GOSSEN METRAWATT

TESTING ELECTRONIC EQUIPMENT PER IEC 62368-1

ELECTRICAL SAFETY FOR AUDIO/VIDEO, INFORMATION AND COMMUNICATION TECHNOLOGY EQUIPMENT

INTERNATIONAL ELECTROTECHNICAL COMMISSION

The International Electrotechnical Commission (IEC) is an international standards organization based in Geneva that prepares and publishes standards in the fields of electrical engineering and electronics.

As an association under Swiss law, the IEC is a non-profit, non-governmental organization. In addition to the IEC's head office in Geneva, there are four regional centers as well: in Singapore for Asia, in Brazil for Latin America, in the USA for North America and in Sydney for the Pacific region.

HISTORY

The IEC was founded in 1906 and was initially located in London, but has been based in Geneva since 1948. The IEC was instrumental in harmonizing standards for units of measure, in particular Gauss, Hertz and Weber. The IEC was also the first to propose a system of standards, namely the Giovanni Giorgi system, which eventually became the International System of Units (SI). A multilingual, international dictionary was published in 1938 in order to standardize electrotechnical terminology. This work continues and the International Electrotechnical Dictionary (IEV) remains an important project in the electrical and electronics industry.

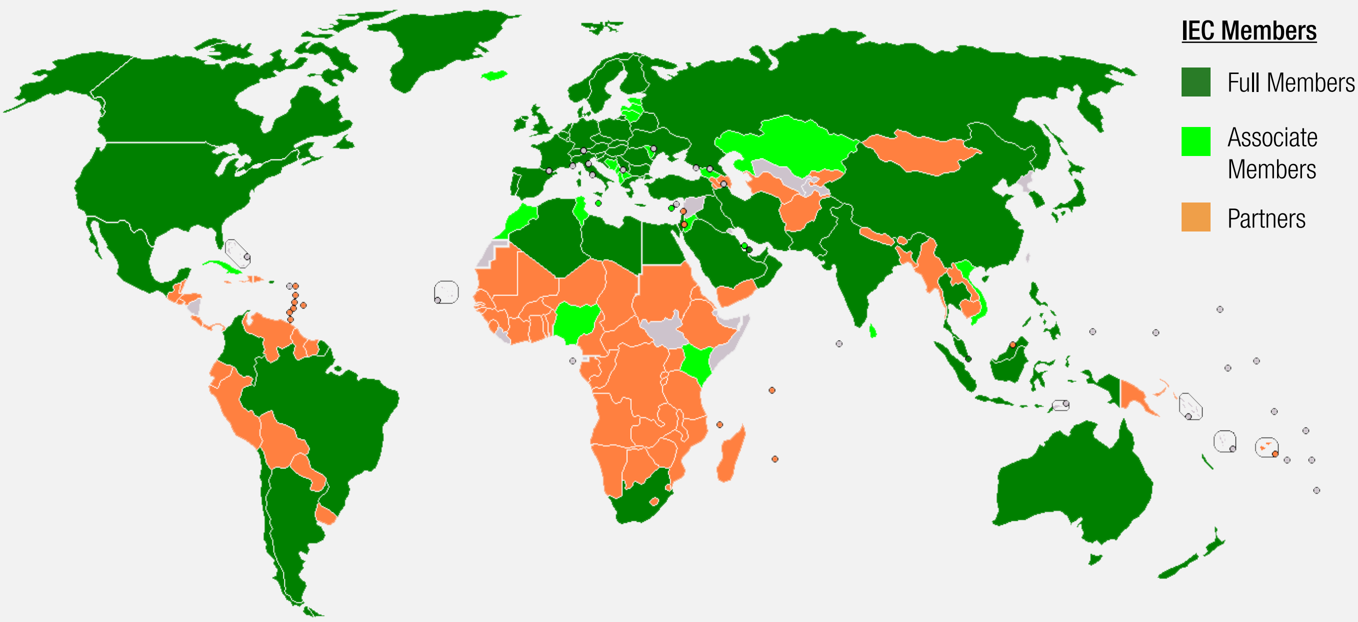
MISSION

The IEC's charter covers the entire spectrum of electrotechnology, including power conversion and distribution, electronics, magnetism and electromagnetism, electroacoustics, multimedia, telecommunications and medical technology, as well as general disciplines such as vocabulary and symbols, electromagnetic compatibility, metrology and operating performance, reliability, design and development, safety and the environment.

MEMBERSHIP

The IEC consists of members known as national committees (NCs). Each NC represents its own national, electrotechnical interests within the IEC covering manufacturers, utilities, distributors and suppliers, consumers and users, government agencies at all levels, professional and trade associations, as well as developers of national standards bodies. Roughly 90% of the employees who prepare IEC standards work in industry.

More than 80 countries are represented by the IEC, organized into 1442 workgroups and commissions.



DIN EN IEC 62368-1

As part of the implementation of the European directive on occupational safety, a standard for testing electrical equipment after repair was also issued – EN 50678. Information technology equipment could not be covered by this standard because, in the opinion of the expert committee, the requirements for testing after repair are determined by the manufacturer of the equipment, taking into account the requirements from the product standard. Consequently, IEC 62368 serves as the basis for testing after repair.

Part 1 of IEC 62368 is a product safety standard which classifies energy sources, stipulates protective measures for energy sources and provides guidelines for their use. The specified safety precautions are designed to reduce the likelihood of pain, injury and, in the event of fire, property damage.

IEC 62368-1 applies to electrical and electronic equipment in the fields of audio, video, information and telecommunications technology, including electric office machines up to a nominal voltage of 600 V. The standard also applies to components and assemblies intended for integration into such equipment.

In contrast to DIN EN 60950-1 (VDE 0805-1) and DIN EN 60065 (VDE 0860), DIN EN 62368-1 (VDE 0868-1) has been entirely restructured and adopts a new safety approach. This new approach is based on the premise that damage can occur when energy of sufficient magnitude and duration acts upon a body. Taking the risk of danger posed by possible energy sources into account is paramount to safe equipment design.

Energy Form	Example: Body Reaction / Property Damage
Electrical energy (e.g. live conductive parts)	Pain, cardiac fibrillation, cardiac arrest, respiratory arrest, burning of the skin or internal organs
Thermal energy (e.g. electrical ignition and spread of fire)	Electrically caused fire resulting in pain or injury due to burns, or property damage
Chemical reaction (e.g. electrolyte, poison)	Skin damage, organ damage or poisoning
Kinetic energy (e.g. moving parts of a device or a moving body part which strikes a device part)	Laceration, puncture, abrasion, contusion, amputation or loss of a limb, eye, ear etc.
Thermal energy (e.g. accessible hot parts)	Burning of the skin
Radiated energy (e.g. electromagnetic energy, optical energy, acoustic energy)	Loss of vision, skin burns or loss of hearing

ELECTRICAL ENERGY

Electrical energy transfer occurs when two or more electrical contacts have been established with the body:

- The first electrical contact is between a body part and a conductive part of the device
- The second electrical contact is between another part of the body and
  - ⇨ ground, or
  - ⇨ another conductive part of the device

HBSE (HAZARD-BASED SAFETY ENGINEERING)

The focus on HBSE is new. This issue has been dealt with to an ever greater extent over the last 20 years. The IEC has been focusing on HBSE more and more intensively since 2002. Within this context, the newly published standard, ECMA-287 (electronic devices), was handed over to the HBSDT (hazard-based standard development team). Working within the framework of the relevant IEC technical committee (TC108), this team aims at developing less prescriptive and thus future-proof standards, in order to ensure the safety of the end user.

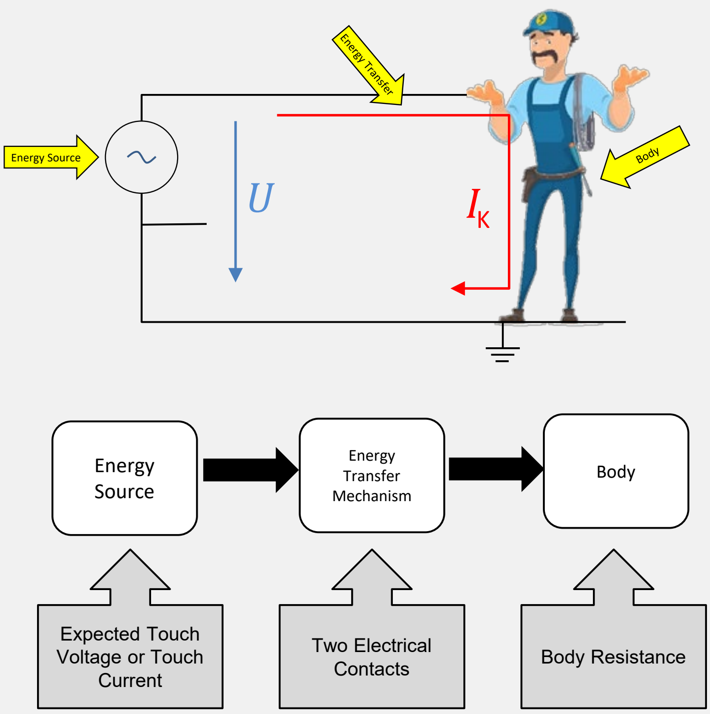
As opposed to the traditional approach of stipulating compliance with prescribed specifications, the manufacturer must, as part of the development and production process, ensure that known hazards have been taken into account and that the product can be used safely within the expected context. Although standards such as 62368-1 are risk-based, they don't stipulate any risk analysis as is the case with IEC 60601-1.

HBSE principles protect equipment users by identifying potentially hazardous sources of energy and the mechanisms by means of which energy can be transmitted to a user, and suggesting appropriate measures for the prevention of such transmission. Normal operation as well as fault conditions are covered. HBSE promotes early identification of hazards during development so that product design can be modified to eliminate them. It also facilitates additional performance options in order to verify compliance with the respective regulations. As an important factor, HBSE also assesses the effectiveness of the safety measures.

ENERGY

One or more protective devices are placed between an electrical energy source that can cause pain or injury and a body part. The most common basic protective measure for an electrical sources of energy that can cause pain is electrical insulation (also called basic insulation) between the source of energy and a body part.

Depending on the magnitude, duration, waveform, and frequency of the current, the effect on the human body varies from imperceptible, perceptible or painful, right on up to injurious.



Schematic and Model for Electrically Induced Pain or Injury

The requirements for leakage current specified in the standard make a distinction with regard to which energy source (ESx) the user is exposed to. For example, a **layperson** may only be exposed to an energy source 1, an **instructed person** to an energy source 2 and a **qualified specialist** to an energy source 3.

Limit Values for Electrical Energy Sources in Steady State – ES1/ ES2

Energy Source		DC	AC to 1 kHz		AC > 1 kHz to 100 kHz		AC > 100 kHz		Combined AC and DC			
ES1	Voltage	60 V	U_{RMS} = 30 V	U_{peak} = 42.4 V	U_{RMS} = 30 [V] + 0.4 f [kHz]	U_{peak} = 42.4 [V] + 0.42 f [kHz]	U_{RMS} = 70 V	U_{peak} = 99 V	$U_{DC}(V) + U_{AC\,RMS}(V)$ £ 1 IDC (mA) + IAC RMS (mA) £ 1 2 0.5	60 $U_{RMS\ limit}$, IDC (mA) + IAC peak (mA) £ 1 2 0.707	$U_{DC}(V)$ + $U_{AC\ peak}(V)$ £ 1	60 $U_{peak\ limit}$
	Current	2 mA	I_{RMS} = 0.5 mA	I_{peak} = 0.707 mA								
ES2	Voltage	120 V	U_{RMS} = 50 V	U_{peak} = 70.7	U_{RMS} = 50 [V] + 0.9 f [kHz]	U_{peak} = 70.7 [V] + 0.42 f [kHz]	U_{RMS} = 140 V	U_{peak} = 198 V	Dynamic per graphic 22, IEC 62368			
	Current	25 mA	U_{RMS} = 5 mA	I_{peak} = 7.07 mA					Dynamic per graphic 23, IEC 62368			
ES3	> ES2											

As an alternative to the above listed requirements, other values for pure sine waves can be used.

Source: IEC 62368-2021-108_755e_CD

SCOPE OF APPLICATION OF THE NEW IEC 62368-1

As a product standard, the new standard replaces former standards IEC 60950 (office equipment) and IEC 60065 (electronics, entertainment) and is valid for products covered by these legacy standards. In general, these include electrical and electronic equipment in the fields of office equipment, information and communications technology, as well as audio and video. IEC 62368 is applicable regardless of the technology, in order to account for new and future developments in these areas such as smartphones, tablets, laptops, electronic devices, 3D printers and more.

IEC/EN 60950-1 and IEC/EN 60065 have no longer been applicable since 20 December 2020, and thus a new certificate is required. All devices manufactured after 20 December 2020 must be certified in accordance with the new DIN EN IEC 62368-1. If this is not the case, for example because a dealer is selling off old stock, affected devices would not meet the requirements of the European low-voltage directive. Under no circumstances may this risk be passed on to the manufacturer; the importer is also affected. If, for example, the power supply in an electrical device does not comply with the requirements, the distributor – e.g. a company that has purchased electrical devices and equipment in Asia at a seemingly low price – may be exposed to liability risks.

International Implementation of the New Standard

New hazard-related safety standards (62368-1) are already being adopted in the US, Canada and the EU, as well as in other countries/regions.

Country/Region	Corresponding Local Standard	Local Publication Date of the Standard	Date of Coming into Force
USA	UL 62368-1, 3rd edition	12/13/2019	12/20/2020
Canada	CAN/CSA C22.2 no. 62368-1:19, 3rd edition	12/13/2019	12/20/2020
European Union	EN 62368-1, 2nd edition	Yet to be determined, 2020	12/20/2020
United Kingdom	BS EN 62368-1, 2nd edition	Yet to be determined, 2020	12/20/2020
Australia and New Zealand	AS/NZS 62368:2018	2/15/2018	2/15/2022
Mexico	NMX-I-62368-1-NYCE-2015	Not applicable	Not applicable

Operating Conditions, Single Fault

Under normal operating conditions, abnormal operating conditions or single-fault conditions (SFC), instructed persons should not come into contact with parts which contain energy sources that can cause injury.

A single-fault condition is a condition in which a single means for reducing risk is defective, or a single abnormal condition prevails. Single-fault safety is defined as a property of an electrical or medical electrical device or its parts, which keeps it free of unacceptable risks for the duration of its expected service life under single-fault conditions.

In order for a device to remain single-fault-proof under single-fault condition, the following sequence of events must be considered:

- An initial, random single-fault condition can occur at any time.
- A device must remain single-fault-proof after the single fault has occurred.
- If the first single-fault condition cannot be detected, a second single-fault condition must be taken into consideration after a given period of time. It should be noted that this second single-fault condition must be independent of the first single-fault condition.
- The device must remain single-fault-proof when the first and second single-fault conditions occur together in combination. It should be noted that the term “single-fault” is misleading, because more than one single-fault condition may need to be taken into account, as described in point three above.

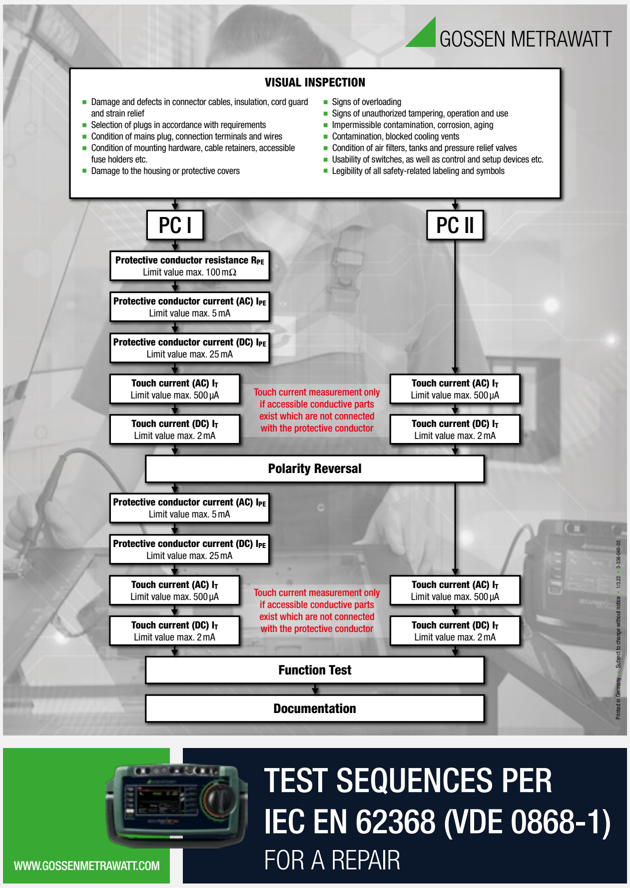
As of version 3.3, the SECUTEST and SECULIFE test instrument series is already furnished with a test sequence – preconfigured at the factory – for testing after repair, based on EN 62638 for ES2.

Repairs may only be conducted by qualified electricians or instructed persons!

A test sequence based on IEC 62911 is also available as an alternative, which is normally used in the production process before delivery of a new device. In this case, the Secutest performs an insulation resistance measurement with a test voltage of 500 V instead of a high-voltage test, in order to avoid accidental damage to the DUT.

Beyond this, test sequences can also be created by the user which, for example, also take the single-fault conditions into account which are required by some manufacturers in their service manuals.

For tests within the scope of preventive occupational safety, the users are often laypersons, so that energy source 1 requirements must be met in this case. This has been taken into account in the new EN 50699, for example – this standard also applies to information technology devices, and the Secutest/Seculife is also furnished with preconfigured test sequences ex works to this end.



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