International standards

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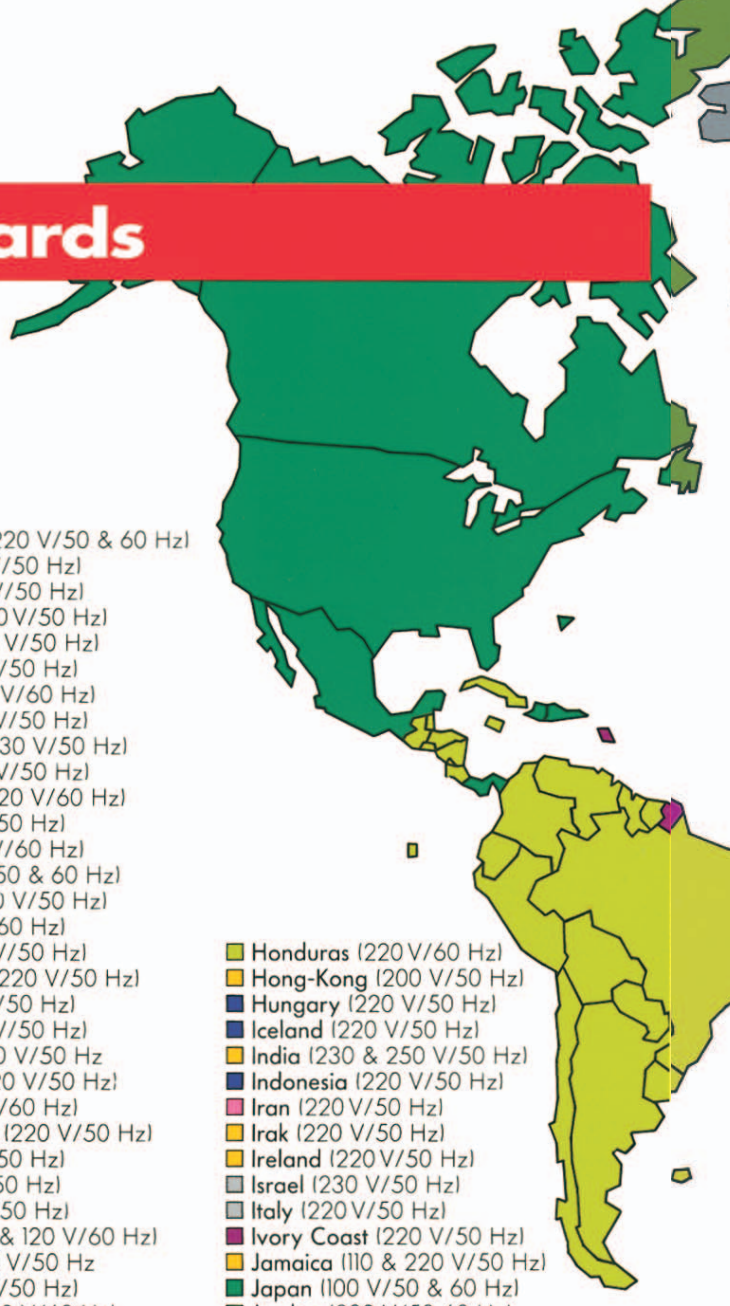

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As the world's largest manufacturer of wiring devices — with operations in dozens of countries, on all major continents — our engineers and scientists participate in and contribute to the formation of the world's safety and performance standards. That involvement not only helps us *build* products that meet and exceed those standards — it enables us to help *you* understand your compliance needs.

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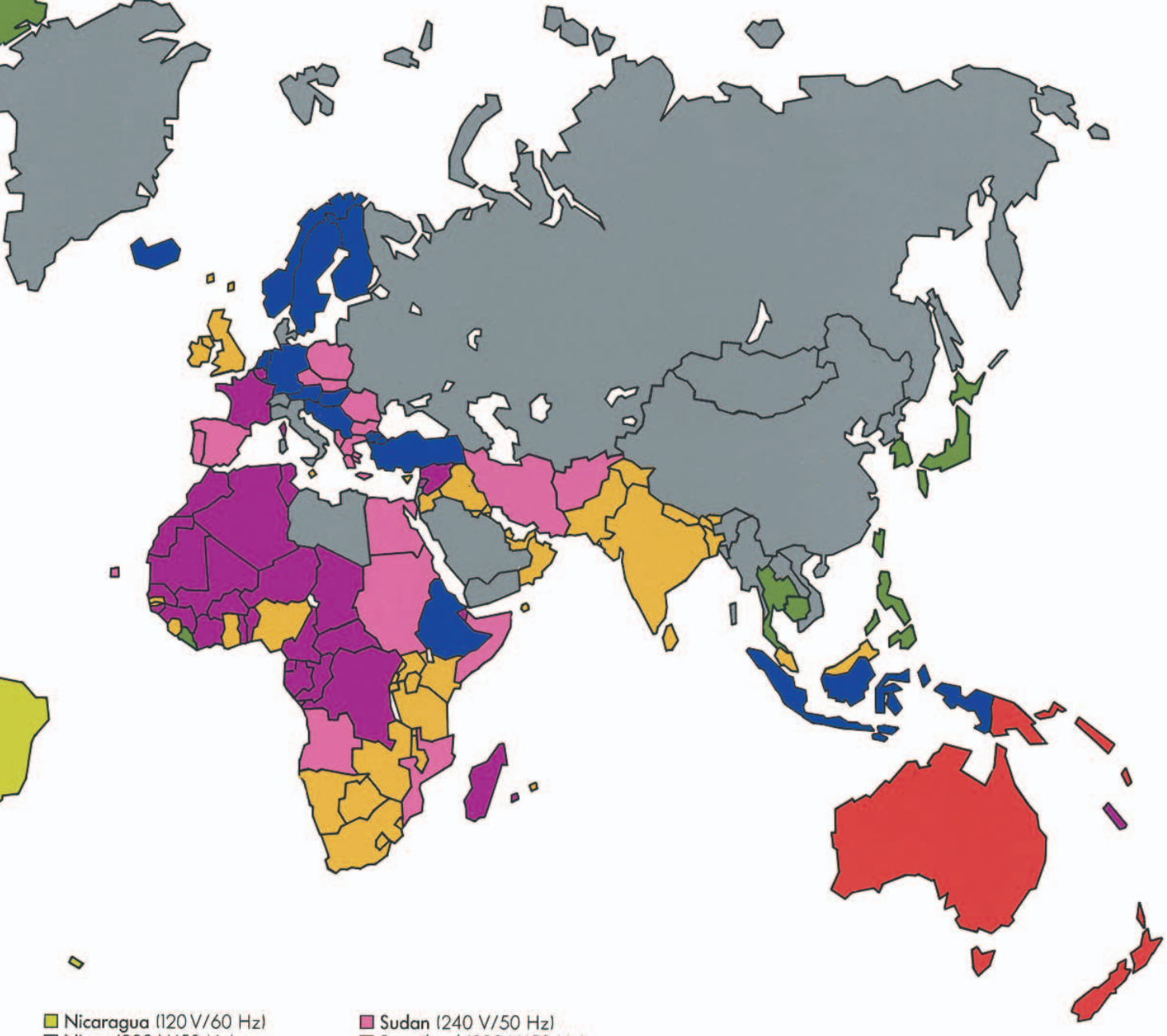
The one that works for you.

- Afghanistan (220 V/50 & 60 Hz)
- Algeria (220 V/50 Hz)
- Angola (220 V/50 Hz)
- Argentina (220 V/50 Hz)
- Australia (240 V/50 Hz)
- Austria (220 V/50 Hz)
- Bahamas (120 V/60 Hz)
- Bahrain (230 V/50 Hz)
- Bangladesh (230 V/50 Hz)
- Belgium (220 V/50 Hz)
- Belize (110 & 220 V/60 Hz)
- Benin (220 V/50 Hz)
- Bermuda (115 V/60 Hz)
- Bolivia (110 V/50 & 60 Hz)
- Botswana (220 V/50 Hz)
- Brazil (220 V/60 Hz)
- Bulgaria (220V/50 Hz)
- Burkina Faso (220 V/50 Hz)
- Burma (220 V/50 Hz)
- Burundi (220 V/50 Hz)
- Cambodia (120 V/50 Hz
- Cameroon (220 V/50 Hz)
- Canada (115 V/60 Hz)
- Central Africa (220 V/50 Hz)
- Chad (220 V/50 Hz)
- Chile (220 V/50 Hz)
- China (220 V/50 Hz)
- Colombia (110 & 120 V/60 Hz)
- Comoros (220 V/50 Hz
- Congo (220 V/50 Hz)
- Costa Rica (120 V/60 Hz)
- Cuba (115 & 120 V/60 Hz)
- Cyprus (240 V/50 Hz)
- Czechoslovakia (220 V/50 Hz)
- Denmark (220 V/50 Hz)
- Djibuti (220 V/50 Hz)
- Dominican Rep. (110 & 120 V/60 Hz)
- Ecuador (110 & 220 V/60 Hz)
- Egypt (220 V/50 Hz)
- El Salvador (120 & 240 V/60 Hz)
- Ethiopia (220 V/50 Hz)
- Fiji (240 V/50 Hz)
- Finland (220 V/50 Hz)
- France (230 V/50 Hz)
- French Guinea (220 V/50 Hz)
- French Polynesia (220 V/60 Hz)
- Gabon (220 V/50 Hz)
- Gambia (230 V/50 Hz)
- Germany (230 & 400 V/50 Hz)
- Ghana (250 V/50 Hz)
- Greece (220 V/50 Hz)
- Greenland (220 V/50 Hz)
- Guadeloupe (220 V/60 Hz)
- Guatemala (220 V/60 Hz)
- Guinea Bissau (220 V/50 Hz)
- Guyana (110 V/50 Hz)
- Haiti (110 V/60 Hz)
- Honduras (220 V/60 Hz)
- Hong-Kong (200 V/50 Hz)
- Hungary (220 V/50 Hz)
- Iceland (220 V/50 Hz)
- India (230 & 250 V/50 Hz)
- Indonesia (220 V/50 Hz)
- Iran (220 V/50 Hz)
- Irak (220 V/50 Hz)
- Ireland (220 V/50 Hz)
- Israel (230 V/50 Hz)
- Italy (220 V/50 Hz)
- Ivory Coast (220 V/50 Hz)
- Jamaica (110 & 220 V/50 Hz)
- Japan (100 V/50 & 60 Hz)
- Jordan (200 V/50-60 Hz)
- Kenya (240 V/50 Hz
- Korea (100 V/60 Hz)
- Kuwait (240 V/50 Hz)
- Laos (220 V/50 Hz)
- Lebanon (110 & 220 V/50 Hz
- Lesotho (230 V/50 Hz)
- Liberia (120 V/60 Hz)
- Libya (110 & 220 V/50 Hz)
- Luxembourg (220 V/50 Hz)
- Macao (220 V/50 Hz)
- Madagascar (220 V/50 Hz)
- Malawi (230 V/50 Hz)
- Malaysia (240 V/50 Hz)
- Mali (220 V/50 Hz)
- Malta (240 V/50 Hz)
- Martinique (220 V/50 Hz)
- Mauritania (220 V/50 Hz)
- Mauritius (230 V/50 Hz)
- Mexico (127 V/50 & 60 Hz)
- Mozambique (220 V/50 Hz)
- Morocco (220 V/50 Hz)
- Namibia (220 V/ 50 Hz)
- Nepal (220 V/50 Hz)
- Netherlands (220 V/50 Hz)
- New Caledonia (220 V/50 Hz)
- New Zealand (230 V/50 Hz)

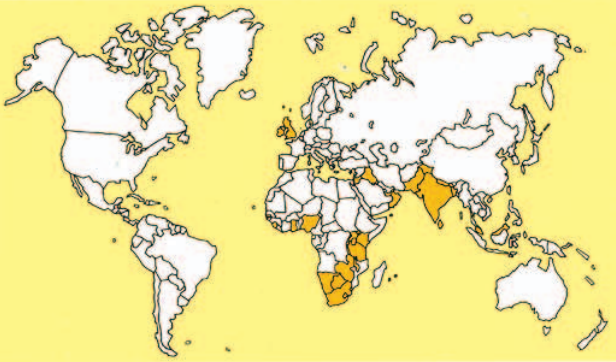


- Nicaragua (120 V/60 Hz)
- Niger (220 V/50 Hz)
- Norway (220 V/ 50 Hz)
- Oman (240 V/50 Hz)
- Pakistan (230 V/50 Hz)
- Panama (110 & 120 V/60 Hz)
- Papua (New Guinea) (240 V/ 50 Hz)
- Paraguay (220 V/50 Hz)
- Peru (220 V/60 Hz)
- Philippines (110 V/60 Hz)
- Poland (220 V/60 Hz)
- Portugal (220 V/60 Hz)
- Puerto Rico (120 V/60 Hz)
- Qatar (240 V/50 Hz)
- Reunion (220 V/50 Hz)
- Romania (220 V/50 Hz)
- Rwanda (220 V/50 Hz)
- Saudi Arabia (127 & 220 V/50 & 60 Hz
- Senegal (110 & 127 V/ 50 Hz)
- Seychelles (240 V/50 Hz)
- Sierra Leone (230 V/50 Hz)
- Singapore (230 V/50 Hz)
- Somalia (220 V/50 Hz)
- South Africa (220 V/50 Hz)
- Spain (220 V/50 Hz)
- Sri Lanka (230 V/50 Hz)
- Sudan (240 V/50 Hz)
- Swaziland (220 V/50 Hz)
- Sweden (220 V/50 Hz)
- Switzerland (220 V/50 Hz)
- Syria (220 V/50 Hz)
- Taiwan (220 V/60 Hz)
- Tanzania (230 V/50 Hz)
- Thailand (220 V/50 Hz)
- Togo (220 V/50 Hz)
- Trinidad & Tobago (115 & 230 V/60 Hz)
- Tunisia (220 V/50 Hz)
- Turkey (220 V/50 Hz)
- U.A.E. (240 V/50 Hz)
- Uganda (240 V/50 Hz)
- United Kingdom(240 V/50 Hz)
- Uruguay (220 V/50 Hz)
- U.S.A. (120 V/60 Hz)
- USSR (220 V/50 Hz)
- Vanuatu (220 V/50 Hz)
- Venezuela (120 V/60 Hz)
- Vietnam (220 V/50 Hz)
- Yemen (250 V/50 Hz)
- Yugoslavia (220 V/50 Hz)
- Zaire (220 V/50 Hz)
- Zambia (230 V/50 Hz)
- Zimbabwe (220 V/50 Hz).

For other countries, please consult us

- **American type standards**
- **British type standards**
- **French type standards**
- **German type standards**
- **Australian type standards**
- **European and American type installation habits**
- **French and German type installation habits**
- **Various standards**

British standard



Supply

Domestic installations are usually single phase 240 V ac 50 Hz. Live and neutral are supplied. Earth can be supplied or local.

House Service Cut-Out

The Electricity Board's protective device, usually a 80 A or a 100 A. HRC fuse. It is sealed in a special housing to prevent tampering.

Meter

Single (a second meter, usually white, for off-peak power, etc.) and sealed to prevent tampering.

Consumer unit

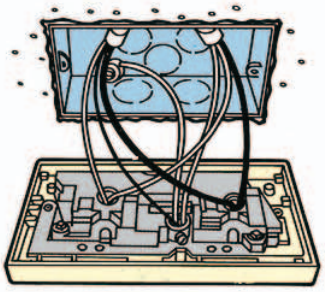
Houses the main switch which isolates the total installation and the individual circuit protection devices. The consumer unit should comply with BS 5486 pt 1 and pt 13. Circuit protection can be by means of :

- semi-enclosed fuses to BS 3036;
- cartridge fuses to BS 1361;
- miniature circuit breakers to BS 3871 pt 1.

The consumer unit may also contain one or more residual current devices protecting all or part of the installation.
RCDs should comply with BS 4293.

Power circuits

Appliances having heavy current consumption (cookers, water-heaters, etc.) should each be supplied on a specific circuit of the appropriate rating. In general, a double pole switch controls and isolates the appliance when necessary and the connection of the appliance can be made either directly to the switch or via a cable-outlet. Switches should conform to BS 3676.

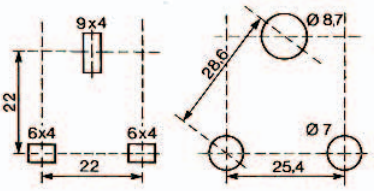


Flush fitting of two gang socket

	height	width	fixing centers
1 gang	75 mm	75 mm	60.5 mm
2 gang	75 mm	135 mm	121 mm

Socket outlet circuits

Socket outlets should comply with BS 1363 and are usually of the switched type. They are usually supplied via a ring main, a circuit running from the protection device to each outlet and the returning to the protection device. Permanent connections to a ring main as well as branches off the ring are made via spur units (BS 5733). Socket outlets to BS 546 are no longer used in the UK but one still widely used in some other countries.



BS 1363 - 13 A BS 546-15 A

Plugs

Plugs should conform to BS 1363. They contain a fuse link to BS 1362 of a rating appropriate to the cord and appliance (max = 13 A). Because of a certain number of unscrupulous suppliers of dangerous plugs, it is wise to insist on third party certification of plugs (eg ASTA certified).

Lighting circuits

Usually a radial circuit supplying each lighting point in turn. A lighting point usually consists of a ceiling rose in which incoming, outgoing and switch connections are made and a pendant flexible cord supplying a lampholder is attached. Light switches should meet BS 3676.

Dimmers should meet BS 5518 and be complet with suppression to BS 800.

Bathrooms

The wiring regulations are very strict. Every switch or other means of electrical control or adjustment shall be so situated as to be normally inaccessible to a person using fixed bath or shower. Pull cord switches are allowed. Shaver sockets with isolating transformers are allowed but should conform BS 3052.

Outdoors

Any socket outlet outdoors or intended to supply outdoor equipment (eg electric lawnmowers) should have 30 mA RCD protection.

Earthing

All sockets to BS 1363 have provision for earthing. A protective conductor (which could also be steel conduit) is generally required for all low voltage circuits (1 000 V ac between conductors) and its continuity must be proved. All main incoming services, for example, water and gas pipes and metallic parts of the building structure, etc... must be bonded and connected to the main earthing terminal of the installation. In addition it may be necessary to supplementary bond water and waste pipes, sinks and other metallic items such as central heating radiators.

However, in rooms with a fixed bath or shower, supplementary bonding must be applied to simultaneously accessible metal parts.

Installation rules

The "Regulations for Electrical Installations" published by the Institution of Electrical Engineers. Savoy Place, London, governs all domestic electrical installations (and many other types).
Copies are available from :
I.E.E.
P.O. Box N° 8. HITCHIN.
HERTFORDSHIRE SG 5 IRS. ENGLAND.
The various British standards governing the construction of electrical equipment are available from :
B.S.I., Sales Department.
LINFORD WOOD. MK 14 6 LE.
MILTON KEYNES. ENGLAND.
B.S.I. also publishes a yearly handbook covering all British standards.

Polarity

The polarity is conserved and marked throughout the installation :

Live :

- terminals marked L (or coloured red or brown);
- solid conductors insulated in red;
- flexible conductors insulated in brown.

Neutral :

- terminals marked N (or coloured black or blue);
- solid conductors insulated in black;
- flexible conductors insulated in blue.

Earth :

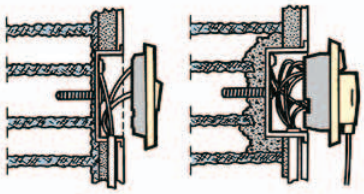
- terminals marked E or ⏚ (or coloured green/yellow);
- conductors insulated green/yellow.

Cabling

Most domestic wiring is done in flat p.v.c. insulated and sheathed 3 core cable (flat twin and earth). Maximum use is made of floor and wall voids to run cables.

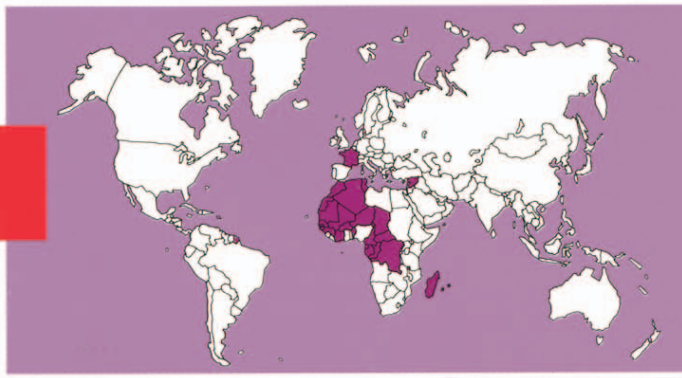
Surface installations are run in conduit or trunking, these can be plastic or metal. Various British standards govern the design and construction of conduits, trunking and cable.

Wiring accessories may be installed in plastic or (more often) metal flush boxes to BS 4662. Surface installations are made in appropriate proprietary boxes.



16 mm plaster-depth box 25 mm socket box

French standard



Supply

Usually single phase 230 V 50 Hz (some 120 V 50 Hz left).

Live and neutral are supplied. Earth is usually local.

An AD (accompagnement disjoncteur) fuse will be installed on the phase.

Meter

As single kWh meter is supplied. If off-peak power is used, a 2-tariff meter with pilot-line switching is installed.

Main circuit-breaker

This unit has 3 functions :

- acts as main isolator for the installation;
- limits consumption of current to a pre-set level determined by contract with electricity supply organisation;
- provides "blanket" residual current protection at 500 mA.

Compulsory protection against lightning

Installation supplied by overhead electric lines and located in areas where thunder is heard more than 25 days per year must be protected by a Search Protective Device immediately place after the main residual current circuit breaker (500 mA and recommended Type SI). The Search Protective Device must be connected to the earth terminal block of the consumer unit.

Consumers distribution board

This contains distribution of power to subcircuits and circuit protection (overload and short circuit). Additionally it may contain other functions :

- residual current protection of sub-circuits;
- time switches and time delay relays;
- bell transformer;
- power relays (heating, etc.);
- latching relays for lighting;
- indicator lamps;
- daylight/dusk switches;
- dimmers;
- load-shedding relays;
- off-peak power relays;
- buzzer or bell.

The unit is usually site-assembled and "soft" wired (no busbars).

Circuit protection

Each circuit must have a suitable protection device at its source. As from 1988, this device shall insure the breaking of both phase and neutral conductors in one operation. Rewirable fuses are now prohibited. The choice must be made between HRC cartridge fuses and miniature circuit breakers.

Power circuits

All appliances having a relatively high consumption of current should be supplied on a specific circuit with appropriate protection and cabling. They will be connected either via a special plug and socket or via a cable outlet box (eg cooker, dishwasher, washing machine, water-heater, etc.).

Socket outlets

Are supplied on radial circuits provided with earth (maximum of 8 outlet points per circuit). All circuits of socket outlets are protected by 30 mA Residual Current Devices.

Socket outlets must be of the earthed type (2 P + E) up to 32 A. Shutters are mandatory for the 16 A type. 20 A and 32 A socket outlets exist for power circuits (see above).

Plugs

Can be 2 P or 2 P + E type. The flat-bodied 2 P type should have sleeved pins. Specific 20 A and 32 A plugs are also available for power circuits.

Lighting points

Are supplied by radial circuits provided with earth (max 8 points per circuit) and controlled by switches or dimmers. Note that the use of intermediate switches has virtually disappeared : multiple-point control of lighting is usually achieved using latching relays and push-buttons (See opposite page).

The use of time-lag switches to control lights in public areas is also commonplace.

Earthing

All circuits distribute a protective conductor. All services should be bonded to earth. Supplementary bonding of metal fittings in bathrooms, kitchens, etc., is also necessary.

Cabling

Most domestic wiring is run either in plastic surface trunking or in flushed-in conduit systems. Various rules govern the choice of the type of conduit to be used. Generally solid copper conductors (usually PVC insulated) are used for fixed wiring. Attention must be paid to the various rules governing cable section, voltage drop, etc.

For plastic surface trunking, protection against external influences must be ensured continuously throughout the length of conduit runs especially at angles and at entries into wiring devices.

Accessory installation

Switches, sockets, etc., should be installed in a flush or surface box or in a purpose made equipment trunking. Accessories may be either screw-fitted or provided with expanding claws which grip the walls of a circular flush box.

Installation rules

All electrical installations should comply with French standard NFC 15-100. This document lays down detailed rules governing all aspects of wiring and designing an installation. Copies of the standards, as well as other French electrical standards are available from :

BUREAU DE VENTE DE L'U.T.E.
CEDEX 64 - 92052 PARIS LA DÉFENSE

Helpful guides and information are available from :

PROMOTELEC
52, BD MALESHERBES
75008 PARIS

An English-language edition of NFC 15 100 is available from :

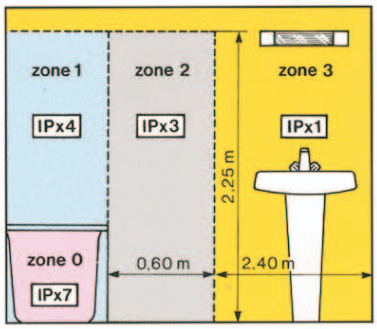
BSI TECHNICAL HELP TO EXPORTERS
LINFORD WOOD
MILTON KEYNES MK 14 6LC - ENGLAND

Outdoors

The use of 30 mA RCD protection is recommended. Outdoor sockets should be at least IP 44.

Bathrooms

Special rules apply to bathrooms which are divided into 4 zones.

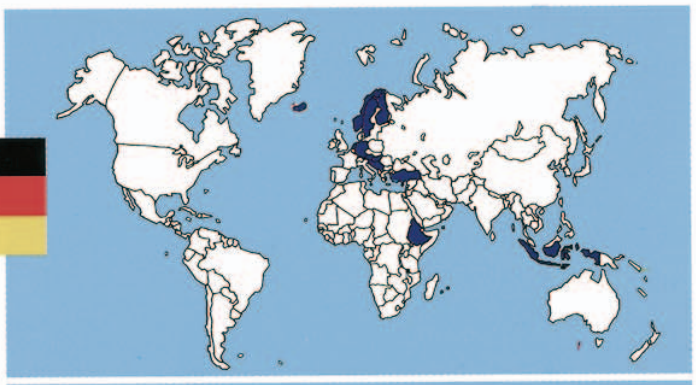


Definition of zone containing bath or shower.

Zones	0	1	2	3
Wiring systems	X (2)	II (1)	II (1)	II
Switchgear and controlgear	X	X (2)	X (2)	• Supplied individually by an isolating transformer. • Supplied by Safety Extra Low Voltage (SELV) (4) • Protected by a 30 mA RCD
Appliances	X (2)	X (2) (3)	II + 30 mA RCD (2) (3) (5)	• Supplied individually by an isolating transformer • Supplied by SELV (d) • Protected by a 30 mA RCD

X Prohibited
II Permitted for Class II.
RCD 30 mA : Protection by 30 mA residual current devices.
(1) Limited to those which are necessary to supply appliances located in this zone.
(2) Except those supplied by SELV, limited to 12 V ac or 30 V dc.
(3) Water heaters permitted.
(4) No voltage limit (≤ 50 V).
(5) Except a socket-outlet supplied by a low-power isolating transformer.

German standard



Supply

May be single phase (230 V 50 Hz) or three phase (400 & 230 V 50 Hz).

Phase or phases and neutral are supplied. Earthing is local.

In general each phase is protected by a 100 A blade type NH VDE 0636. Cables are either 16 mm^2 or 25 mm^2.

There is usually 1 meter. Facilities are provided for a second meter for special tariffs, etc.

A fuse isolator unit allows all phases to be cut-off thus isolating total domestic installation.

Control Panel (Unterverteilung)

This will usually contains 500 mA Residual Current Device (D.C. sensitive) protection for the whole installation and a miniature circuit breaker for each circuit. The circuit supplying the bathroom will have 30 mA residual Current protection.

Other functions are often included in the control panel: latching relays, switches, control lamps, buzzers, modular dimmers, etc.

Power Circuits

Single phase up to 3 kVA, > 3 KVA: 3 phases.

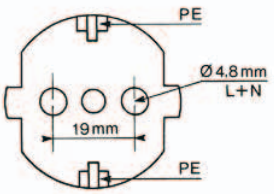
Electrical applicances having a high power consumption (cookers, washing machines, etc.) are supplied via a specific circuit and connected either via a cable outlet or via a specific socket (Perilex) or CEE 17.

It is not uncommon to find 3 phases appliances.

Protection rating and cable size of each circuit is calculated according to the appliance (min. section 1.5 mm^2 Cu/16 A).

General Circuits

These circuits supply both lighting points and socket outlets. The protective device is usually 16 A rating. There is no limitation of the number of outlets on the circuit. This limit is calculated according to expected/probable use of the circuit. Socket outlets are generally of the 2 P + E type "schuko" pattern. Since these plugs are reversible, no polarity is observed in connection of plugs or socket outlets. Polarity is observed for lighting points, switching on live conductor, inner contact live on Edison-type lampholders. All socket outlets are earthed, in general, the protective conductor is distributed throughout all circuits.



16 A / 250 V DIN 494 00/0873

Damp and Outdoor Installations

Special rules apply in particular IP ratings of accessories and equipment and RCD protection.

Bathrooms

Special rules apply to bathrooms. The room is divided into 4 zones (Bereich).

Bereich 0 - The structure and inner volume of the bath or shower basin.

Bereich 1 - The zone surrounding the Bereich 0, formed by the vertical planes of the edges of the bath or shower basin and shower walls to a height to 2.25 meters (or alternatively where no walls exist a radius of 0.60 meters from the shower head).

Bereich 2 - A zone 0.60 meter wide and 2.25 meters height from the floor surrounding Bereich 1.

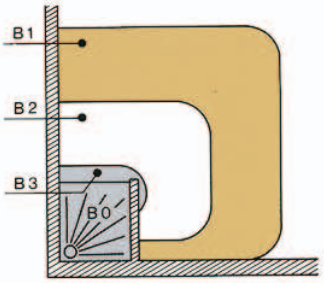
Bereich 3 - A zone 2.4 meters wide and 2.25 meters height from the floor surrounding Bereich 2.

In practice this area is often limited by the walls of the bathroom (note the doorways into other rooms also act as limits to Bereich 3).

In bathrooms, switches and socket outlets may only be installed in Bereich 3, and sockets must have RCD protection less than or equal to 30 mA. Various other rules apply in particular to the IP rating of equipment in the arious zones.

It is not permitted to route circuits feeding other rooms, etc. through the bathroom.

Effective bonding to earth of all metal services (water-pipes, drainage, etc.) is required.



bathroom zones VDE 0100 Teil 701

Cabling

Cabling is usally flush in conduit, single PVC, insulated conductors. Other possibilities are multi-core insulated and sheathed cable installation or surface trunking installations.

The function of conductors is conserved and indicated:

PE Earth : green/yellow;
N Neutral : blue;
L Live : any other colour than green, yellow, blue or green/yellow. In practice black and/or brown are used.

Sections of conductors, should be chosen according to the various rules laid down by the regulations.

Installation Rules

All domestic electrical installations should comply with the requirements of VDE 0100 and may only be completed by registered electricians. Note that the electricity supply organisation can extend or modify requirements for electrical installations.

There are about 220 EVU organisations in Germany. (EVU = Elektrizitätsversorgungsunternehmen = Electricity supply enterprise.)

VDE Standards are available from:
VDE, Verlag GmbH
MERIANSTRASSE 29
D-6050 OFFENBACH - GERMANY

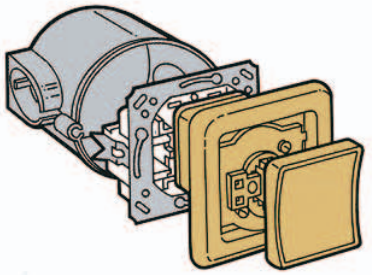
Some of the VDE-standards are available in English or French from VDE-Verlag.

The UTE publishes some French translation of VDE standards including VDE 0100.

More and more VDE-standards are translation of EN (European Standards) and IEC (International Standards).

Accessories

Should meet the appropriate VDE standards in their contructions. Flush accessories are fitted in boxes. Claw-mounting is common but screw-mounting is also used.



Earthing

Earthing is local usually through the foundations of the building. All services should be bonded (gas, water, heating, waste, etc.) with 10 mm^2, general and bathroom cross-bonding is done in 4 mm^2.

Neutral is re-earthed at the control panel. A protective (earth) conductor is distributed to all outlet points independantly of neutral.