

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Robotics for electricity generation, transmission, and distribution systems –
Part 1-1: Terminology for electric power robots**

**Robotique pour les réseaux de production, de transport et de distribution de
l'électricité –**

Partie 1-1: Terminologie pour les robots électriques

[IEC 63439-1-1:2025](https://standards.iteh.ai/IEC/63439-1-1:2025)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROBOTICS FOR ELECTRICITY GENERATION, TRANSMISSION AND DISTRIBUTION SYSTEMS –

Part 1-1: Terminology for electric power robots

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The text of this International Standard is based on the following documents:

Draft	Report on voting
129/35/FDIS	129/44/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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ROBOTICS FOR ELECTRICITY GENERATION, TRANSMISSION AND DISTRIBUTION SYSTEMS –

Part 1-1: Terminology for electric power robots

1 Scope

This part of IEC 63439 defines terms relating to electric power robot. It defines terms used for describing classification, constitution, function, performance, safety, working environment and other topics relating to electric power robot.

This document applies to the design, production, testing, sales, application, maintenance, management, scientific research of electric power robot.

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.

ISO 8373:2021, *Robotics – Vocabulary*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 8373 and the following 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 General terms related to EPR

3.1.1

electric power robot

EPR

robot applied in electric power systems, such as power plants, substations, transmission and distribution lines

3.1.2

unmanned aircraft power robot

UAVPR

unmanned aircraft power robot that can move itself in all three dimensions

3.1.3

diving electric power robot

DEPR

EPR that can move in liquids such as water and oil

3.1.4 electric power robot system EPRS

system comprising the EPR, task equipment, human-robot interaction equipment, and any ancillary facilities supporting the robot performing its task

3.1.5 patrol

activity done by the EPR which involves the collection, storage, transmission and background display of the images, videos, audios and other information about the status of equipment and facilities and environment

3.1.6 inspection

action comprising patrol and check of the electrical equipment and facilities along the route through manual remote control or autonomous operation

EXAMPLE Appearance inspection equipment based on visual images, equipment temperature detection based on infrared images, etc.

3.1.7 electrical operation

action in which the EPR operates electrical equipment in accordance with the intended task and applicable standards

EXAMPLE Switching opening and closing, etc.

3.1.8 electrical maintenance

action in which the EPR replaces or assists a human in order to retain the electrical equipment in, or restore it to, a state in which it can perform as required

EXAMPLE Cleaning of an electrical insulator.

3.1.9 live part

conductive part intended to be energized under normal operating conditions, including the neutral conductor and mid-point conductor, but excluding the protective earthing neutral conductor, protective earthing mid point conductor and protective earthing line conductor

[SOURCE: IEC 60050-195:2021, 195-02-19]

3.1.10 work environment

factors affecting the work of the EPR in its workspace

3.1.11 numbering rules

instructions for assigning a serial number to each EPR

Note 1 to entry: EPRs can be numbered with enterprise codes, functions, movement modes and design codes.

Note 2 to entry: An enterprise code can be the name of a company or a standard number.

3.2 Terms and definitions related to EPR classification

3.2.1 inspection electric power robot IEPR

EPR that can complete inspection tasks according to preset programs or instructions

3.2.2 operation electric power robot OEPR

EPR that can complete operation tasks related to the power system according to preset programs or control instructions

3.2.3 rescue electric power robot REPR

EPR that can assist or replace a human to complete tasks such as survivor search and rescue, environmental detection, and which is adapted to an environment where it is dangerous or difficult for humans to carry out rescue operations

3.2.4 firefighting electric power robot FFEPR

EPR that can carry out fire extinguishing operations according to preset program or remote control instructions

3.2.5 EPR for electricity generation equipment

robot that is used for the construction, operation, testing or maintenance of power generation facilities such as thermal power, hydraulic power, wind power, nuclear energy and solar energy

EXAMPLE Solar photovoltaic panel cleaning robot, power station rotor detection robot, etc.

3.2.6 EPR for electricity transmission equipment

EPR that is used for the construction, operation, testing or maintenance of overhead transmission lines, cable transmission lines, submarine cable transmission lines and their auxiliary power facilities

3.2.7 EPR for electricity transformation equipment

EPR that is used for the construction, operation, testing or maintenance of alternating current substation and converter station

3.2.8 EPR for electricity distribution equipment

EPR that is used for the construction, operation, testing or maintenance of distribution facilities

EXAMPLE Live working robot for distribution line.

3.3 Terms and definitions related to EPR constitution

3.3.1 Mechatronic subsystem

3.3.1.1 actuator

device that provides a physical output in response to an input signal in a predetermined way

[SOURCE: ISO/IEC 29182-2:2013, 2.1.1]

3.3.1.2 task equipment

equipment with functions such as inspection, maintenance and live working for electric power operation

EXAMPLE Infrared thermal imagers, lidars, robotic arms, etc.

3.3.1.3 pan and tilt device

platform that allows the position of the task equipment of the EPR to be adjusted in space

Note 1 to entry: The device can be used to carry inspection devices such as video cameras, ultrasonic probes, ultraviolet imagers and infrared thermal imagers, etc.

3.3.1.4 ancillary facility

construction, machinery, electric and electronic facilities necessary for the operation of the EPR

EXAMPLE Robot control rooms, ancillary positioning and navigation facilities, transport vehicles, etc.

3.3.1.5 specialized tool

object that is specially designed or adjusted for the completion of a specific electric power task, often installed at the end of the robotic arm, with single or combined functions such as image shooting, detection, grabbing, cutting, welding, grinding, fastening, and cleaning

Note 1 to entry: Specialized tools include live working tools.

3.3.1.6 interaction device

device used for human-robot and robot-robot information exchange and physical interaction

EXAMPLE Control handles, keyboards, mice, monitors, voice interactive devices, wearable interactive devices, etc.

3.3.1.7 insulating aerial device

any device, extensible, articulating, or both, made essentially of insulating components and which is primarily designed and used to position the EPR at an electric potential different from that of earth

Note 1 to entry: An insulating aerial device may also be used to handle material if designed and equipped for that purpose.

Note 2 to entry: An insulating aerial device does not include a chassis. When an insulating aerial device is mounted on a mobile chassis it becomes a component of a mobile elevating work platform (MEWP).

[SOURCE: IEC 60050-651:2014, 651-22-17, modified – The word "personnel" has been replaced by "the EPR" in the definition.]

3.3.1.8 work platform

pole platform, fenced platform or bucket on or in which EPRs performing live working stand

Note 1 to entry: Work platforms are used for erection, repair, inspection or similar work. They can be moved to the working position.

Note 2 to entry: Where applicable, the work platform can accommodate tools and equipment.

[SOURCE: IEC 60050-651:2014, 651-22-18, modified – The word "workers" has been replaced by "EPRs" in the definition and Note 3 to entry has been deleted.]

3.3.1.9 linkage device

automation device used for assisting robots to achieve autonomous operation as well as the linkage to electrical facilities relating to power environment

EXAMPLE The devices used for the linkage between robots and other devices (such as electric fireproof door, electric rat guard, electric curtain).

3.3.1.10**remote handling tongs**

mechanical device consisting of a gripper, a handle and a rod between them

[SOURCE: ISO 17874-1:2010, 3.4, modified – The note has been deleted.]

3.3.2 Perception subsystem**3.3.2.1****sound sensor**

sensor used to detect the sound intensity of the environment

[SOURCE: ISO/IEC 18038:2020, 3.27]

3.3.2.2**gas sensor**

sensor that evaluates such parameters as gas composition and gas concentration and converts them into usable output signals

3.3.2.3**inertial sensor**

device that measures triaxial attitude angle and acceleration

3.3.2.4**distance sensor**

sensor that measures the distance to an object

3.3.2.5**image sensor**

optoelectronic device which produces electrical signals representing the optical characteristics of an image

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<https://standards.iteh.ai/IEC-63439-1-1-2025> [SOURCE: IEC 60050-723:1997, 723-07-05]

3.3.2.6**video surveillance system**

system consisting of camera equipment, monitoring and associated equipment for transmission and controlling purposes, which can be necessary for the surveillance of a protected area

[SOURCE: ISO/IEC 30137-4:2021, 3.5]

3.3.2.7**lidar****light detection and ranging**

system consisting of 1) a photon source (frequently, but not necessarily, a laser), 2) a photon detection system, 3) a timing circuit, and 4) optics for both the source and the receiver that uses emitted laser light to measure ranges to and/or properties of solid objects, gases, or particulates in the atmosphere

[SOURCE: ISO/TS 19159-2:2016, 4.19, modified – Note 1 to entry has been deleted.]

3.3.3 Control subsystem

3.3.3.1 control station

part of the robot system which contains one or more control devices intended to activate or deactivate functions of the system or parts of the system

Note 1 to entry: The control station can be fixed in place (e.g. control panel) or moveable (e.g. control pendant).

[SOURCE: ISO 10218-2:2011, 3.4]

3.3.3.2 IEPR system for overhead transmission line

system that is used for inspecting overhead transmission lines through autonomous or remote control mode

Note 1 to entry: The electric power inspection robot system for overhead transmission line is generally composed of electric power inspection robots, a local monitoring system, an inspection data management system, etc.

3.3.3.3 IERP system for substation

system that is used for inspecting substations through autonomous or remote control mode

Note 1 to entry: The electric power inspection robot system in a substation is generally composed of electric power inspection robots, a local monitoring system, an inspection data management system, a remote centralized control system, etc.

3.3.3.4 supervisory control system

system that displays, stores, analyses and alarms the data acquired by robots and their ancillary facilities and that is equipped with functions of task setting and remote control

Note 1 to entry: The supervisory control system is generally composed of data receivers, storage devices, display devices, control devices and corresponding software.

3.3.3.5 local system

computer system that is installed locally to monitor the operation of EPRs

Note 1 to entry: The local monitoring system is generally composed of computers (servers), communication equipment, monitoring and analysis software and a database.

3.3.3.6 remote system

computer system that is used for centralized monitoring and management of multiple EPRs

3.4 Terms and definitions related to EPR function

3.4.1 Patrol and inspection

3.4.1.1 autonomous locating

selection of the optimal inspection position based on the map and positions of the inspected equipment without any human intervention

3.4.1.2 autonomous inspection

inspection operation according to pre-planned routes and tasks without any human interventions

3.4.1.3**shortest path routing**

shortest automatically defined reachable path between the current position and the target position based on the environment map after receiving the inspection task

3.4.1.4**path planning**

planning an ordered set of poses to travel

[SOURCE: ISO 19649:2017, 3.6.4]

3.4.1.5**trajectory planning**

path planning with time as parameter

[SOURCE: ISO 19649:2017, 3.6.5]

3.4.1.6**obstacle crossing**

crossing obstacles without changing the pre-determined path

3.4.1.7**obstacle avoidance**

preventing interference, such as approaching, contacting or collision, with obstacles by detecting them with external state sensors and adjusting trajectory planning

[SOURCE: ISO 19649:2017, 3.6.7]

3.4.1.8**real-time communication during inspection**

maintaining real-time communication with the local system during the inspection process

3.4.1.9**target status recognition**

identification of the specific properties of the target and its components, such as the shape, temperature and position by methods such as data processing, feature extraction, learning modeling and expert systems, based on the collected information

EXAMPLE Recognition of the opening and closing status of disconnectors, automatic meter reading, etc.

3.4.1.10**autonomous return**

autonomously judging and returning according to the predetermined trajectory when facing special circumstances during its operations

3.4.1.11**one key return**

specific one-shot key or button to terminate the current operation and return to the predetermined position

3.4.1.12**relocalization**

locating the new position after losing the current one

3.4.2 Detection and analysis

3.4.2.1

infrared detection

detecting the temperature on the surface of electrical equipment through an infrared sensor

3.4.2.2

three-phase temperature difference analysis

analysis of the difference of the temperature on the surface of electrical equipment among phases

3.4.2.3

thermal analysis

automatically judging and analysing the current-induced heating and voltage-induced heating defects by thermal imaging technology

3.4.2.4

gauge reading

meter reading

reading of the gauge or meter by machine vision or other detection methods

3.4.2.5

partial discharge detection

detection of the discharge phenomenon on the surface of or inside the electrical equipment by using ultrasonic sensors, ultra-high frequency sensors and other sensors

3.4.2.6

tactile perception

ability to perceive the force distribution, shape, texture, slippage and temperature of an object through physical contact

3.4.2.7

force perception

ability to perceive the interaction forces and torques

3.4.2.8

visual perception

ability to perceive surrounding environment through optical information

3.4.2.9

gas monitoring

detection of special or harmful gases in the surrounding environment

3.4.2.10

sound recognition

automatic analysis of the sound of electrical equipment and judging whether the inspected object has defects or failures

3.4.2.11

history retrospection

checking of the data in terms of previous operations, tests, maintenance and other aspects of equipment through information retrieval

3.4.2.12

diagnosis analysis

detection of the potential defects or faults based on data collected from robot systems