

voltimum

Consumer Units



www.voltimum.co.uk

INTRODUCTION

The consumer unit has been, and remains, the standard piece of equipment for distributing electrical energy within an installation. There has been much discussion about what a consumer unit is and how it should be installed. In this article I will consider what a consumer unit is, what it should contain, the risks associated with a consumer unit and the appropriate certification.

WHAT IS A CONSUMER UNIT?

A consumer unit is defined in Part 2 of *BS 7671* as: 'A particular type of distribution board intended for operation by ordinary persons, comprising a type-tested co-ordinated assembly for the control and distribution of electrical energy, incorporating manual means of double-pole isolation on the incoming circuit(s) and an assembly of one or more protective devices, signalling and other devices proven during the type-test of the assembly as suitable for such use. This does not preclude the use of consumer units within non-domestic premises.

All consumer units (as defined) in the UK conform to the relevant parts of *BS EN IEC 61439-1* and *BS EN 61439-3*.

BS EN IEC 61439-1: 2021 Low-voltage switchgear and controlgear assemblies Part 1: General rules covers the general definitions, service conditions, construction requirements, technical characteristics, and verification requirements of such assemblies. *BS EN 61439-3: 2012 (as amended) Low-voltage switchgear and controlgear assemblies Part 3: Distribution boards intended to be operated by ordinary persons (DBO)* is to be read in conjunction with *BS EN IEC 61439-1* and details the specific requirements for DBOs intended to be operated by ordinary persons.

All consumer units, therefore, are a particular type of single-phase distribution board containing, as a minimum, the following:

- Manually operated double-pole main switch.
- One or more protective devices.
- Additionally, they may contain signalling and other devices.

There are a range of ways in which consumer units are legitimately set up, including:

- Main switch and a split-load consumer unit typically containing two RCCBs and a series of circuit-breakers for the final circuits.
- Main switch and separate RCBOs for each final circuit.
- Main switch and a mixture of RCBOs and circuit-breakers for each final circuit.

GENERAL

→ SHORT-CIRCUIT RATING

Regulation 536.4.201 is a UK requirement dealing with fault current (short-circuit) ratings. This regulation requires that a consumer unit being supplied from a 230 V single-phase supply having a rating not exceeding 100 A under the control of ordinary persons must comply with *BS EN 61439-3* having a suitable fault current (short-circuit). However, where a consumer unit incorporates components and protective devices specified by the manufacturer complying with *BS EN 61439-3*, it is recognised that the 16 kA conditional short-circuit rating will be met where the supply cable is at least 2 m in length.

The practical application of this is that it is permissible to use circuit-breakers rated at 6 kA or 10 kA even where the prospective short circuit current is 16 kA. However, this is only the case where the consumer unit and its associated equipment has been suitably tested by a reputable manufacturer. There should be no intermixing of components from different manufacturers unless permission has been given by the manufacturer. Under all circumstances manufacturer's instructions should be met (536.4.203 and its associated notes).

→ METALLIC

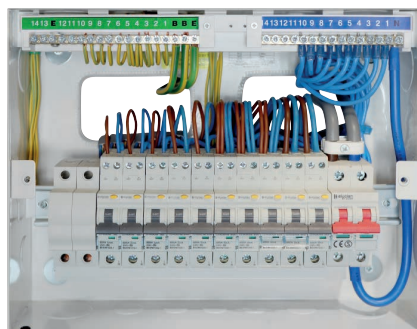
Regulation 421.1.201 requires consumer units in domestic premises to have their enclosure manufactured from non-combustible material or be enclosed in a cabinet or enclosure constructed of non-combustible material. In practice this means that all consumer units are now made of steel.

There is no specific requirement to 'fire proof' a consumer unit. However, care should be taken to advise the client not to store combustible material near consumer units irrespective of the material they are constructed from (421.1.2).

→ BASIC PROTECTION BY BARRIERS/ENCLOSURES

A consumer unit provides basic protection (protection against direct contact) by barriers and enclosures as detailed in Regulation Group 416.2. Regulation 416.2.1 requires that live parts shall be inside enclosures or behind barriers providing a degree of protection of at least IP2X or IPXXB; ideally any openings should be smaller than this. Where the top surface of the consumer unit is accessible, Regulation 416.2.2 requires the degree of protection not to exceed IP4X or IPXXD. Furthermore, Regulations 416.2.3 and 416.2.4 require that the barrier/enclosure is firmly secured in place and, amongst other things, that the removal of the barrier/enclosure is only possible by the use of a key or tool.

The remainder of this article will consider the elements that should be considered when installing a consumer unit.



Consumer unit (image provided by Scolmore).

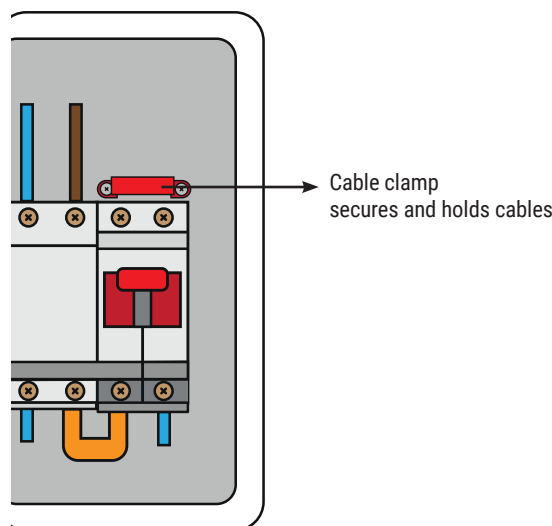
CUT-OUT TO THE MAIN SWITCH

The cut-out at the intake position is not owned by the customer and it is not permitted for electrical contractors to break the seal and remove the fuse. However, Regulation 433.3.1(iii) permits the main fuse to be used as a means of overload protection where the distributor agrees that it affords protection to the part of the installation between the origin and the main distribution point of the installation where further overload protection is required. Similarly, Regulation 434.3(iv) permits the main fuse to be used as a means of fault current protection for the same reasons as Regulation 433.3.1(iii).

In practice this means that the main fuse to a premises may be used as both overload and fault current protection under certain specific conditions (434.3):

- The wiring (typically meter tails) is carried out in such a way as to reduce risk of fault to a minimum;
 - Not exceed 3 m in length, and
 - Be installed in such a manner as to reduce the risk of fault to a minimum, for example by reinforcing the wiring against external influences (434.2.1).
- The wiring is installed in such a manner as to reduce to a minimum, the risk of fire or danger to persons.

Regulation 522.8.5 requires every cable or conductor to be supported in such a way that it is not exposed to undue mechanical strain. The note attached to this regulation indicates that meter tails are included in this requirement. Many manufacturers now include a cable clamp at the terminals of the main switch to help the installer limit the mechanical strain on conductors.



MAIN SWITCH

→ **BS EN 60947-3**

The manually operated double-pole main switch should conform to *BS EN 60947-3*. The latest version of this standard is *BS EN IEC 60947-3: 2021 Low-voltage switchgear and controlgear Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*.

The selection of the main switch should take account of:

- Full load current.
- Making and breaking requirements.
- Frequency of operation.
- Short-circuit performance.

The differing switching requirements are divided into 'utilisation categories'. Typically, a main switch for a domestic consumer unit will have a utilisation category of AC22/DC22 – switching of mixed resistive / inductive loads, including moderate overloads.

The utilisation category label should also have either a 'A' or 'B' code to indicate frequent (A) or infrequent (B) operation.

→ **RCCB – BS EN 61008-1**

An RCCB conforming to *BS EN 61008-1* may be used as a main switch as an alternative to a main switch conforming to *BS EN 60947-3*. Such residual current circuit-breakers do not contain integral overcurrent protection (as the title of the standard reflects) and the maximum current rating should not be exceeded.

Typically, an RCCB will be installed where the Earthing system is TT. In such a setting the likely rated residual operating current ($I_{\Delta n}$) will be 100 – 300 mA and either 'S' type or time-delayed.

To provide selectivity between the RCCB when used as a main switch, and downstream devices which usually have a $I_{\Delta n}$ of 30 mA, Regulation 536.4.1.4(ii) requires that the upstream RCD is either type 'S' or time-delayed and the ratio of the $I_{\Delta n}$ of the upstream device to that of the downstream device is 3:1.

Irrespective of whether the main switch conforms to *BS EN 60947-3* or *BS EN 61008-1*, a domestic installation will typically rely on the main fuse to provide overcurrent protection.

Where there is overheating or a fire that exists within a consumer unit, it is typically the neutral connection that is the source. Great care should be taken to ensure that any connections are electrically and mechanically sound (526.1).



Effects of a loose neutral (image provided by Scolmore).

There are two factors to consider when selecting an RCCB as either a main switch or as part of a split-load consumer unit:

- Should a fault to Earth exist a significant part of the installation will lose power.
- Since an RCCB is not designed to handle overload current, damage to the RCCB could arise should a number of final circuits draw more current than the RCCB can manage.

Reference should be made to Regulation 536.4.202, particularly to the last paragraph which requires the electrical contractor to comply with the instructions of the manufacturer when seeking to meet the overload protection of RCCBs or switches.

PROTECTIVE DEVICES

All consumer units will contain protective devices. These will commonly be circuit-breakers conforming to *BS EN 60898*, RCCBs conforming to *BS EN 61008-1* or RCBOs conforming to *BS EN 61009-1*, Arc Fault Detection Devices (AFDDs) conforming to *BS EN 62606* and Surge Protection Devices (SPDs – reference DD CLC/TS 61643-12:2009).

→ SPDs

The introduction of SPDs has grown apace over the last five years. Currently (Feb 2022), Regulation 443.4 requires that where no risk assessment has been carried out, SPDs shall be installed in domestic premises.



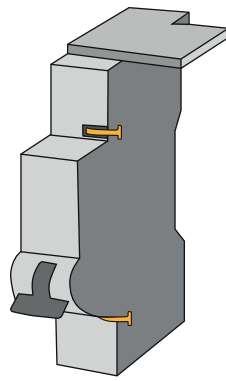
SPD (Image provided by Scolmore).

There are three types of SPD, 1, 2 and 3. Care should be taken in selecting the type of SPD for a consumer unit installed in a domestic premises. A type 1 SPD provides protection against fire and shock but will **not** provide any effective overvoltage protection for connected electronic equipment (534.4.1.1 Note). Both type 2 and type 3 SPDs will provide overvoltage protection for connected equipment. Typically, therefore, a type 2 SPD will be selected and erected within a consumer unit for a domestic premises. A type 3 SPD is **not** adequate for use at the origin of a domestic premises.

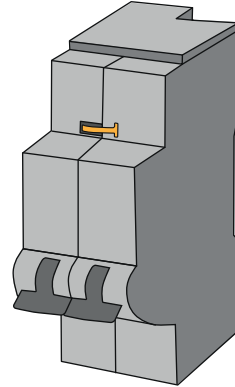
The use of SPDs within consumer units is now the norm.

→ AFDDs

AFDDs were introduced into *BS 7671* in Regulation 421.1.7. This regulation recommends their use to provide additional protection against fire.



AFD module



Combined AFD module and circuit-breaker

However, it is likely that in AMD2 of *BS 7671*, the use of AFDDs will be focussed on those final circuits supplying socket-outlets having a rated current not exceeding 32 A. Such devices will provide additional protection particularly for equipment plugged into the socket-outlets.

CIRCUIT-BREAKERS/FUSES

There is nothing precluding the overcurrent protective devices within a consumer unit being fuses or RCCBs. What the designer and installer need to be sure of is what their purpose is; there needs to be clarity on a device's function:

- Short-circuit - Earth fault.
- Short-circuit.
- Overload.

Device / Overcurrent	Circuit-breaker BS EN 60898	Fuse BS 88, BS 3036	RCCB BS EN 61008-1	RCCB BS EN 61008-1
Short-circuit – Earth fault	YES	YES	YES	YES
Short-circuit	YES	YES	NO	YES
Overload	YES	YES Care to be taken when considering using rewireable fuses	NO	YES

It is unlikely in a domestic premises that overload will be a significant issue on any one single circuit. However, practically it is clear that manufacturers do not make consumer units having fuses as the means of overcurrent protection, and as such, fuses can be ignored.

→ CIRCUIT-BREAKERS – *BS EN 60898*

There are three types of circuit-breaker detailed within *BS EN 60898*; types B, C and D. The table below gives guidance as to the applicability of the different types of circuit-breaker.

Type	"Instantaneous" operating current	Use
B	$5I_n$	Resistive loads with little inductive loading
C	$10I_n$	Moderate inductive loads
D	$20I_n$	Heavy inductive loads

The most commonly installed circuit-breaker in domestic premises is type B.

→ RCBOs – BS EN 61009-1

An RCBO is a device that combines both overcurrent protection as well as a residual current device, typically having a rated residual operating current of 30 mA.

As with circuit-breakers conforming to BS EN 60898, the overcurrent aspect of an RCBO will be either a type B, C or D and have the same operating characteristics. The RCD part of the device functions exactly as a normal RCD.

POTENTIAL ISSUES

Care should be taken when replacing a consumer unit to consider any factors which may affect the safety and functionality of the consumer unit. These factors include:

- Orientation of the consumer unit – manufacturer's will generally type test their consumer units in a horizontal plane and as such vertical orientation may breach warranty.
- Nature of the existing installation – consider Regulation 132.16 carefully.
- Whether there is any existing DC components that may cause unwanted tripping of new RCDs.
- Incorrect selection of RCD types for the connected load.
- Connection to PV systems.
- Connection to EV chargers.
- Any potential issues with the proposed new Chapter 82.

CONCLUSION

Whilst there remain issues that have not been touched upon in this article, such as certification, it is clear that whilst a consumer unit is a relatively straightforward item of electrical equipment, there are many factors for the electrical contractor to consider when installing them.

It is necessary to keep in mind the instructions of manufacturers. Should a manufacturer have created a unit including, for example pre-installed main switch and SPD, it would be wise to contact them prior to making any changes to such components. Any change without their prior approval would, in all likelihood, be a breach of any warranty issued.

voltimum

www.voltimum.co.uk