

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Low-voltage electrical installations –
Part 7-702: Requirements for special installations or locations – Swimming
pools and fountains**

**Installations électriques à basse tension –
Partie 7-702: Exigences pour les installations ou emplacements spéciaux –
Piscines et fontaines**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

**Part 7-702: Requirements for special installations or locations –
Swimming pools and fountains**

FOREWORD

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International Standard IEC 60364-7-702 has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock.

This third edition cancels and replaces the second edition published in 1997 and constitutes a technical revision.

The main changes with respect to the previous edition are as follows:

- the scope has been improved, including natural areas in natural waters;
- the description of zones has been improved;
- all figures have been updated.

The text of this standard is based on the following documents:

FDIS	Report on voting
64/1724/FDIS	64/1728/RVD

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

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

The reader's attention is drawn to the fact that Annex B lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this standard.

A list of all parts in the IEC 60364 series, under the general title *Low-voltage electrical installations*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

The requirements of this part of IEC 60364 supplement, modify or replace certain of the general requirements contained in Parts 1 to 6 of IEC 60364.

The clause numbering appearing after 702 refers to the corresponding parts or clauses of IEC 60364, Parts 1 to 6¹⁾. Numbering of clauses does not, therefore, necessarily follow sequentially. Numbering of additional text is shown by the addition of “.101, etc”. Numbering of figures and tables takes the number of this part followed by a sequential number. For annexes, the numbering of figures and tables takes the letter of the annex, the number of the part and a sequential number.

The absence of reference to a part or clause means that the general requirements contained in Parts 1 to 6 of IEC 60364 are applicable.

¹⁾ For historical reasons, IEC 60364-1:2005 numbering is as follows: 11 Scope; 12 Normative references; 20 Terms and definitions, etc.

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 7-702: Requirements for special installations or locations – Swimming pools and fountains

702 Swimming pools and fountains

702.1 Scope

The particular requirements of this part of IEC 60364 apply to electrical installations of:

- basins of swimming pools and paddling pools and their surrounding zones;
- areas in natural waters, lakes in gravel pits and coastal and similar areas, specially intended to be occupied by persons for swimming, paddling and similar purposes, and their surrounding zones. Such areas in natural waters, lakes in gravel pits and coastal and similar areas, are considered as swimming pools;
- basins of fountains and their surrounding zones.

NOTE In these areas, in normal use, the effect of an electric shock is increased by a reduction in body resistance and contact of the body with earth potential.

For swimming pools for medical use, special requirements may apply.

This standard does not cover the use of mobile equipment, e.g. pool cleaning equipment.

702.2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60245 (all parts), *Rubber insulated cables – Rated voltages up to and including 450/750 V*

IEC 60335-2-41, *Household and similar electrical appliances – Safety – Part 2-41: Particular requirements for pumps*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60598-2-18, *Luminaires – Part 2: Particular requirements – Section 18: Luminaires for swimming pools and similar applications*

IEC 61386-1, *Conduit systems for cable management – Part 1: General requirements*

702.3 Terms and definitions

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

702.3.1**fountain**

arrangement, typically for decorative purposes, where water issues from a source and fills a basin of some kind

702.3.2**basin of fountain**

part of the fountain which collects discharged water

NOTE See also 702.30.101.

702.3.3**swimming pool**

water basin designed for purposes such as swimming, diving, etc. and not for personal cleaning activity

702.3.4**paddling pool**

water basin with low water level, e.g. for playing or wading

702.30 Assessment of general characteristics**702.30.101 General**

Add the following:

The requirements of this part are based on the dimensions of three zones, zone 0, zone 1 and zone 2 as described in 702.30.102 to 702.30.104 (see Figures A.702.1 to A.702.4).

For electrical equipment in parts of walls, floors or ceilings limiting the zones specified in 702.30.102 to 702.30.104, but being part of the surface of that wall, floor or ceiling, the same requirements that apply for the zone limited by the surface shall be fulfilled unless specific requirements exist (see 702.55).

The width of zone 1 or zone 2 may be reduced by fixed partitions having a minimum height of 2,5 m.

The requirements for swimming pools also apply to paddling pools.

For basins of fountains which are intended to be occupied by persons, the specifications and requirements for zone 0 and zone 1 for swimming pools apply.

NOTE 1 Fixed partitions are fixed separating walls, walls including windows and doors. The zones are also limited by ceilings, slopes of roofs and floors. Fixed partitions that are lower than 2,5 m are only limiting if they end at a ceiling or slope of a roof.

NOTE 2 When a fixed partition is erected inside a zone, its effects on the zone are illustrated in Figure A.702.3.

NOTE 3 For the installation of a prefabricated swimming pool, the requirements of this standard are applicable.

NOTE 4 Annex A provides some examples of the zones.

702.30.102 Description of zone 0

This zone comprises

- the interior of basins, including any recesses in their walls or floors, and
- the interior of basins for foot cleaning, and
- the interior of waterjets or waterfalls, and the space below them (see Figure A.702.4).

NOTE If the zone cannot be precisely determined under waterjets or waterfalls, it is recommended to take the vertical plane from the rim of the basin as the horizontal limitation of the zone and the maximum height of the water jet or waterfall as the limitation of height.

702.30.103 Description of zone 1

This zone is limited by

- the zone 0 boundaries,
- a vertical plane 2 m from the rim of the basin,
- the floor or surface expected to be occupied by persons,
- the horizontal plane 2,5 m above the floor or the surface expected to be occupied by persons.

NOTE Inaccessible equipment installed in an enclosure below the surface of a floor or wall or above a ceiling is not considered to be within zone 1 (see 702.55.101.3).

Where the swimming pool contains diving structures, starting blocks, chutes or other components expected to be occupied or accessible by persons, zone 1 also comprises the zone limited by

- a vertical plane situated 1,5 m around the diving boards, springboards, starting blocks, chutes and other components such as accessible sculptures and decorative basins,
- the horizontal plane 2,5 m above the highest surface expected to be occupied by persons.

702.30.104 Description of zone 2

This zone is limited by

- the vertical plane external to zone 1 and a parallel plane 1,5 m from the former,
- the floor or surface expected to be occupied by persons, and
- the horizontal plane 2,5 m above the floor or surface expected to be occupied by persons.

There is no zone 2 for fountains.

NOTE Inaccessible equipment installed in an enclosure below the surface of a floor or wall or above a ceiling is not considered to be within zone 2 (see 702.55.101.3).

702.4 Protection for safety

702.41 Protection against electric shock

Add the following:

NOTE 1 For selection and erection of socket-outlets, see 702.53.

NOTE 2 For selection and erection of other equipment, see 702.55.

702.410.3 General requirements

702.410.3.5

Replace the existing clause by the following:

The protective measures of obstacles and placing out of reach, as specified in Annex B of IEC 60364-4-41:2005, shall not be applied.

702.410.3.6

Replace the existing clause by the following:

The protective measures of non-conducting location, earth-free local equipotential bonding and electrical separation for the supply of more than one item of current-using equipment, as specified in Annex C of IEC 60364-4-41:2005, shall not be applied.

702.410.3.101 Particular requirements for each zone

Add the following:

702.410.3.101.1 Zones 0 and 1 of swimming pools and in areas of natural waters, lakes in gravel pits and coastal and similar areas

In zones 0 and 1 only protection by SELV at a nominal voltage not exceeding 12 V a.c. or 30 V d.c. is permitted, except where 702.55.104 applies. The source of supply shall be installed external to zones 0 and 1. Where the source of supply is installed in zone 2, 702.53 applies.

702.410.3.101.2 Zones 0 and 1 of fountains

In zones 0 and 1, only the following protective measures shall be employed:

- SELV (see Clause 414 of IEC 60364-4-41:2005), the source of supply being installed external to zones 0 and 1; or
- automatic disconnection of supply (see Clause 411 of IEC 60364-4-41:2005) using a residual current protective device with a rated residual operating current not exceeding 30 mA; or
- electrical separation (see Clause 413 of IEC 60364-4-41:2005), the separation source supplying a single item of equipment and being installed external to zones 0 and 1.

702.410.3.101.3 Zone 2 of swimming pools and in areas of natural waters, lakes in gravel pits and coastal and similar areas

NOTE There is no zone 2 for fountains.

One or more of the following protective measures shall be employed:

- SELV (see Clause 414 of IEC 60364-4-41:2005). The source of supply shall be installed external to zone 0 and 1. Where the source of supply is installed in zone 2, 702.53 applies; or
- automatic disconnection of supply (see Clause 411 of IEC 60364-4-41:2005) using a residual current protective device with a rated residual operating current not exceeding 30 mA; or
- electrical separation (see Clause 413 of IEC 60364-4-41:2005). The separation source shall supply a single item of equipment and be installed external to zones 0 and 1. Where the separation source is installed in zone 2, 702.53 applies.

702.414 Protective measure: extra-low-voltage (SELV and PELV)

702.414.4 Requirements for SELV and PELV circuits

Add the following:

PELV is not permitted.

702.414.4.5

Add the following:

Where SELV is used, whatever the nominal voltage, basic protection (protection against direct contact) shall be provided by

- barriers or enclosures affording at least the degree of protection according to IEC 60529 IP2X or IPXXB, or
- insulation capable of withstanding a test voltage of 500 V a.c. for 1 min.

702.415 Additional protection

702.415.2 Additional protection: supplementary protective equipotential bonding

Add the following:

All extraneous-conductive-parts in zones 0, 1 and 2 shall be connected by protective equipotential bonding conductors to the protective conductors of the exposed-conductive-parts of equipment situated in these zones.

NOTE 1 This connection with the protective conductor may be provided in close proximity to the location, for example at an accessory or a distribution board or other equipment.

NOTE 2 See also 702.522.8 and 702.55.101.

Extraneous-conductive-parts are conductive parts not forming part of the electrical installation and liable to introduce an electric potential, including the electric potential of a local earth – for the scope of this standard, from outside zones 0, 1 and 2 into these zones.

NOTE 3 Such parts may, for example, be

- metallic pipelines for freshwater, waste water, gas, heating, climate control,
- metallic parts of building construction,
- metallic parts of the basin construction,
- metal reinforcement of non-insulating floors,
- metal reinforcement of concrete basins.

Floors made of individual concrete tiles, the reinforcement of which is fully encapsulated within the tile and not accessible without damaging the tile, are not considered as extraneous-conductive-parts and therefore need not be included in additional protective equipotential bonding.

Concrete tiles without metallic reinforcement, tile coverings and topsoil (e.g. lawn) are not considered as extraneous-conductive-parts and therefore need not be included in additional protective equipotential bonding.

NOTE 4 The following conductive parts generally need not be included in additional protective equipotential bonding:

- basin ladders and barriers;
- diving structure ladders;
- handrails and handholds on the rim of the basin;
- grid covers including the mounting frames of overflow pipes;
- window frames;
- door frames;
- starting blocks.

702.5 Selection and erection of electrical equipment

702.51 Common rules

702.512 Operational conditions and external Influences

702.512.2 External influences

Add the following:

Electrical equipment shall have at least the IP code (see IEC 60529) according to Table 702.1.

Table 702.1 – Minimum IP number per zone

Zone	Outdoor, with waterjets during cleaning operation	Outdoor, without waterjets	Indoor, with waterjets during cleaning operation	Indoor, without waterjets
0	IPX5 / IPX8	IPX8	IPX5 / IPX8	IPX8
1	IPX5	IPX4	IPX5	IPX4
2	IPX5	IPX4	IPX5	IPX2

NOTE 1 IEC 60529 states that, unless there is a relevant product standard, the test conditions for IPX8 are subject to agreement between manufacturer and user.

NOTE 2 For zone 0, where waterjets during cleaning operations are expected, both IPX5 (to ensure resistance to the operations during the cleaning process) and IPX8 (to ensure resistance to the immersion in the water) are necessary (see 4.3 of IEC 60529:1989). Both IPX5 and IPX8 are necessary because IPX8 does not include protection against water jets.

702.52 Wiring systems

702.522 Selection and erection in relation to external influences

702.522.8 Other mechanical stresses

Add the following:

702.522.8.101 Erection according to the zones

In zones 0, 1 and 2, wiring systems shall not have accessible metallic covering. Metallic coverings which are inaccessible shall be connected to the supplementary equipotential bonding.

NOTE Cables should be installed in conduits to facilitate rewiring.

702.522.8.102 Limitation of wiring systems according to the zones

In zones 0 and 1, wiring systems shall be limited to those necessary to supply equipment situated in these zones.

Circuits erected in zone 2 or in walls, ceilings or floors delimiting zones 0, 1 or 2 and supplying equipment outside the zones shall be:

- embedded at a minimum depth of 5 cm; or
- protected by a residual current protective device with a rated residual operating current not exceeding 30 mA; or
- supplied by SELV; or
- protected by electrical separation.

702.522.8.103 Additional requirements for the wiring of fountains

Only cables of type 66 according to IEC 60245 series or a type with at least equivalent properties shall be used.

NOTE Their suitability for permanent contact with water should be declared by the cable manufacturer in addition to compliance with IEC 60245-1 and IEC 60245-4.

Only conduit with classification code X5XX according to the resistance to impact in IEC 61386-1 shall be used.

For fountains not intended to be occupied by persons the following additional requirements shall be met:

- a) cables or insulated conductors in non-metallic conduit for electrical equipment in zone 0 shall be installed as far outside the basin rim as possible and run to the electrical equipment inside the basin by the shortest practicable route. The cables shall be installed in conduits to facilitate rewiring;
- b) in zones 0 and 1, cables or insulated conductors in non-metallic conduit shall be installed with suitable mechanical protection.

702.522.8.104 Junction boxes

Junction boxes shall not be installed in zone 0.

In zone 1, only junction boxes for SELV circuits are permitted (see 702.410.3.101).

702.53 Switchgear and controlgear

Add the following:

In zone 0, no switchgear or controlgear, including socket-outlets, shall be installed.

In zone 1, switchgear, controlgear and socket-outlets may be installed only if supplied by SELV, the source of supply of which being installed outside zones 0 and 1. Where the source for SELV is installed in zone 2 its supply circuit shall be protected by a residual current protective device with a rated residual operating current not exceeding 30 mA.

In zone 2, switchgear, controlgear and socket-outlets are not allowed unless protected by one of the following protective measures:

- a) SELV (see 414.3 of IEC 60364-4-41:2005), the source of supply being installed outside zones 0 and 1. Where the source for SELV is installed in zone 2, its supply circuit shall be protected by a residual current protective device with a rated residual operating current not exceeding 30 mA; or
- b) automatic disconnection of the supply with additional protection (see 415.1 of IEC 60364-4-41:2005), using a residual current protective device with a rated operating current not exceeding 30 mA; or
- c) electrical separation (see Clause 413 of IEC 60364-4-41:2005), supplied individually by the separation source which is installed outside zones 0 and 1. Where the source for electrical separation is installed in zone 2 its supply circuit shall be protected by a residual current protective device with a rated residual operating current not exceeding 30 mA.

702.55 Other equipment

Add the following:

702.55.101 Current-using equipment of swimming pools

702.55.101.1 In zones 0 and 1, only fixed current-using equipment especially designed for use in swimming pools may be installed, taking into account the requirements of 702.55.102 and 702.55.104.

702.55.101.2 Fixed connected swimming pool cleaning equipment intended to be used in zones 0 and 1 shall be supplied by SELV not exceeding 12 V a.c. or 30 V d.c. with the source being installed outside zones 0 and 1. Where the source of supply is installed in zone 2, 702.53 applies (see 702.410.3.101.1).

702.55.101.3 Feed pumps, or other special electrical equipment especially intended for use in swimming pools located in a room or location adjacent to the swimming pool and accessible

via a hatch (or door) located on the deck surrounding the swimming pool, shall be protected by one of the following protective measures:

- a) SELV not exceeding 12 V a.c. or 30 V d.c. with the source being installed outside zones 0 and 1. Where the source of supply is installed in zone 2, 702.53 applies (see 702.410.3.101.1);
- b) electrical separation according to Clause 413 with simultaneous fulfilment of the following conditions:
 - where the pump or other equipment is connected to the swimming pool basin, the connection shall only be made by non-conductive water piping;
 - it shall only be possible to open the hatch or the door by means of a key or tool;
 - all equipment installed in the room or location shall have a degree of protection of at least IPX5 or such protection shall be provided by an enclosure.
- c) automatic disconnection of the power supply with simultaneous fulfilment of the following conditions:
 - where the pump or other equipment is connected to the swimming pool basin, the connection shall be made by either electrically insulated water piping, or metal water piping connected to the pool basin's equipotential bonding;
 - it shall only be possible to open the hatch or the door by means of a key or tool;
 - all equipment installed in the room or location shall have a degree of protection of at least IPX5 or such protection shall be provided by an enclosure;
 - additional equipotential bonding shall be installed in accordance with 702.415.2;
 - the equipment shall be protected by a residual current protective device with a rated residual operating current not exceeding 30 mA.

NOTE The room where the equipment is located is considered to be outside zones 1 and 2.

702.55.102 Underwater lighting of swimming pools

Luminaires for use in the water or in contact with the water shall comply with IEC 60598-2-18.

Underwater lighting located behind watertight portholes and serviced from behind shall be installed in such a way that no intentional or unintentional conductive connection between any exposed-conductive-part of the underwater luminaires and any conductive parts of the portholes can occur.

702.55.103 Electrical equipment of fountains

Electrical equipment in zones 0 and 1 shall be inaccessible, e.g. by use of mesh glass or by grids which can be removed only by tools.

Electric pumps shall comply with the requirements of IEC 60335-2-41.

702.55.104 Special requirements for the installation of low voltage electrical equipment in zone 1 of swimming pools

702.55.104.1 Fixed equipment (e.g. filtration systems, jet stream pumps), especially intended for use in swimming pools and supplied at low voltage, is allowed in zone 1 provided all the following requirements are met:

- a) the equipment shall be located inside an enclosure equivalent to supplementary insulation and providing protection against mechanical impact AG2;
- b) the requirements of 702.55.101.3 apply;
- c) the opening of the hatch specified in 702.55.101.3 shall result in the disconnection of all live conductors of the equipment located in the enclosure. The supply cable and the main disconnecting means shall be installed in a way which provides protection of class II or equivalent insulation.