IEC 60364-5-55

Edition 2.0 2012-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

Electrical installations of buildings –
Part 5-55: Selection and erection of electrical equipment – Other equipment

Installations électriques des bâtiments –
Partie 5-55: Choix et mise en oeuvre des matériels électriques – Autres matériels

IEC 60364-5-55:2011/A1:2012

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FOREWORD

This amendment has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock.

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

FDIS	Report on voting
64/1831/FDIS	64/1863/RVD

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

The committee has decided that the contents of this amendment and the base 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

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- withdrawn,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

Insert the following new references into Clause 550.2, Normative references:

IEC 60038, *IEC standard voltages*

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60364-5-52:2009, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 61439-1:2011, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61557-8, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems*

IEC 61557-9, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 9: Equipment for insulation fault location in IT systems*

Replace "IEC 60364-4-43" *by* "IEC 60364-4-43:2008.

Insert the following new Clause 557 after Clause 551.8 and before Clause 559:

557 Auxiliary circuits

557.1 Scope

This clause applies to auxiliary circuits, except those covered by specific product or system standards.

557.2 Terms and definitions

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

NOTE For general definitions, see IEC 60050-826.

557.2.1
auxiliary circuit
circuit for transmission of signals intended for control, detection, supervision or measurement of the functional status of a main circuit

557.2.2
main circuit
circuit containing electrical equipment for generation, conversion, distribution or switching of electrical power or current-using equipment

557.2.3
current-limiting signal output
signal output provided by a device which serves to limit the current

557.2.4
inherently short-circuit and earth fault proof
state of an electric equipment or assembly protected against short-circuits and earth faults by suitable design and erection provisions

[SOURCE: IEC 60050-826:2004, definition 826-14-15]

557.2.5
safety integrity level
SIL
discrete level for specifying the safety integrity requirements of the safety functions to be allocated to the electrical/electronic/programmable electronic safety-related systems, where safety integrity level 4 has the highest level of safety integrity and safety integrity level 1 has the lowest

[SOURCE: IEC 61508-4:2010, 3.5.8, modified]

557.3 Requirements for auxiliary circuits

557.3.1 General

The power supply a.c. or d.c. for an auxiliary circuit may be either dependent or independent of the main circuit according to its required function. If the status of the main circuit has to be signaled, then the signaling circuit shall be able to operate independently of that main circuit.

NOTE In extensive installations the use of a d.c. auxiliary supply may be preferred.

557.3.2 Power supply for auxiliary circuits dependent on the main circuit

557.3.2.1 General

Auxiliary circuits with a power supply dependent on the main a.c. circuit shall be connected to the main circuit:

– directly (see Figure 557.1); or
– via a rectifier (see Figure 557.2); or
– via transformer (see Figure 557.3).

It is recommended that auxiliary circuits supplying primarily electronic equipment or systems should not be supplied directly but at least via simple separation from the main circuit.

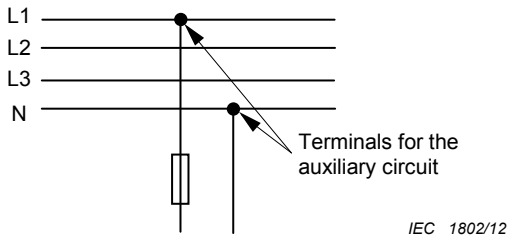

Figure 557.1 – Auxiliary circuit supplied directly from the main circuit

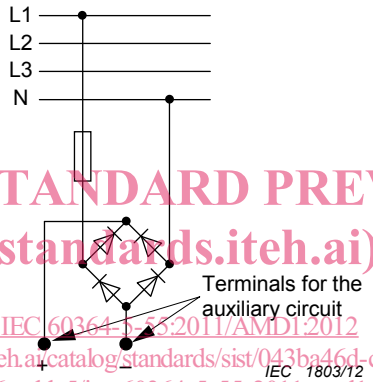

Figure 557.2 – Auxiliary circuit supplied via rectifier from the main circuit

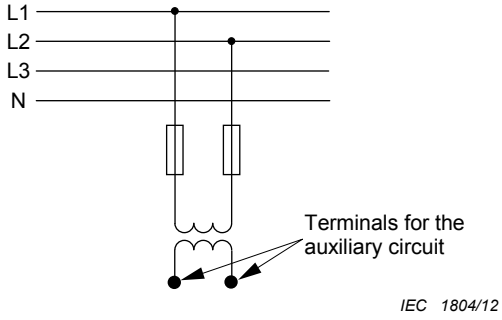

Figure 557.3 – Auxiliary circuit supplied from the main circuit via transformer

NOTE In the case of an auxiliary circuit supplied from the main circuit, directly or via the rectifier, the auxiliary circuit begins at the connection point to the main circuit, see Figure 557.1. When via the rectifier, see Figure 557.2, or by a transformer supply, see Figure 557.3, the auxiliary circuit begins on the d.c. side of the rectifier or on the secondary side of the transformer.

557.3.2.2 Auxiliary circuit supplied from the main circuit via transformer

Where an auxiliary circuit is supplied by more than one transformer, they shall be connected in parallel both on primary and secondary sides.

557.3.3 Auxiliary circuit supplied by an independent source

Where an independent source is used, a loss of supply or undervoltage of the main circuit source should be detected. An independent auxiliary circuit shall not create a hazardous situation.

NOTE Batteries and a power supply system independent of the mains are examples of independent sources.

557.3.4 Auxiliary circuits with or without connection to earth

557.3.4.1 General

An auxiliary circuit shall comply with the earthing requirements in IEC 60364, except as modified by 557.3.4.2 or 557.3.4.3.

NOTE It depends on the requirements for an auxiliary circuit as to whether it is operated earthed or unearthed. For example, in earthed auxiliary circuits an earth fault in a non-earthed conductor leads to a switching off of the power supply of the auxiliary circuit. In unearthed auxiliary circuits, an earth fault in a conductor leads only to a signal from the IMD (see 557.3.4.3).

The use of unearthed auxiliary circuits should be considered, where high reliability is required.

557.3.4.2 Earthed auxiliary circuit

Earthed auxiliary circuits supplied via a transformer shall be connected to earth only at one point on the secondary side of the transformer. The connection to earth shall be situated close to the transformer. The connection shall be easily accessible and capable of being isolated for insulation measurement.

557.3.4.3 Unearthed auxiliary circuit

If an auxiliary circuit is operated unearthed via a transformer, an insulation monitoring device (IMD) according to IEC 61557-8 shall be installed on the secondary side.

NOTE Depending on a risk assessment it should be determined if the signal of the IMD is to initiate an acoustic and/or flash alarm or transmit it to a monitoring system.

557.3.5 Power supplies for auxiliary circuits

557.3.5.1 General

The rated voltage of the auxiliary circuit and the components used in the circuit shall be compatible with the supply to that circuit.

NOTE If the supply voltage is too low for the design of the circuit, then the operation will not be reliable, e.g. for the proper function of relays.

Consideration should be given to the effects of voltage drop on the correct function of the electrical equipment of the auxiliary circuit, e.g.:

– for an a.c. supply, relays and solenoid valves may have an inrush current of 7 to 8 times of the holding current;
– for a d.c. supply, the inrush current is equal to the steady current;
– in the case of motors starting direct-on-line, the starting current could reduce the supply voltage of an auxiliary circuit dependent on the main circuit below the minimum operating voltage of the associated switchgear.

557.3.5.2 Standby power supply or power supply for safety services

Where a standby power supply or a power supply from a generating set is used to supply auxiliary circuits, the frequency variation shall be taken into account.

557.3.5.3 AC supply

The nominal voltage of control circuits should preferably not exceed

– 230 V for circuits with 50 Hz nominal frequency,
– 277 V for circuits with 60 Hz nominal frequency,

respectively, taking into account voltage tolerances according to IEC 60038.

The dimensioning of cable length with respect to the conductor capacitances, e.g. connection to a limit switch, needs to be coordinated with the selected relays or solenoid valves.

The standing voltage caused by high conductor capacitances may impair the switching off of the relay or solenoid valve.

557.3.5.4 DC supply

557.3.5.4.1 Supply by a power system

The nominal voltage of control circuits should preferably not exceed 220 V.

557.3.5.4.2 Supply by batteries

Where batteries are used as a power supply for auxiliary circuits, the voltage fluctuation due to charging or discharging shall not exceed voltage tolerances specified in IEC 60038, unless the auxiliary circuit is specifically designed to compensate for such voltage fluctuation.

Compensation of the voltage fluctuation may be achieved by counter cells.

557.3.6 Protective measures

557.3.6.1 Protection of wiring systems

In the case of extended auxiliary circuits it is necessary to ensure that the required tripping current of the protective device will be achieved also at the far end of the respective cables or conductors, see IEC 60364-4-43:2008, Clause 433.1.

Single-phase earthed a.c. or d.c. auxiliary circuits supplied on the secondary side of the transformer for an auxiliary supply are permitted to be protected by single-pole switching devices. The protective devices shall only be inserted in conductors which are not connected directly to the earth.

Unearthed a.c. or d.c. auxiliary circuits shall be protected against short-circuit current by protective devices interrupting all line conductors. Single-pole protection is permitted if the rated voltage and the time-current characteristic of the related short-circuit protective device are such that the conductor with the smallest cross-sectional area is protected.

NOTE 1 The use of protective devices which disconnect all lines of an unearthed auxiliary circuit will aid fault diagnosis and maintenance activities.

If the short-circuit protective device on the primary side of the transformer for an auxiliary circuit is selected so that it also protects against short-circuit current on the secondary side, a protective device on the secondary side of the transformer may be omitted.

NOTE 2 The magnitude of the short-circuit current on the primary side depends also on the impedance of the transformer.

557.3.6.2 Protection against short-circuit

Switching contacts of electrical switching devices of the auxiliary circuit shall be protected against damage caused by short-circuit currents, according to the manufacturer's instructions.

557.4 Characteristics of cables and conductors – Minimum cross-sectional areas

In order to ensure adequate mechanical strength, the following minimum cross-sectional areas indicated in Table 557.1 shall be met. If there are special mechanical strength requirements for cables or conductors, then a larger cross-sectional area of the conductors should be selected in accordance with IEC 60364-5-52:2009, 522.6.

Table 557.1 – Minimum cross-sectional area of copper conductors in mm^2

Application	Type of cable				
	Single-core		Two-core		Multi-core
	Single-wire	Stranded	Screened	Unscreened	Screened or unscreened
Control circuits[a]	0,5	0,5	0,5	0,5	0,1
Data transfer	–	–	–	–	0,1
[a] Other auxiliary circuits may need a larger cross-sectional area of copper conductor, e.g. for measuring.					
NOTE The cross-sectional area of copper conductors is derived from IEC 60364-5-52:2009.					

557.5 Requirements for auxiliary circuits used for measurement

557.5.1 General

Measuring circuits are auxiliary circuits with dedicated requirements which are given in the following subclauses.

557.5.2 Auxiliary circuits for direct measurement of electrical quantities

Where there is direct contact of a measurement device with the main circuit, the following measures for protection of cables against overheating shall be applied:

– requirements according IEC 61439-1:2011. 8.6.2 and 8.6.4; and/or

– use of short-circuit protective devices.

If an interruption of the measurement circuit by disconnection of the short-circuit protective device could lead to a hazardous situation, the short-circuit protective device shall also disconnect the related main circuit.

For a measurement device with direct contact between the measurement circuit and the auxiliary source attention should be given to phase coincidence and correct polarity.

557.5.3 Auxiliary circuits for measurement of electrical quantities via a transformer

557.5.3.1 Current transformer

Where a measurement device is connected to the main circuit via a current transformer, the following requirements shall be taken into account:

– the secondary side of the transformer in a low voltage installation shall not be earthed, except where the measurement can only be carried out with a connection to earth;

– protective devices interrupting the circuit shall not be used on the secondary side of the transformer;

– conductors on the secondary side of the transformer shall be insulated for the highest voltage of any live parts or shall be installed such that their insulation cannot come into contact with other live parts, e.g. contact with busbars;

– terminals for temporary measurements shall be provided.

To reduce the influence of conductor impedance on the measuring result, the transformer should preferably have a secondary nominal current of 1 A.

The above requirements do not apply to summation current transformers where hazardous voltages do not occur, e.g. equipment for insulation fault location according to IEC 61557-9.

557.5.3.2 Voltage transformer

The secondary side of a voltage transformer shall be protected by a short-circuit protective device.

557.6 Functional consideration

557.6.1 Voltage supply

Where loss of voltage, i.e. voltage fluctuation, overvoltage or undervoltage, could cause the auxiliary circuit to be unable to perform its intended function, means to ensure continued operation of the auxiliary circuit shall be provided.

557.6.2 Quality of signals depending on the cable characteristics

The operation of an auxiliary circuit shall not be adversely affected by the characteristics, including impedance and length, of the cable between operational components.

The capacitance of the cable shall not impair the proper operation of an actuator in the auxiliary circuit. The cable characteristics and length shall be taken into account for the selection of switchgear and controlgear or electronic circuits.

For an extensive auxiliary circuit, the use of a d.c. power supply or bus-system is recommended.

557.6.3 Measures to avoid the loss of functionality

An auxiliary circuit serving a special function where reliability is a concern will require additional design considerations to minimize the likelihood of wiring faults. These wiring faults could result in loss of function and/or loss of signal. Among the design considerations are

– selection of appropriate installation methods of cables (see 557.4),

– selection of equipment where a short-circuit to exposed-conductive-parts is not possible, e.g. Class II equipment.

– use of inherently short-circuit and earth fault proof installation and equipment

For the use of inherently short-circuit and earth fault proof installation and equipment, the following shall be considered:

a) Arrangements of single wires if measures are provided which prevent mutual contact and contact to exposed-conductive-parts, e.g. with basic insulation and where short-circuits by external influences are not expected. This may be achieved by, e.g.
   – installation in cable trunking systems, or
   – installation in conduit.

b) Arrangements of
   – single-core cables, or

– single-core, non-metallic-sheathed cables, or
– rubber-insulated flexible cables.

c) Provision of protection against mechanical damage and of safe distance from flammable material for non-metallic sheathed cables.

d) Arrangements of non-metallic-sheathed cables with nominal voltage U_0/U at least 0,6/1 kV (U_0 = conductor to earth voltage, U = conductor-to-conductor voltage).

e) Use of cables with an insulation which is self-extinguishing and flame-retardant.

f) Use of cables that are afforded physical protection by being buried, e.g. installation of cables in soil or concrete.

Lateral short-circuit proof means having provision for protection against the shorting of two parallel conductors forming part of an assembly.

NOTE This may be achieved by use of cables with an earthed screen. In the case of pinching/shearing of a cable, a possible short-circuit to earth via the cable screens should be considered. In earthed auxiliary circuits, designed as closed-circuit working, a short-circuit may lead to tripping of the short-circuit protective device. In unearthed auxiliary circuits, the short-circuit is detected by the IMD, see 557.3.4.3.

557.6.4 Current-limiting signal outputs

In earthed or unearthed auxiliary circuits with current-limiting signal outputs or electronically controlled protection against short-circuit conditions, respectively, the signal circuit shall be disconnected within 5 s if the respective measure operates. In special cases, a shorter disconnection time may be required.

For current-limiting signal outputs or electronically controlled protection of the signal output, respectively, automatic disconnection of supply may be omitted if a hazardous situation is not likely to occur.

557.6.5 Connection to the main circuit

557.6.5.1 Auxiliary circuits without direct connection to the main circuit

Electrical actuators, e.g. actuating relays, contactors, signaling lights, electromagnetic locking devices, shall be connected to the common conductor (see Figure 557.4):

a) in earthed auxiliary circuits, at the earthed (common) conductor;

b) in unearthed auxiliary circuits, at the common conductor.

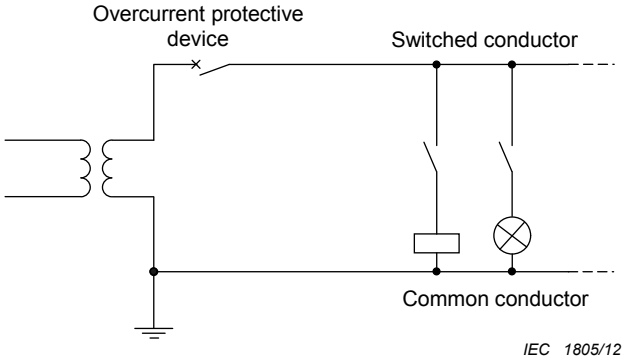

Figure 557.4 – Configuration of an auxiliary circuit

Exception: Switching elements of protective relays, e.g. overcurrent relays, which may be installed between the earthed or the non-earthed conductor and a coil, provided that

– this connection is contained inside a common enclosure, or