.
Single-phase system	An electrical system that is composed of only one current or which has only one conductor.

T	
Technical sheet	Document given by the manufacturer which provides all the technical information related to their product.
Testing	Test that is performed on a product in order to verify any of its specific characteristics.
Thermoplastic	Insulation material made of PVC or low-density polyethylene. It is susceptible to softening if it is heated or to hardening if its cooled repeatedly. Once the plastic is within a specific temperature range, it will reach a softening state which will allow for it to be extruded.
Thermoset	Insulation material that undergoes a drying and curing process after it has been heated and extruded onto the cables. These processes will prevent it from softening ever again.
Three-phase system	Electric system composed by three single-phase alternating currents. Energy flows through each of the three conductors.
V	
Voltage Drop	Difference in the electric potential between two points within an installation.
Voltage	Measurement of the difference in electrical potential between two points.

GLOSSARY OF ABBREVIATIONS

A	
A	Unit used to denote the intensity of electric current.
AAC	All Aluminum Conductor: conductor or cable of aluminum wires.
AACS	Aluminum Alloy Standed Conductor: aluminum alloy cable.
AC	Armored Cable: cables provided with flexible metal armor.
ACSR	Aluminum Conductor Steel Reinforced: aluminum conductor with galvanized steel center.
ACSR-AW	ACSR with steel center coated with aluminum (Alumo-Weld). Also known as ACSR-AS.
ACSS	Aluminum Conductor Steel Supported: high temperature aluminum cables.
ACSS-AW	Aluminum Conductor Steel Supported (Alumo-Weld): high temperature aluminum cables, with aluminum coated steel core.
ACSS-TW	Aluminum Conductor Steel Supported (Trapezoidal Wire): high temperature aluminum cables, formed with trapezoidal wires.
Al	Aluminum symbol.
AW	Alumo Weld: steel rod with aluminum coating.
AWG	American Wire Gauge: Scale of American gauges for wires and cables, also known as b&s (Brown and Sharpe) Wire Gauge.

AWM	Appliance Wiring Material: conductors intended for the internal wiring of household appliances.
	B
BIL (NBIA):	Basic Impulse Insulation Level: nivel básico de aislamiento al impulso (NBIA).
	C
CM	Circular Mil: Area of a wire with a diameter of 0.001 inch.
CP	Horsepower: also known as HP.
CPE	Chlorinated PolyEthylene
CT	Engraving of cables for use in trays.
CT-SR	Engraving of cables for use in trays and exposed to the rays of the sun.
Cu	Copper symbol.
CUSn	Symbol denoting tinned copper.
CV	Continuous Vulcanization: vulcanization process in line with extrusion.
CW	CopperWeld: steel rod with copper coating.
	D
DLO	Diesel Locomotive cable. Cable for diesel locomotives.
DRS	Cables for Underground Residential Distribution (URD type).
DS	Cables for Underground Distribution (UD type).
	E
EP(R)	Ethylene Propylene (Rubber): ethylene-propylene-based insulation.
	G
G	Ground: flexible cable for mines with conductors for grounding.
G-GC	Ground-Ground Check: flexible cable for mines, with conductors for grounding and an insulated conductor to check the continuity of the ground conductors
	H
HDPE	High Density Polyethylene (HDPE)
HMWP	High Molecular Weight Polyethylene
HP	Horse Power.
Hz	Hertz: unit for frequency denomination.
	I
IACS	International Annealed Copper Standard: international standard for copper conductivity (equal to 100% for annealed electrolytic copper).
	K
kcmil	kiloCircularMil: unit of area of the North American system of calibers of electrical conductors, equal to 1 000 circular mils (CM). Formerly known as MCM.
kV	kiloVolt: unit of measurement of electrical voltage equal to 1 000 volts.
	L
LDPE	Low Density Polyethylene (PEBD).
LS	Low Smoke. Engraving of cables that comply with the non-propagation of the fire, reduced emission of fumes and reduced emission of halogenated acid gas.
	M
MC	Metal Clad: cable armed with a metal cover of the interlock type or corrugated tube
MP	Mine Power Feeder Cable: mine feeder cable with three phase conductors and three grounding conductors.
MP-GC	MP-Ground Check: MP with an isolated conductor to check the continuity of the ground conductors.
m.s.n.m	Meters above mean sea level (mamsl)

MTW	Machine Tool Wire: conductor with thermoplastic insulation for wiring machine tools.
MT	Medium Voltage (Media Tensión): cables with solid insulation for voltages from 2 001 to 35 000 volts.
MV	Medium Voltage Cable: solidly insulated cables for voltages from 2,001 to 35,000 volts.
	N
Neoprene	Polychloroprene, synthetic rubber used as insulation and flexible cable cover.
NM	Non-Metallic Sheathed Cable: insulated conductors and with non-metallic cover, flame retardant, for use in dry places at 75 ° C
NM-B	Non-Metallic Sheathed Cable: insulated conductors and with non-metallic cover, flame retardant, for use in dry places at 90 ° C
NMC-B	Non-Metallic Sheathed Cable: insulated conductors with non-metallic cover, flame retardant, for use in dry, damp, wet and corrosive places at 90 ° C
	P
PE	Polyethylene, can be of the PEAD or PEBD types.
PEAD	High Density Polyethylene.
PEBD	Low Density Polyethylene.
PCG	Portable Cable Control and Ground Conductors: flexible cable for mines with control conductors and for grounding, 2 000 volts.
PG	Portable Cable Ground Conductor: flexible cable for mines with phase conductors and for grounding, 2 000 volts.
psi	Pounds per square inch.
PVC	PolyVinyl Chloride: compound widely used as insulation and cover
	R
RHH	Rubber High Heat: cables with insulation and synthetic rubber cover, for 90 °C, 600v
RH/RW	Rubber Heat, Rubber Moisture (Water): cables with insulation and cover of synthetic rubbers for 75 °C in dry environment and 60 °C in wet, 600 volts.
RHW	Rubber Heat Moisture (Water): cables with insulation and cover of synthetic rubbers for 75 °C in dry and humid environment.
RHW-2	Same as RHW but with insulation of 90 °C in dry and humid environment.
	S
SE	Service Entrance: one or more drivers with or without an outer deck used to power services.
SH	Shielded Mining Cable Single Conductor: flexible monopolar cable for mines with screen and cover for heavy use.
SHD	Shielded Mining Cable with Ground Conductors: flexible three-phase cable for mines with screen and conductors for grounding.
SHD-GC	SHD-Ground Check: SHD with one conductor isolated for the grounding continuity check circuit and two ground conductors.
SIC	Specific Inductive Capacity: specific capacitive inductance, dielectric constant of a material that is the relationship that exists between a capacitor with the material as a dielectric and the same condenser with air as a dielectric.
SIS	Synthetic Insulated Switch Board Cable: cable for boards with synthetic elastomeric insulation, 90 °C, 600 volts.
SJ	Hard Service Cord Junior: rough use cord for light service with elastomeric isolation, 300 volts.
SJO	SJ Oil Resistant: SJ with oil resistant insulation.

SJT	SJ Thermoplastic: SJ with insulation and thermoplastic cover, 60 °C, 300 volts (90 and 105 °C with PVC insulation).
SMT	Construction equal to the SPT but with M-class drivers.
SO	Service Cord Oil Resistant: heavy duty cord rough use; insulation and elastomeric cover; the cover is oil resistant, up to 90 °C, 600 volts.
SR	Engraving for cables that are weather resistant.
SPT	Service Parallel Thermoplastic: parallel cord with PVC insulation for light service, 60 °C, 300 volts. (90 and 105 °C with PVC insulation).
ST	Hard Service Cord Thermoplastic: cable or cord rough use for heavy duty with insulation and thermoplastic cover, 60 to 105 °C, 600 volts.
	T
TC	Power and Control Tray Cable: two or more insulated conductors with or without ground conductor and with an outer cover of non-metallic material and approved for use in tray installations.
TC-ER	Tray Cable-Exposed Run. Engraving of exposed wires that pass the impact and crush test.
TF	Thermoplastic Fixture: 7-wire wire or cable for wiring electrical appliances, PVC insulation, 60 °C. 600 volts.
TFF	TF Flexible: TF but with flexible conductor.
TFN	TF Nylon: TF with PVC insulation and nylon cover. 90 °C, 600 volts.
TFFN	Thermoplastic Fixture Flexible Nylon: TFN with flexible conductor.
TGP	General Purpose Thermoplastic: cables for wiring in general.
THHN	Thermoplastic High Heat Nylon: wire or cable with PVC insulation and nylon cover, 90 °C in dry environment, 600 volts.
THW	Thermoplastic Heat and Moisture (Water) Resistant: wire or cable with PVC insulation for 75 °C in dry or humid environments. 600 volts.
THW-2	THW for 90 °C in dry and humid environments.
THHW	Thermoplastic High Heat Moisture (Water) Resistant: insulated cable with PVC for 90 °C in dry environments and 75 °C in wet environments, 600 volts.
THWN	THW with nylon cover, resistant to moisture, oils, and hydrocarbons, 75 °C in humid environments. 600 volts.
TW	Thermoplastic Building Wire Moisture (Water) Resistant: wire or cable insulated with moisture-resistant PVC. 60 °C. 600 volts.
THWN-2	THWN for 90 °C in dry and humid environments.
TSJ-N	Cord use rough for light service with thermoplastic insulation, 600 volts. 60, 90 and 105 °C with PVC insulation).
	U
UD	Underground Distribution: cables for underground distribution, also known as DS cables.
UF	Underground Feeder: single or several conductor cable with insulation and thermoplastic cover for underground connections in low voltage.
	thermoplastics for underground connections in low voltage.
URD	Underground Residential Distribution: underground residential distribution cables, also known as DRS.
USE	Underground Service Entrance: cable for underground connections in low voltage, insulation and elastomeric covers.
	V
V	Volt: unit used to denote electrical voltage.
VA	Volt Ampere: apparent power unit for transformers.

VW-1	Vertical Wire Flame Test: flame resistance test by placing the specimen in an upright position.
W	
W	Flexible cables for mines: one or more conductors with insulation and elastomeric cover for extra-weighed service.
X	
XHHW	Cross (X)-Linked Polyethylene High Heat and Moisture (Water) Resistant: cable with cross-chain polyethylene insulation, 90 °C dry environment and 75 °C wet environment, 600 volts.
XHHW-2	XHHW for 90 °C in dry and humid environments.
XLP	Cross (X)-Linked Polyethylene: cross-chain polyethylene, also known as vulcanized polyethylene or XLPE.
Xt	Xmas Tree Cord: parallel cord, two insulated conductors with PVC for series of Christmas trees.

GLOSSARY OF INSTITUTIONS AND ORGANIZATIONS

A	
AAR	Association of American Railroads.
Abs	American Bureau of Shipping.
AEC	Atomic Energy Commission.
AEIC	Association of Edison IlIuminating Companies.
AENOR	Spanish Association of Standardization and Certification
ANCE	National Association for Standardization and Certification of the Electricity Sector.
ANSI	American National Standards Institute.
ASTM	American Society for Testing and Materials: Organization dedicated to the publication of standards, test methods and recommendations on materials.
B	
BSI	British Standards Institution, its main activities include certification, auditing and standards development.
C	
CEI (IEC)	(lEC): Commission Electrotechnique Internationale: French name for the International Electrotechnical Commission.
CEI	Comitato Elettrotecnico Italiano: Italian Electrotechnical Committee.
CFE	Federal Electricity Commission (Mexico).
CCNNIE	National Advisory Council for the Standardization of Electrical Installations.
CIDET	Center for Research and Technological Development of the Electricity Sector, whose objective is to promote and develop activities of standardization and certification of product conformity.
CSA	Canadian Standard Association: Canadian institution for the certification of electrical and electronic equipment according to the standards that it publishes.
D	
SGN	General Directorate of Standards of the Ministry of Trade and Industrial Development.
DIN	German Standards Institute.
E	
ECA	Costa Rican Accreditation Body.

EIA	Electronic Industries Association: American grouping of the electronics industry.
EMA	Mexican Accreditation Entity.
	I
ICEA	Insulated Cable Engineers Association: current name of IPCEA (Power), North American association for the standardization of electrical conductors.
IEC	International Electrotechnical Commission: international organization in charge of the standardization of electricity producers.
IEEE	Institute of Electrical and Electronic Engineers: the world's leading association of engineers in electricity, electronics and related matters.
INTECO	Instituto de Normas Técnicas de Costa Rica, its main activities include certification, auditing and standards development.
ISO	International Standards Organization.
	J
JIS	Japanese Industrial Standard.
	M
MESA	Mine Enforcement Safety Act: Health and Safety Council for the Mining Industry
MSHA	Mine Safety and Health Administration: north American health and safety unit of the mining industry.
MIL	Standard American Military
	N
NBS	National Bureau of Standards: Standardization division of the U.S. Department of Commerce.
NEC	National Electrical Code: General standard on electrical products and installations published by the NFPA under OSHA guidelines
NEMA	National Electrical Manufacturers Association: association of manufacturers of electrical equipment in support of standardization and manufacturing technologies.
NESC	National Electrical Safety Code.
NFPA	National Fire Protection Association: American Association for Fire Protection, responsible for the publication of the NEC.
NMX	Mexican standards for industry.
NOM	Official Mexican Standard: documents published by the DGN for standardization and specification of products.
	O
OSHA	Occupational Safety and Health Administration: U.S. office of the Department of Labor responsible for the regulation of the safety factors required in the workplace.
	R
REA	Rural Electrification Administration: U.S. office of the Department of Agriculture responsible for standardization of equipment offered by independent telephone companies.
	S
SAE	Society of Automotive Engineers: Association of Automotive Engineers.
SEDE	Ministry of Energy.
	U
UL	Underwritters Laboratories, Inc.: A private institution dedicated to the recognition and approval of electrical and electronic products, in accordance with its own standards.

V	
VDE	Verband Deutscher Elektrotechniker: German Association of Electrical Engineers.