INTERNATIONAL STANDARD

ISO 8818

First edition
1988-12-15

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Leisure accommodation vehicles — Caravans — 12 V direct current extra low voltage electrical installations

Véhicules habitables de loisirs — Caravanes — Installations électriques à très basse tension de 12 V *en courant continu*

Reference number
ISO 8818 : 1988 (E)

Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8818 was prepared by Technical Committee ISO/TC 177, *Caravans*. It is one of a series that is being published for leisure accommodation vehicles as habitations.

Annex A forms an integral part of this International Standard.

Leisure accommodation vehicles — Caravans — 12 V direct current extra low voltage electrical installations

1 Scope

This International Standard specifies safety and functional requirements for 12 V direct current (d.c.) extra low voltage (ELV) electrical installations for habitation aspects of caravans, including trailer tents. It includes an annex that gives means of determining the minimum cross-sectional area of cables.

It does not apply to commercial trailers or motor caravans, nor does it include requirements for ELV road lighting and signalling lamps and their installations.

This International Standard also specifies the ELV output requirements of low voltage (LV) equipment that may be used to provide an ELV supply, but it does not specify safety, technical and functional requirements for LV appliances and installations. Requirements for LV installations are specified in IEC 364-7-708[1].

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3732 : 1982, *Road vehicles — Electrical connections between towing vehicles and trailers with 6 or 12 V electrical equipment — Type 12 S (supplementary).*

ISO 4141 : 1978, *Road vehicles — Seven-core connecting cable.*

ISO 6722-1 : 1984, *Road vehicles — Unscreened low-tension cables — Part 1: General requirements and test methods.*

ISO 6722-2 : 1985, *Road vehicles — Unscreened low-tension cables — Part 2: Cable classes, applicable tests and special requirements.*

ISO 7418: —[2], *Leisure accommodation vehicles — Vocabulary.*

IEC 335-2-29 : 1979, *Safety of household and similar electrical appliances — Part 2: Particular requirements for battery chargers.*

IEC 529 : 1976, *Classification of degrees of protection provided by enclosures.*

IEC 536 : 1976, *Classification of electrical and electronic equipment with regard to protection against electric shock.*

IEC 742 : 1983, *Isolating transformers and safety isolating transformers — Requirements.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 7418 apply.

4 Power

4.1 Power supply

The power supply shall be a nominal 12 V d.c. (see also 4.4.1).

4.2 Sources of supply

The supply shall be obtained from one or more of the following sources:

a) the towing vehicle battery;

b) an auxiliary battery mounted on the caravan;

c) an external LV supply via a transformer/rectifier unit that complies with the requirements of IEC 742 or that has the equivalent of double insulation between LV and ELV that complies with the requirements of IEC 536;

d) d.c. generator that is driven by any form of energy;

e) solar energy cells.

1) IEC 364-7-708 : 1988, *Electrical installations of buildings — Part 7: Requirements for special installations or locations — Section 708: Electrical installations in caravan parks and caravans.*

2) To be published.

4.3 Auxiliary batteries

4.3.1 Type of battery

An auxiliary battery shall be of the rechargeable type, and its recharging characteristics shall be compatible with those of lead-acid automotive batteries. It shall either be fitted as original equipment or provision made for one to be installed by the user.

NOTE — Disposable or dry-cell rechargeable batteries are not auxiliary batteries that comply with the requirements of 4.2 b). They may be used in caravans, providing that they are used in circuits separated from other forms of electrical supply specified in 4.2.

4.3.2 Capacity

An auxiliary battery shall have a minimum capacity of 40 A·h at 20 h rate.

4.3.3 Terminals

Battery terminals shall be clearly marked "+" and "−". Connections to battery terminals shall be securely clamped or bolted and shall be shrouded unless the battery has a clip-down lid.

4.3.4 Location

If an auxiliary battery is permanently located on a caravan, it shall be in a separate compartment, with easy access for maintenance and/or removal and secured to prevent movement of the battery when the caravan is in motion.

4.3.5 Battery compartment

The interior of a battery compartment shall be protected against the corrosive effect of acid-laden gases that are released by a battery when it is on charge, either by

a) installing a sealed battery that incorporates an external ventilating kit that is taken to the exterior of the caravan; or

b) installing the battery in an enclosed battery box that is protected internally against corrosion and is ventilated to the exterior of the caravan by means of a polyvinyl chloride (PVC) tube; or

c) ventilating the compartment at low-level and high-level to the exterior of the caravan and constructing the interior of the compartment, including the sides of the ventilator openings, of acid-resistant material or providing it with an anti-corrosive finish. If the compartment opens into the interior of the caravan, the lid shall provide an air seal.

If the compartment is not constructed in accordance with c) above, and if a vented battery has not been provided as part of the original equipment of the caravan or has not been installed in accordance with a) or b) above, instructions for the installation of the battery and the battery box shall be included in the Users' Handbook and a notice shall be fixed in or near the compartment stating:

"For instructions on battery installation, see Users' Handbook."

4.3.6 Warning notice

A warning notice shall be fixed in a prominent position near the battery or displayed on the lid of the battery box or compartment. This shall be in the language of the country in which the caravan is first offered for retail sale and shall state:

"Switch off all appliances and lamps before disconnecting the battery."

4.4 Other sources of supply

4.4.1 Generators and transformer/rectifiers

If a supply is obtained from a generator or from a low voltage supply via a transformer/rectifier, the extra low voltage at the output terminals of the supply unit shall be maintained between 11 V minimum and 13 V maximum with applied loads varying from 0,5 A minimum up to the maximum rated load of the supply unit. Over the same load range, alternating current (A.C.) ripple shall not exceed 10 %.

4.4.2 Battery chargers

The requirements of 4.4.1 shall not apply to battery chargers where the output voltage and A.C. ripple is controlled by the battery.

4.4.3 Natural sources

Wind-driven generators and solar energy cells shall be used only for charging batteries as the output of those devices is dependent upon climatic conditions.

5 Wiring

5.1 Connection to electrical system of towing vehicle

5.1.1 Connecting cable and plug

A connection from a towing vehicle to the supplementary circuits of a caravan shall be by means of a flexible seven-core connecting cable that complies with the requirements of ISO 4141. The maximum length of the seven-core connecting cable shall be as given in annex A. To this cable shall be attached a 12 S plug that shall connect with a 12 S socket on the towing vehicle; these shall comply with the requirements of ISO 3732. Sufficient seven-core connecting cable shall be provided to allow the face of the 12 S plug to extend 500 mm in front of the coupling head of the caravan.

5.1.2 Protection of plugs

Provision shall be made for storing the 12 S plug, when not connected, to protect it from the weather and accidental damage.

NOTE — Similar protection should be provided for the 12 N plug.

5.1.3 Allocation of pins

Pins in the 12 S plug, with the corresponding cable colour, shall be as given in table 1.

Table 1 — Pin allocation

Pin number	Cable colour	Circuit
4	Green	ELV interior lighting, etc.
6	Red	ELV for refrigerator while the caravan is in motion
3	White	Common return (negative earth only)

5.1.4 Common return

The white lead in the seven-core connecting cable from the 12 S plug shall not be connected, directly or indirectly, to the white lead in the seven-core connecting cable from the 12 N plug that carries the ELV supply to the road lighting and signalling lamps of the caravan.

5.1.5 Junction with fixed wiring

The seven-core connecting cable shall be connected on the caravan to the fixed wiring, maintaining the same colour or marking code. It shall be permitted to add an orange tracer colour to the cable base colours or to fit an orange identification sleeve to differentiate this wiring from the wiring to the road lighting and signalling lamps.

5.1.6 Protection of terminal block

If the junction specified in 5.1.5 is by means of a terminal block, it shall have a protective cover which, if external, shall provide protection that complies with designation IP 35 of IEC 529.

5.2 Fixed wiring

5.2.1 Cables

All circuits shall consist of a feed and a return cable. The return (negative) cable shall be white and, when the power supply is from a battery, shall be connected to battery negative. The feed (positive) cable shall be green or red, according to the circuit and, when the power supply is from a battery, shall be connected to battery positive. It shall be permitted to provide cables with an orange tracer or identification sleeve.

5.2.2 Segregation of circuits

Cables carrying extra low voltage shall be run separately from cables carrying low voltage and shall be so disposed that there is no risk of physical contact between the two wiring systems.

5.2.3 Type of cable

Cables shall be single-core PVC, insulated and sheathed, or twin-core PVC, insulated and sheathed, automotive type that complies with the requirements of ISO 6722-1 and ISO 6722-2.

5.2.4 Supporting of cables

Cables shall be supported by clips at maximum intervals of 400 mm for vertical runs. Horizontal runs, unless run in tubes or otherwise supported along their entire length, shall be supported by clips at maximum intervals of 250 mm.

5.2.5 Internal cables

Cables within a caravan shall be either surface-mounted or concealed. If they are concealed, all connections shall be accessible.

NOTE — There can be a chemical reaction between the plasticizer in PVC sheathing of cables and expanded polystyrene that creates a sticky coating on the PVC. If there is a possibility of the two materials coming into contact, there should be a barrier between them or the cables should be run in tubes. There is no fire risk involved.

5.2.6 External cables

Cables outside the caravan can be grouped, and single-core cables shall be protected additionally by PVC sheathing or taping.

5.2.7 Connections

All connections shall be insulated and connections in external cables shall be enclosed to provide protection that complies with designation IP 35 of IEC 529.

5.2.8 Auxiliary battery cables

Cables from an auxiliary battery mounted on the caravan shall be protected additionally by PVC sheathing or taping as far as the main fuse or fuses.

5.2.9 Prohibited cable runs

Cables shall not be run through a compartment or housing intended for the storage of a liquefied petroleum gas cylinder, unless enclosed in a rigid tube to protect them against mechanical damage.

5.3 Cable sizes

5.3.1 General

Except for a refrigerator that is connected only for ELV operation while the caravan is in motion, minimum cable sizes for the fixed wiring, including those of supply leads between an auxiliary battery and the main fuse or fuses, shall be as laid down in annex A, the minimum cross-sectional area being determined from figure A.4.

5.3.2 Refrigerator

If a refrigerator is connected for ELV operation from the towing vehicle battery whilst the caravan is in motion, the cables for

the refrigerator circuit (excluding the seven-core connecting cable) shall be of a size recommended by the refrigerator manufacturer.

NOTE — A low temperature can be maintained in some types of refrigerator in this way while the caravan is temporarily stationary, but this facility requires a considerable current and should not be used when the caravan is parked.

5.3.3 External extension leads

If an extension lead from the 12 S socket on a towing vehicle to the seven-core connecting cable is supplied as original equipment for use while a caravan is parked on a caravan pitch, its length shall be kept to a minimum and shall not exceed 5 m. The minimum cross-sectional area of the supply and return leads in the extension cable shall be 2,5 mm^2.

NOTE — Attention is drawn to the information required to be included in the Users' Handbook if an extension lead is not supplied as original equipment [see clause 8 f)].

6 Overcurrent protection

6.1 Protection

The ELV installation shall be protected against overcurrent by at least one overcurrent protective device which will disconnect all live conductors in the circuit or circuits controlled by the device. The capacity of any overcurrent protective device shall not exceed the maximum current rating of the cable with the smallest cross-sectional area in the circuit controlled by that device.

6.2 Types of device

Overcurrent protective devices shall be either fuses or miniature circuit breakers. Fuses shall be of the glass cartridge, blade or ceramic automotive type.

6.3 Installation of fuses

Fuses shall be enclosed in fuse holders or fuse boxes to prevent accidental damage to the fuses and to limit fire risk.

6.4 Prohibited location of devices

Overcurrent protective devices shall not be fitted in a fuel storage compartment or fuel storage housing intended for the storage of a liquefied petroleum gas cylinder or auxiliary battery.

7 Installation of appliances

7.1 General

The caravan manufacturer's technical specification shall state whether an ELV appliance is suitable for use with a supply obtained from a generator or a transformer/rectifier unit as specified in 4.4.1.

NOTE — ELV appliances should be of flame-retardant material.

7.2 Supply lead capacity

If the supply is provided by the battery in the towing vehicle, the total current consumption of all appliances, including internal and external luminaires (and that for a refrigerator while the caravan is stationary unless it is connected by a separate circuit), shall not exceed the rated capacity of the supply lead in the seven-core cable (see 5.1 and 5.3.2).

7.3 Connection of appliances

All appliances shall be fitted and connected in accordance with the manufacturer's instructions. When polarity-sensitive appliances are fitted and connected, only those shall be used that have terminals clearly marked "−" and "+", or that have two leads, indicating polarity by colour (white for negative, red or green for positive), or by identification tags or sleeves marked "−" or "+".

7.4 Socket outlets

ELV socket outlets shall be two pole non-reversible and shall be of a type different from those provided for any low voltage installation. If not marked on the face of each socket outlet, a notice shall be fixed next to it stating its voltage and maximum current and identifying the positive and negative terminals.

7.5 Plugs

At least one plug shall be provided for each socket outlet.

7.6 Battery charger

If a battery charger is fitted that is operated off a low voltage A.C. supply, it shall comply with the requirements of IEC 335-2-29. The d.c. output shall either be electronically regulated or the maximum d.c. output of the charger in amperes shall be limited to 10 % of the capacity of the fitted or recommended battery in A·h at 20 h rate.

7.7 External fittings

Fittings, such as porch lamps, fixed outside a caravan shall be constructed or enclosed to provide protection against the ingress of water that complies with designation IP 35 of IEC 529.

7.8 Voltage drop

Where possible, there shall be only one appliance in each circuit. If it is essential for there to be two appliances in a final circuit, the appliance with the larger current consumption shall be the nearer to the supply source and it shall not take more than twice the current of the other appliance.

8 Users' Handbook

As required by ISO 7422[1)], the following information shall be provided in the Users' Handbook on the ELV installation.

a) Instructions on the maintenance and recharging of an auxiliary battery when it is fitted. When a battery charger is provided, instructions on its safe use shall be included.

b) Instructions on selecting and installing an auxiliary battery when provision is made for one to be fitted.

c) Details of the warning notice specified in 4.3.6 and its importance for safety.

d) Instructions for the wiring of a 12 S socket to the battery of the towing vehicle when this is to provide the source of supply for the ELV installation. Special attention shall be drawn to the required cable sizes and fuses.

e) Recommendations of the manufacturer of the refrigerator, when one is fitted, for completing the wiring of its circuit on the towing vehicle.

f) Maximum length of extension leads and the importance of limiting the length.

g) Simplified diagram of the wiring of the ELV installation, with details of the cable colours and the rating of protective devices.

h) Type of appliances that can be used and from what source of supply.

i) Instructions for the correct operation and maintenance of fitted appliances.

1) ISO 7422, *Leisure accommodation vehicles — Caravans — Habitation requirements*. (To be published.)