Consumer mains wiring

From Wikipedia, the free encyclopedia
(Redirected from Radial circuit)

Domestic **consumer mains wiring** refers to the wiring in the house hold premises and low voltage installations. Even though arbitrary electric wiring demands detailed calculations for selection of conductor sizes, circuit breakers, voltage drops and so on, for domestic wiring some standard methods and component sizes are used, as supported by IEE wiring regulations.

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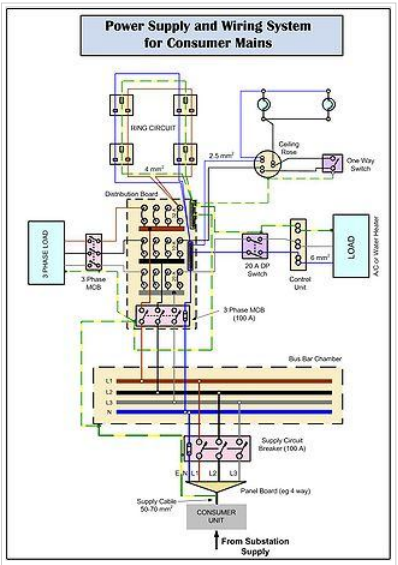

An illustrative consumer mains wiring

Distribution board

Main article: Distribution board

A distribution board (or panelboard) is a component of an electricity supply system which divides an electrical power feed into subsidiary circuits, while providing a protective fuse or circuit breaker for each circuit, in a common enclosure. Normally, a main switch, and in recent boards, one or more Residual-current devices (RCD) or Residual Current Breakers with Overcurrent protection (RCBO), will also be incorporated. The RCDs are used for earth leakage protection, while RCBOs combines RCDs with overcurrent protection. In a UK-style board, breaker positions are numbered top to bottom in the left hand column, then top to bottom in the right column. Modern consumer units supply up to around 100 Amperes from the input.

Supply voltage

Since the early 1970s, the supply voltage in UK domestic premises has been 240 volt (RMS) alternating current (AC) at 50 Hertz (Hz). In 1988, a Europe-wide agreement was reached to change the various national voltages, which ranged at the time from 220 volts to 240 volts, to a common European standard of 230 volts(CENELEC Harmonization Document HD 472 S1:1988). As a result, the standard nominal supply voltage in domestic single-phase 50 Hz installations in the UK has been 230 V AC (RMS) since 1 January 1995 (Electricity Supply Regulations, SI 1994, No. 3021).

Cable types used

The following are the cable types typically used in domestic wiring

Internal wiring

- Single core PVC insulated cables (fixed internal wiring)
- Flexible cords

Supply side wiring

- 2/3/4 core PVC insulated, SWA, PVC sheathed cables
- PVC Insulated, PVC sheathed (Unarmoured Cables)
- Three and four cores XLPE insulated, SWA, PVC sheathed cables

Colour code of conductors

The colour code for wire insulation accepted by the European Union (IEC 60446), including UK from 31 March 2004, is shown in the table below. The old colour code followed by British standard, which is still continued in many older installations is shown.

Conductor	Old Colour code	New Colour Code
L (single phase)	Red (or yellow/white/blue)	Brown
L1	Red	Brown
L2	Yellow (or white)	Black
L3	Blue	Grey
N	Black	Blue
Protective Conductor	Green & Yellow (or Green)	Green & Yellow

Selection of conductors and circuit breakers

The selection of conductors must be done taking into consideration both maximum voltage drop allowed at the load end and also the current carrying capacity of the conductor. Conductor size and voltage drop tables are available to do the selection, which is based on the load current supplied.

The choice of circuit breaker is also done based on the normal rated current of the circuit. Modern circuit breakers have overload and short circuit current protection combined. The overload protection is for protection of the equipment against sustained small to medium increase in current above the rated current while short circuit protection is for the protection of the conductors against high over currents due to short circuits.

For domestic circuits the following choices are typically adopted for selecting conductor and circuit breaker sizes.

CB and conductor Selection

Capacity (A)	Main conductor size mm^2 (copper)	Earth conductor size mm^2	Circuit breaker capacity
Up to 600 W	1.5	1.5	5 A
600-1200 W	1.5/2.5	1.5	10 A
1200-1800 W	2.5/4	2.5	15 A
Ring circuit (floor area 100 m2)	4.0	4.0	30/32 A
A2 Radial Circuit (floor area 75 m2)	4.0	4.0	30/32 A
A3 Radial Circuit (floor area 50 m2)	2.5	2.5	20 A
Air conditioner (1.5 ton)	6.0	6.0	30/32 A
Cooker	6.0	6.0	30/32 A
Water Heater	4.0	4.0	20 A

For distribution boards the incomer circuit breaker rating depends on the actual current demand at that board. For this the maximum demand and diversity is taken into consideration based on which the probable current is calculated. Diversity refers to the condition that all appliances are not likely to be working all at the same time or at their maximum ratings. From this the maximum demand is calculated and the currents are added to determine the load current and hence the rating of the circuit breaker.

IEE recommends these current demands and diversity factors for various loads to determine the load current and rating of overcurrent protective device.

Outlet point or equipment	Assumed load	Diversity factor
socket outlet 2 A	0.5 A	25%
other socket outlets	rated current	50%
Light outlet (per lamp holder)	100 W	50%
Domestic cooker	10 A + 30% remainder + 5A for auxiliary socket	
Other stationary equipment	BS current rating or normal current	

Isolating Devices

Single pole switches are most commonly used. These switches isolate only the line conductor feeding the load and are used for lighting and other smaller loads. For larger loads like Air conditioner, cooker, water heater and other fixed appliances a double pole switch is used, which isolates also the neutral, for more safety. A three pole isolator or circuit breaker is used for three phase loads, and also at the distribution board which isolates all the phases as well as the neutral.

Ring Circuit

Main article: Ring circuit

Ring circuit is feeding the socket outlets within a ring which starts and ends at the distribution board at the points. This applies for both live, neutral and earth conductors. This design enables the use of smaller-diameter wire than would be used in a radial circuit of equivalent total current. Ideally, the ring acts like two radial circuits proceeding in opposite directions around the ring, the dividing point between them dependent on the distribution of load in the ring. If the load is evenly split across the two directions, the current in each direction is half of the total, allowing the use of wire with half the current-carrying capacity. In practice, the load does not always split evenly, so thicker wire is used.

Radial circuit

A radial circuit is one where power is transmitted from point to point by a single length of cable linking each point to the next. It starts at the main switch or fuse and simply terminates at the last connected device. It may branch at a connection point. Lighting circuits are normally wired in this way, but it may also be used for low power socket circuits.

Division of loads between phases

The loads are usually divided approximately equally between the three phases. While three phase loads take balanced power from the three phases, the single phase loads are distributed to ensure equal loading of the three phases. Each row of breakers in the distribution board is fed from a different phase (A, B and C), to allow 3-pole common-trip breakers to have one pole on each phase.

Earthing

Earthing refers to connecting the exposed conductive part of electrical equipment and also the extraneous conductive parts of earthed bodies like water pipe to the general mass of the earth to carry away safely any fault current that may arise due to ground faults. This is done to minimize the danger of electric shock due to human contact with live parts which could result from bad insulation and insulation failures.In domestic wiring earthing of equipment is done by bonding together the earth points and metallic parts of the appliances and earthed bodies using Green/Yellow wire coming from the consumer main earthing terminal. The earth terminal is in turn connected to either consumer's earth electrode (TT system) or to the earth point given by the supplier (TN system). See the main article Earthing system.

References

ASEE Illustrated Guide to the IEE Wiring Regulations (15th Edition 1981), The Association of Supervisory and Executive Engineers

