



**SLOVENSKI STANDARD**  
**oSIST prEN IEC 62933-5-1:2023**  
**01-oktober-2023**

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**Električne naprave za shranjevanje energije (EES) - 5-1. del: Varnostni vidiki za sisteme EES, vključene v omrežje - Splošna specifikacija**

Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems - General specification

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[oSIST prEN IEC 62933-5-1:2023](https://standards.iteh.ai/catalog/standards/sist/d748-553-2023/osist-pr-en-iec-62933-5-1-2023)

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**ICS:**

27.010	Prenos energije in toplote na splošno	Energy and heat transfer engineering in general
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**oSIST prEN IEC 62933-5-1:2023**                      **en**





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SECRETARIAT: Japan	SECRETARY: Mr Hideki HAYASHI
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 21,SC 21A,TC 64	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input checked="" type="checkbox"/> SAFETY	
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TITLE:

**Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems - General specification**

PROPOSED STABILITY DATE: 2029

NOTE FROM TC/SC OFFICERS:

This CDV has been reflected the observations of 120/309A/CC by MT8 experts.

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**ELECTRICAL ENERGY STORAGE (EES) SYSTEMS –**

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**Part 5-1: Safety considerations for grid-integrated EES systems –  
General specification**

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## FOREWORD

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This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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A list of all parts in the IEC 62933 series, published under the general title *Electrical energy storage (EES) systems*, can be found on the IEC website. Additional criteria specific to electrochemical type electrical energy storage (EES) systems are in IEC 62933-5-2.

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## INTRODUCTION

211 Many governments' plans for how electricity will be generated and managed in the future have  
212 been determined. Such current plans cannot be implemented without long-term storage with  
213 capacities in the multi-MWh range.

214 There are a number of types of storage technologies that have emerged. Examples of these  
215 technologies are pumped hydro storage (PHS), electrochemical batteries, flywheel storage  
216 systems and hydrogen and synthetic natural gas (SNG). Pumped hydro storage has been widely  
217 used in terms of the total amount of stored energy. A flywheel is a model of kinetic energy storage  
218 with a high power density, excellent cycle stability and long life. While some flywheels are  
219 intended for short term operation, others can operate over longer periods of time of up to a few  
220 hours. Batteries require development primarily to decrease cost, and for some technologies to  
221 increase energy density as well. Hydrogen and synthetic natural gas (SNG) added to natural gas  
222 are likely to be essential elements of future electric grids because of their energy storage duration  
223 and capacity. Hydrogen and SNG should be further researched and developed across a broad  
224 front, including physical facilities, interactions with existing uses of gas for supply and distribution  
225 network, optimal chemical processes, safety, reliability and efficiency. The IEC White Paper  
226 "Electrical Energy Storage" (2011-12) may provide further background information concerning  
227 EES systems.

228 The IEC expects to keep pace, as in other areas in the past, with the need for international  
229 consensus standards for the safety of new storage technologies. It encourages regulators to  
230 anticipate the requirement to guarantee the safety of these technologies, and to contribute to  
231 shaping suitable international standards upon which harmonized regulations may be based.

232 For mature EES systems, various IEC standards exist, covering technical features, testing and  
233 system integration. For other technologies, there are only a few standards, covering special  
234 topics.

235 Up to now no general standard addressing safety for EESS integration into an electrical grid has  
236 been developed.

237 The rapid growth and the new technologies involved in electrical energy storage in the near future,  
238 as well as their installation by consumers will impose particular requirements for safety. At the  
239 same time, society and governments will need assurance of safety before the much-needed  
240 systems can be deployed.

241 This document stands as a decisive step towards the gradual alignment with specific  
242 technologies and applications concerning the safety of packaged or site-assembled grid-  
243 integrated EESS.

244

## ELECTRICAL ENERGY STORAGE (EES) SYSTEMS –

### Part 5-1: Safety considerations for grid-integrated EES systems – General specification

#### 1 Scope

This part of IEC 62933 specifies safety considerations (e.g. hazards identification, risk assessment, risk mitigation) applicable to EES systems integrated with the electrical grid.

This provides criteria to enable the safe application and use of electrical energy storage systems of any type or size intended for grid-integrated applications.

This standard can be applied to all EESS technologies, but for requirements specific to electrochemical EES systems, additionally refer to IEC 62933-5-2.

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASME B31.1, *ASME B31 Code for Pressure Piping, Section 1: Power Piping*

ASME B31.3, *ASME B31 Code for Pressure Piping, Section 3: Process piping*

<https://standards.iteh.ai/catalog/standards/sist/d74fb772-8433-4a3b-a3d4-1a3b5c15e974/osist-iec/iso-31010>, *Risk management – Risk assessment techniques*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60079-2:2014, *Explosive Atmospheres - Part 2: Equipment Protection by Pressurized Enclosures "p"*

IEC 60204-1, *Safety of Machinery – Part 1: General requirements*

IEC 60204-11, *Safety of Machinery – Electrical equipment of machines – Part 11 Requirements for equipment for voltages above 1000 VAC or 1500 VDC and not exceeding 36kV*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60364-4-41:2017, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-4-43, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-4-44, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60529, *Degrees of Protection Provided by Enclosures (IP Code)*

- 282 IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical*  
283 *flame test methods*
- 284 IEC 60730-1: *Automatic Electrical Controls - Part 1: General Requirements*
- 285 IEC 60730-2-9, *Automatic Electrical Controls - Part 2-9: Particular Requirements for Temperature*  
286 *Sensing Controls*
- 287 IEC 60947-5-1, *Low-Voltage Switchgear and Controlgear – Part 5-1: Control Circuit Devices and*  
288 *Switching Elements – Electromechanical Control Circuit Devices*
- 289 IEC 61000-1-2, *Electromagnetic compatibility (EMC) – Part 1-2: General – Methodology for the*  
290 *achievement of functional safety of electrical and electronic systems including equipment with*  
291 *regard to electromagnetic phenomena*
- 292 IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity*  
293 *standard for industrial environments.*
- 294 IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission*  
295 *standard for residential environments.*
- 296 IEC 61000-6-5, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity*  
297 *for equipment used in power station and substation environment.*
- 298 IEC 61000-6-7, *Electromagnetic compatibility (EMC) – Part 6-7: Generic standards – Immunity*  
299 *requirements for equipment intended to perform functions in a safety-related system (functional*  
300 *safety) in industrial locations*
- 301 IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-*  
302 *related systems*
- 303 IEC 61511 (all parts), *Functional safety – Safety instrumented systems for the process industry*  
304 *sector*
- 305 IEC 61936-1, *Power installations exceeding 1 kV AC and 1,5 kV DC – Part 1: AC*
- 306 IEC 61936-2, *Power installations exceeding 1 kV a.c. and 1,5 kV d.c. – Part 2: d.c.*
- 307 IEC 62061, *Safety of machinery – Functional safety of safety-related control systems*
- 308 IEC 62116:2014, *Utility interconnected photovoltaic inverters – Test procedure of islanding*  
309 *prevention measures*
- 310 IEC 62443-3-3, *Industrial communication networks - Network and system security Part 3-3:*  
311 *System security requirements and security levels*
- 312 IEC 62477-1:2022, *Safety requirements for power electronic converter systems and equipment*  
313 *– Part 1: General*
- 314 IEC 62477-2:2018, *Safety requirements for power electronic converter systems and equipment*  
315 *– Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV AC or 54 kV*  
316 *DC*
- 317 IEC 62933-1, *Electrical energy storage (EES) systems – Part 1: Terminology*
- 318 IEC 62933-5-2, *Electrical energy storage (EES) systems Part 5-2: Safety requirements for grid*  
319 *integrated EES systems - electrochemical based systems*

320 IEEE 1547.1, *Standard conformance test procedures for equipment interconnecting distributed*  
 321 *energy resources with electric power systems and associated interfaces*

322 ISO 1182, *Reaction to fire tests for products – Non-combustibility test*

323 ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

324 ISO 12100, *Safety of machinery – General principles for design – Risk assessment and risk*  
 325 *reduction*

326 ISO 12944, *Paints and varnishes – Corrosion protection of steel structures by protective paint*  
 327 *systems*

328 ISO 13849 (all parts), *Safety of machinery – safety-related parts of control systems*

329 ISO 15649, *Petroleum and natural gas industries — Piping*

### 330 **3 Terms and definitions**

331 For the purposes of this document, the terms and definitions given in IEC 62933-1 and the  
 332 following apply.

333 ISO and IEC maintain terminological databases for use in standardization at the following  
 334 addresses:

- 335 • IEC Electropedia: available at <http://www.electropedia.org/>
- 336 • ISO Online browsing platform: available at <http://www.iso.org/obp>

337

#### 338 **3.1** 339 **operation status**

340

##### 341 **3.1.1**

##### 342 **commissioning**

343 activities undertaken to prepare a system or product prior to demonstrating that it meets its  
 344 specified requirements

345 [SOURCE: IEC 60050-821:2017, 821-12-09]

346

##### 347 **3.1.2**

##### 348 **decommissioning**

349 administrative and technical actions taken to allow the removal of some or all of the EESS  
 350 regulatory controls from a facility

351

352 Note 1 to entry: These actions may include the processes of discharging ~~decontamination~~ and dismantling.

353 [SOURCE: IEC 60050-395: 2014, 395-08-28, modified - the term “regulatory controls” is replaced  
 354 with “EESS” and the term “decontamination” with “discharging”]

### 355 **3.2**

#### 356 **electrical installation**

357 assembly of electrical equipment which is used for the generation, transmission, conversion,  
 358 distribution and/or use of electric energy

359

360 Note 1 to entry: The electrical installation includes energy sources such as batteries, capacitors and all other sources  
 361 of stored electric energy.

362

363

364 [SOURCE: IEC 60050-651:2014, 651-26-01]

365

**3.3**366 **energized**, adj.367 **live**, adj.368 at an electric potential different from that of earth at the worksite and which presents an electrical  
370 hazard371 Note 1 to entry: A part is energized when it is electrically connected to a source of electric energy. It can also be  
372 energized when it is electrically charged and/or under the influence of an electric or magnetic field.

373 [SOURCE: IEC 60050-651:2014, 651-21-08]

374

**3.3.1****hazardous-live-part**

377 live part that, under certain conditions, can give a harmful electric shock

378 Note 1 to entry: A hazardous voltage can be present on the accessible surface of solid insulation. In such a case,  
379 this surface is considered to be a hazardous-live-part.

380 [SOURCE: IEC 60050-195:2021, 195-06-05]

381

**3.4****harm**

384 physical injury or damage to persons, property, and livestock

385 [SOURCE: IEC 60050-903:2013, 903-01-01]

**3.5****hazard**

388 potential source of harm

389 Note 1 to entry: In English, the term "hazard" can be qualified in order to define the origin of the hazard or the nature  
390 of the expected harm (e.g. "electric shock hazard", "crushing hazard", "cutting hazard", "toxic hazard", "fire hazard",  
391 "drowning hazard"). [s.iteh.ai/catalog/standards/sist/d74fb772-8433-4a3b-a3d4-1a3b5c15e974/osist-](https://standards.iteh.ai/catalog/standards/sist/d74fb772-8433-4a3b-a3d4-1a3b5c15e974/osist-62933-5-1-2023)392 Note 2 to entry: In French, the synonym "risque" is used together with a qualifier or a complement to define the origin  
393 of the hazard or the nature of the expected harm (e.g. "risque de choc électrique", "risque d'écrasement", "risque de  
394 coupure", "risque toxique", "risque d'incendie", "risque de noyade").395 Note 3 to entry: In French, the term "risque" also denotes the combination of the probability of occurrence of harm  
396 and the severity of that harm, in English "risk" (see 3.6).

397 [SOURCE: IEC 60050-903:2013, 903-01-02]

**3.6****risk**

400 combination of the probability of occurrence of harm and the severity of that harm

402 Note 1 to entry: In French, the term "risque" also denotes the potential source of harm, in English "hazard" (see 3.5).

403

404 [SOURCE: IEC 60050-903:2013, 903-01-07]

405

**3.6.1****tolerable risk**

408 risk which is accepted in a given context based on the current values of society

409 [SOURCE: IEC 60050-903:2013, 903-01-12]

410

### 411 **3.7**

### 412 **risk and hazard analysis**

413

#### 414 **3.7.1**

#### 415 **failure mode**

416 manner in which failure occurs

417 Note 1 to entry: A failure mode may be defined by the function lost or other state transition that occurred.

418 [SOURCE: IEC 60050-192:2015, 192-03-17]

#### 419 **3.7.2**

#### 420 **failure modes and fault tree analysis**

#### 421 **FMEA**

422 qualitative method of analysis that involves the study of possible failure modes and faults in sub  
423 items, and their effects at various system and subsystem levels

424 [SOURCE: IEC 60050-192:2015, 192-11-05]

#### 425 **3.7.3**

#### 426 **failure modes, effects and criticality analysis**

#### 427 **FMECA**

428 quantitative or qualitative method of analysis that involves failure modes and effects analysis  
429 together with a consideration of the probability of the failure mode occurrence and the severity  
430 of the effects

431 [SOURCE: IEC 60050-192:2015, 192-11-06]

#### 432 **3.7.4**

#### 433 **fault tree analysis**

#### 434 **FTA**

435 deductive analysis using fault trees

436 [SOURCE: IEC 60050-192:2015, 192-11-08]

#### 437 **3.7.5**

#### 438 **hazard and operability studies**

#### 439 **HAZOP studies**

440 structured and systematic technique for examining a defined system with the objective of  
441 identifying potential hazards in the system and identifying potential operability problems with the  
442 system and, in particular, identifying causes of operational disturbances and production  
443 deviations likely to lead to non-conforming products

444 Note 1 to entry: The hazards involved may include both those essentially relevant only to the immediate area of the  
445 system and those with a much wider sphere of influence, for example some environmental hazards

#### 446 **3.7.6**

#### 447 **risk analysis**

448 systematic use of available information to identify hazards and to estimate the risk

449 [SOURCE: IEC 60050-903:2013, 903-01-08]

#### 450 **3.7.7**

#### 451 **risk assessment**

452 overall process comprising a risk analysis and a risk evaluation

453 [SOURCE: IEC 60050-903:2013, 903-01-10]