

INFORMATION LEAFLET:

MAINS ELECTRICAL INSTALLATIONS (NOMINAL VOLTAGE 230V + 10% - 6% AC) IN TRAILER CARAVANS AND MOTOR CARAVANS

This leaflet is prepared as a Club service. The contents are based on the British Standard 7671, 2001 (I E E Wiring Regulations, sixteenth edition) incorporating amendments No 1 & 2, Part 6, Section 608, Divisions One and Two, Part 7, Chapters 72-74 and IEC Standard 364.

It has not yet been reviewed against BS 7671:2008 (17th edition), although substantial changes to the content are not anticipated

The contents are believed correct at date of publication, but cannot include every detail of the relevant regulations. Further information can be obtained from the Information Office at East Grinstead, or a qualified electrical contractor.

October 2008

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1. WARNING

Mains electricity is a convenient and economical form of energy, but if abused, it is a serious hazard to life and property. The contents of this

leaflet are intended as a general guide to the installation work involved, and must not be regarded, under any circumstances, as DIY instructions.

Mains electrical installations and extensions or modifications to existing installations should be entrusted to a skilled installer. Upon completion the work should be inspected and tested by a "competent person" (see p.9) who will issue an official inspection certificate if the installation is satisfactory.

2. Test Certificates

The caravan owner should be supplied with and be in possession of a completed and signed Electrical Installation Certificate issued by a "competent person". These should be originals, giving details of the caravan (make, model and VIN number) and signed by a "competent person" as defined on page 10. Photocopies are not acceptable.

3. UK Regulations

The distribution and supply of electrical power in the UK, as well as wiring installations in buildings, caravan sites and caravans is governed by the British Standard BS7671, 2001. The Supply Authority (Supplier) will not supply any building or caravan site until they are satisfied that the installation conforms to this British Standard. These details indicate the specification for new equipment. Older caravans and accessories may not meet all the requirements of the latest standard, but this would not generally mean they are unsafe nor inappropriate to use, subject to being in good condition. Service workshops or inspection engineers may point out deficiencies compared to the latest standards, and may recommend updating of the system to give a higher standard of safety. In some cases, upgrading may be necessary before having a new appliance fitted.

4. The Installation

The location and wiring of mains electrical appliances in a caravan will depend upon the interior layout and the individual requirements of the caravan owner. In spite of these variations the basic installation (*Fig 1 on page 7*) will be unchanged. The various items are identified by letter for quick reference to the text.

4.01 Site Socket Outlet

The British Standard requires each site socket outlet to be 3 pin, 16 Amp, 250 volt (maximum) in accordance with BS EN 60309-2, which also requires the socket to be colour coded blue to indicate the rated voltage. All Caravan Club sites, where mains is available, have socket outlets which comply with this standard. Most of those on Club sites have a 'plug in and turn clockwise' action. On CLs and other sites the plug may simply push straight in.

4.02 Site to Caravan Connection

The maximum permitted distance between socket outlet and any point on the caravan pitch is 20 metres. To connect the caravan to the socket outlet, a connecting cable is required. This cable must be 3 core (each core to be 2.5mm² **do not use thinner cable**), PVC/PVC, flexible cable and 25 metres (+/- 2 metres) in length.

It is recommended that the cable is coloured orange for good visibility in longer grass. Shorter lengths of cables, although less expensive and less bulky to carry, may limit the choice of pitch. Note that caravan manufacturers must now provide hook-up cable.

At one end of this cable, a connector should be fitted for plugging into the caravan inlet. At the other end of the cable, a plug is fitted for connection to the site socket. Both items must be to BS EN 60309-2 (formerly known as 'CEE17') and coloured blue.

(NOTE: A connector is similar to the plug, but is provided with female contacts and has a spring cover to shield the contacts when disconnected.) International markings for the live and neutral terminals have not yet been agreed, so only the earth terminal may be identified by the symbol '≡'. First identify the earth terminal, and determine 'L' and 'N' terminals by the position relative to the earth terminal. *Fig 2* shows the correct connections.

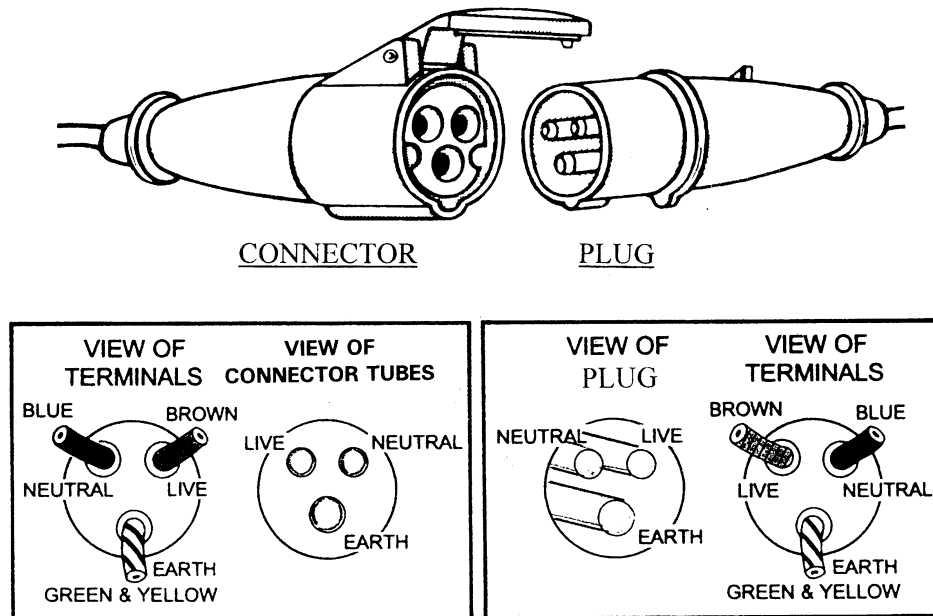
Members should not need to assemble these connecting cables, since most caravan accessory shops supply cables of suitable length with connector and plug fitted. An adaptor may be required by members intending to use mains when touring outside the UK (see page 13).

Adaptors are also available to connect the standard connecting cable to a domestic 13A socket, so that the caravan can, perhaps, be connected to a house supply while being stored at home. These should consist of a blue BS EN 60309-2 trailing socket, a short length of cable, and a standard UK 3 pin 13A plug. It should be ensured that the domestic plug is connected inside the house, or in a suitable weatherproof enclosure outside.

4.03 Caravan Inlet

This must be to BS EN 60309-2 and again rated at 16 Amp. The inlet must be installed not more than 1.8 metres above ground level, in a readily accessible position and in a suitable recess incorporating a lid on the outside of the caravan. Exterior surface mounted 'inlets' are therefore not recommended. The specialist suppliers have inlets mounted in boxes with lids, ready for locating in a caravan wall. It is recommended that this inlet is located in a wall which will not be enclosed by an awning. The caravan inlet is, in effect, a '*fixed*' version of a plug, and is therefore connected as shown in *Fig 2*.

Fig 2 Caravan to site connections



Wiring Arrangement of connector-cable

Wiring Arrangement of plug-cable

4.04 Wiring Systems

Flame propagating wiring systems shall not be used.

4.04.01 Wiring - Caravan Inlet to Isolating Switch

This should be 3 core (each 2.5mm²) PVC/PVC flexible cable. An unbroken length not exceeding 2.0 metres is recommended. Unless routed in conduit or rigid plastic trunking the cable must be supported by insulated clips at intervals not exceeding 400mm for vertical runs or 750mm for horizontal runs.

4.04.02 Wiring from Circuit Breaker to Appliances

Mains cables shall run separately from 12V cables, so that as far as is reasonably practical, that there is no risk of physical contact between the two wiring systems.

The cross-sectional area of every conductor shall be not less than 1.5mm². Flexible single core PVC insulated and sheathed cables may be used. All cables unless routed in rigid conduit and all flexible conduit, must be supported by insulated clips at intervals not exceeding 400mm for vertical runs or 250mm for horizontal runs.

Cable joints must be made at junction boxes of non-flammable material. These should be accessible. No electrical equipment shall be installed in LPG compartments and cables should not be routed through such compartments.

4.05 Isolating Switch/Residual Current Device/Distribution Board

The British Standard requires the caravan to be fitted with an isolating switch and overcurrent protection, i.e. fuses and mcb's. Also required is an RCD complying with BS 4293, BS EN 61008 - 1 or BS EN 6 AN 1009 - breaking all live conductors and having a rated residual operating current not exceeding 30 mA and an operating time not exceeding 40 ms at a residual current of 150 mA (compliant with BS 4293). Distribution boards are available with mcb's which are easier to reset instead of replacing a fuse. A version with two mcb's (one 5 or 6 Amp and one 10 or 16 Amp) should suit most caravan owners. The lower rated mcb should protect the lighting circuit, TV, refrigerator (LV) and battery charger circuits, whilst the 10 or 16 Amp mcb should protect the socket outlets used for heavier consumption appliances such as electric kettles, toasters, hairdryers, etc. It must be remembered that the mcb fuses are purely to protect the caravan wiring against overloading and must not be regarded as an indication of the power available.

4.06 Bonding

Except where the caravan or motor caravan is made substantially of insulating material, and metal parts are unlikely to become live in the event of a fault, extraneous-conductive-parts shall be bonded to the circuit protective conductor with a conductor of minimum cross-sectional area of 4mm² and in more than one place if the construction of the caravan does not ensure continuity between extraneous-conductive-parts.

Metal sheets forming part of the structure of the caravan or motor caravan are not considered to be extraneous-conductive-parts

4.07 Switches, Socket Outlets and Spur Socket Outlets

Switches and socket outlets should be mounted in boxes designed for that specific purpose. Switched socket outlets should be of the 13 Amp 3 pin (flat sided) type, to BS 1363, but must not be exposed to outside conditions.

Plugs are normally supplied with a 13 Amp fuse which is suitable for heavier consumption appliances, but when the plug is connected to appliances with lower consumption, such as a lamp, TV set or refrigerator, the fuse should be replaced with one of the recommended rating for the appliance. Generally, the manufacturers state the size of fuse to be used with each appliance.

If a pendant luminaire is to be installed, a ceiling rose should be used and provision must be made to secure the lamp when the caravan is towed. A filament lamp shall be so designed or mounted so as to allow a free circulation of air between it and the caravan body.

4.08 Instruction Notices

The British Standard requires an instruction notice of durable material to be fixed in a prominent position near the Isolating switch in the caravan. The notices currently recommended are reproduced on page 10.

4.09 12V Power Supply/Battery Charger

Caravans having a mains installation as original equipment are normally fitted with a unit comprising of a mains battery charger and a 12V DC fused distribution board. Subject to available space, such units can be fitted to existing caravans. The unit should be in accordance with BS EN 1648-1. and wired in accordance with manufacturers' instructions.

NOTE: This unit has two separate functions:

- a) To provide a 12V power supply to lights, heater controls, pumps etc.*
- b) To charge the 12V battery*

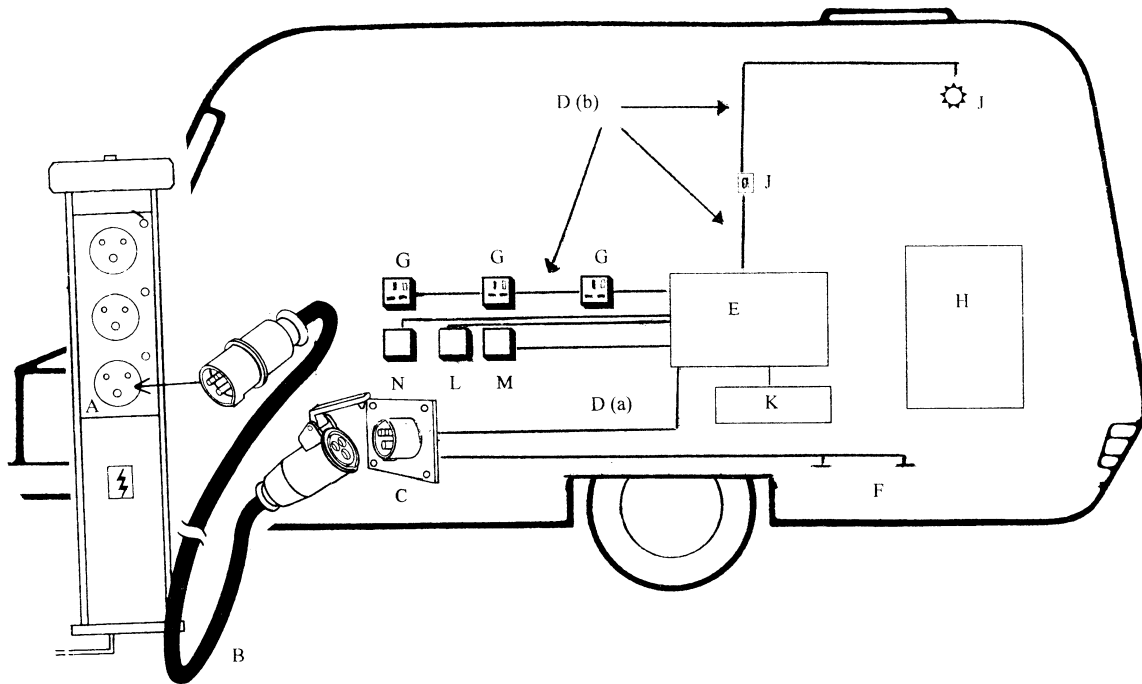
If a 230 volt supply is available on site the caravan will draw its 12V supply from the unit and "top up" from the battery on peak load. When the 12V load is reduced the battery will then receive a charge, although note that this system is not designed to fully re-charge a flat battery.

Unless the battery charger is electronically regulated for both current and voltage, it should not be left permanently switched on when the caravan is not in use, since this may result in battery overcharging and possible battery damage. Conversely a battery will quickly deteriorate if left in an uncharged state and must be kept fully charged at all times, i.e. terminal voltage "off charge" in excess of 12.5 volts.

4.10 Electrical Appliances, including Water Heater and Refrigerator

Every appliance connected to the supply by means other than a plug and socket outlet shall be controlled by a switch incorporated in or adjacent to the appliance. Note a fused spur will be required for most fixed appliances.

Fig 1



KEY

- A Site socket outlet
- B Connecting cable
- C Caravan inlet
- D Wiring systems
- D (a) Supply to isolating switch
- D (b) Wiring to appliances
- E Isolating Switch/RCD/Fuse box
- F Bonding
- G Socket outlets for accessories and appliances
- H Notices
- J 230v luminaire (lights) if fitted
- K 12V power supply/battery charger unit
- L Space heater
- M Spur socket outlet for electric water heater
- N Refrigerator (may be on same circuit as D(b))

5. Appliances and Power Limitation on Sites

It is not possible to review all the appliances which could be used in a caravan. Some important general guidance can however be given. Whenever possible, use only appliances

complying with British Standards with BEAB approval. Other appliances made by well known manufacturers and sold by reputable traders may be suitable but if in doubt, ask the manufacturer if the appliance can be used in a caravan. Some may not be designed to cope with vibration on the road.

Many appliances are now of the double insulated type, denoted by the symbol '☐'. This means the appliance has been so constructed that it is practically impossible to receive a shock via the outside casing should a fault occur within the appliance. Such appliances do not require an earth conductor and accordingly have only twin core cable. The two cable cores coloured brown and blue should therefore be connected to the supply 'L' and the neutral 'N' terminals respectively. If the cable cores have no identifying colours, they may be connected either way.

For technical reasons, it is not possible to construct all appliances double insulated. Appliances with an earth terminal or fitted with 3 core cable must have the earth connection made to the earth terminal in the 3 pin plug and the L and N terminals connected to the correctly coloured cable core.

Although the caravan installation is designed for a maximum current of 16 Amp, some sites may, for technical or economic reasons, limit the maximum current loading per caravan to a lower figure, usually 10 Amp in the UK and sometimes 5 Amp or less abroad (*refer to Site Warden for the relevant amperage on a Club Site*). On arrival at a site, check the maximum permitted current, and make sure that this figure is never exceeded. Failure to do so will result in tripped circuit breakers - at the site rather than in the caravan - and this will not endear the culprit to the site warden! It is now more common for appliance power to be quoted in watts and kilowatts (1 kilowatt (kW) = 1000 watts (w)). In general it may be assumed that a total electrical load of 1 kW will require a 5 Amp supply at 230V. Hence the normal supply of 16 Amp in the UK would be suitable for a total load of approximately 3 kW (although this may exceed the circuit limitations of the caravan).

Note therefore, that the average domestic kettle/jug having a power consumption in excess of 2000 watts may not be usable with outlets at present limited to 10 Amp. Lower consumption kettles/jugs should be readily available at any well stocked caravan accessory shop.

Remember that although an individual caravan can be supplied with up to 16 amps on a suitable site, there is a demand limitation. A diversity factor applied to the design of the site electrical installation for economic reason both in terms of capital costs and maximum demand electrical energy costs results in the site circuit breakers tripping with a complete loss of power if everyone on a busy site makes a maximum demand of 16 amps at the same time. So be economical with your use of electrical power, for everyone's benefit.

In the UK a Club Site Warden has authority to refuse to offer a supply to a caravan if it is believed that the installation may be unsafe.

6. Safe Practice and Maintenance

6.01 Recommendations

- i) *THE CARAVAN MAINS ELECTRICAL SYSTEM SHOULD BE CHECKED AT REGULAR INTERVALS - ANNUALLY IF YOU COVER HIGH MILEAGES (SEE PERIODIC INSPECTION NOTICE PAGE 10).*
- ii) Maintain equipment in good order, and have appliances serviced as recommended by the manufacturer.
- iii) Damaged or worn cables should be replaced immediately.
- iv) Do not abuse appliances by forcing them to perform in excess of their capability.
- v) Switch off ALL caravan internal appliances before connecting to or disconnecting from site supply.
- vi) Check operation of RCD by means of test button every time caravan is connected to a site supply (*NOTE: Supply must be switched on at site socket outlet*).
- vii) In the event of a blown fuse or mcb trip, switch off the supply and ascertain cause before replacing the fuse or resetting mcb.
- viii) In the event of appliance malfunction switch off supply before removing the appliance for inspection.
- ix) Always make sure the caravan to site connecting cable is fully unwound when used. If necessary, lay out any excess cable in parallel rows (not tight coils) beside the caravan. Failure to do this can result in the cable overheating and even catching fire.
- x) Motorcaravanners: please do not leave cables plugged in on pitches while your vehicle is away from the site during the day. This creates a major safety hazard for wardens when grass cutting, or for children (and others) who might pick up the live end of the cable. At the very least, disconnect the cable at the bollard end. Best still, disconnect and coil it next to the bollard (or take it with you) and use a suitable sign to reserve your pitch.

6.02 Instructions for use of "On Site" Electricity Supply

Refer to Instruction Notice on page 11

7. Persons Authorised to Sign and Issue Electrical Installation and Periodic Inspection Certificates

A “Competent person” will have a sound knowledge and experience relevant to the nature of the work undertaken and to the technical standards set out in BS 7671 and be fully versed in the inspection and testing procedures contained in the BS and employ adequate testing equipment.

It is strongly recommended that they should also be one of the following:

- a member of the Electrical Contractors Association (ECA) or a member of the Electrical Contractors Association of Scotland*
- an approved contractor of the National Inspection Council for Electrical Installation Contracting (NICEIC)**
- a qualified person acting on behalf of the above (in which case he should state for whom he is acting).

** The names and addresses of Approved Contractors in any locality (there are over 8,000 in the UK) can be obtained from NICEIC (Tel: **01582 531000**).

* Members of the ECA can be obtained from ECA (Tel: **020 7313 4800**) or ECA Scotland (Tel: **0131 445 5577**).

8 Instruction Notices : See Item H page 6

INSTRUCTIONS FOR ELECTRICITY SUPPLY

TO CONNECT

1. Before connecting the caravan installation to the mains supply, check that:
 - (a) the supply available at the caravan pitch supply point is suitable for the caravan electrical installation and appliances, and
 - (b) the caravan main switch is in the OFF position.
2. Open the cover to the appliance inlet provided at the caravan supply point and insert the connector of the supply flexible cable.
3. Raise the cover of the electricity outlet provided on the pitch supply point and insert the plug of the supply cable.

THE CARAVAN SUPPLY FLEXIBLE CABLE MUST BE FULLY UNCOILED TO AVOID DAMAGE BY OVERHEATING

4. Switch on at the caravan main switch.
5. Check the operation of residual current devices, if any, fitted in the caravan by depressing the test button.

IN CASE OF DOUBT, OR IF AFTER CARRYING OUT THE ABOVE PROCEDURE THE SUPPLY DOES NOT BECOME AVAILABLE, OR IF THE SUPPLY FAILS, CONSULT THE CARAVAN PARK OPERATOR OR HIS AGENT OR A QUALIFIED ELECTRICIAN

TO DISCONNECT

6. Switch off at the caravan main isolating switch, unplug both ends of the cable.

PERIODIC INSPECTION

Preferably not less than once every three years and more frequently if the vehicle is used more than normal average mileage for such vehicles, the caravan electrical installation and supply cable should be inspected and tested and a report on their condition obtained as prescribed in BS7671 (formerly the Regulations for Electrical Installations published by the Institution of Electrical Engineers).

PERIODIC INSPECTION NOTICE

IMPORTANT

This installation should be periodically inspected and tested and a report on its condition obtained as prescribed in BS 7671 (formerly the IEE Wiring Regulations for Electrical Installations) published by the Institution of Electrical Engineers.

Date of last inspection

Recommended date of next inspection

9. Abbreviations Used in this Leaflet

B E A B	British Electrotechnical Approvals Board
B S	British Standard
B S I	British Standards Institute
C E E	International Commission on Rules for the approval of Electrical Equipment
I E C	International Electrotechnical Commission (for electricity the equivalent of the International Standards Organisation)
I E E	Institution of Electrical Engineers
N C C	National Caravan Council
N I C E I C	National Inspection Council for Electrical Installation Contracting
m c b	Miniature Circuit Breaker
mm ²	Cross sectional area of a conductor (excluding insulation) in square millimetres
PVC	Polyvinylchloride - a common insulator material
PVC/PVC	Indicates that a multicore cable has PVC insulation around conductors, and these conductors are then enclosed in a PVC outer coating
R C D	Residual Current Device (formerly known as RCCB or ELCB)

10. Addresses of Suppliers

COMPANY	CODE	TRADE NAMES
Hawkins Electrical Ltd Heath Road, Skegness, PE25 3SU Tel: 01754 610440	1	
Caravan Park Electrical Services Unit 5, Vale Industrial Estate, Spilsby, Lincs, PE23 5HE Tel: 01790 753153	1	
Bonus Plug-in-Systems Ltd Citadel Trading Park, Citadel Way, Hull, HU9 1TQ Tel: 01482 580077	1 2 3	CEC Plug-in-Systems KT Series (Logic)
Electro-Tec Leisure Systems Ltd Unit 1 & 2 New England Business Park Wainfleet, Skegness, Lincs, PE24 4AW Tel: 01754 881919	1	
W4 Ltd Unit B, Ford Lane Industrial Estate, Arundel West Sussex, BN18 0DF Tel: 01243 553355	5	
Zig Electronics Ltd Saxon Business Park, Hanbury Road, Stoke Prior, Bromsgrove, Worcs, B60 4AD Tel: 01527 556715	3	Zig

CODES:	1 Site supplies
	2 Caravan mains inlets etc
	3 Battery chargers/12V distribution panels
	4 Battery boxes
	5 Plugs, leads, polarity testers etc

11. Use of Mains in Continental Europe

11.01 Electrical Hook-ups – General Advice

Electricity on continental European sites is usually 220V nominal, but in practice can be considerably less. Most appliances sold in the UK are rated at 220-240V and usually work satisfactorily. Some high-powered equipment, such as microwave ovens, may not function well - consult the manufacturer's literature for further information. Eventually 230 volts will be the European standard supply, but this will take some years to achieve.

Frequently you will be offered a choice of Amp allowances and the following table gives an approximate idea of what appliances can be used (erring on the side of caution) - you can work it out more accurately by noting the wattage of each appliance in your caravan. The kettle given is the caravan type, not a household kettle which usually has at least a 2000 watt element. Note that each caravan circuit also has a maximum Amp rating which should not be exceeded.

AMPS	WATTAGE (approx)	FRIDGE	BATTERY CHARGER	TABLE LAMP	COLOUR TV	KETTLE (750 W)	HEATER (1KW)	HAIR DRYER
2	400	√	√	√				
4	800	√	√	√	√			
6	1200	√	√	√	√	√		*
8	1600	√	√	√	√	√	√ ≠	√ ≠
10	2000	√	√	√	√	√	√ ≠	√ ≠
16	3000	√	√	√	√	√	√ ≠	√ ≠

* Possible, depending on wattage of appliance in question

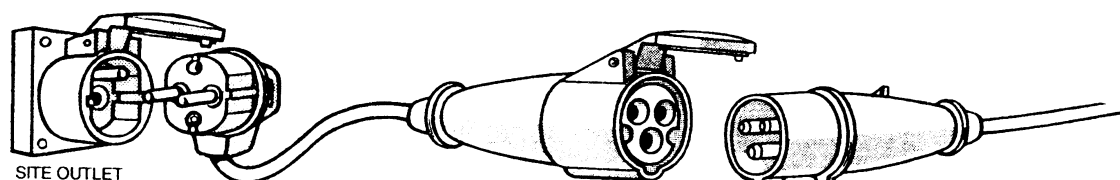
≠ Not to be used at the same time as other high-wattage equipment

11.02 Electrical Connections

Whilst there is a European Standard for connectors (EN60309-2, formally known as CEE17) this is not retrospective so you may find some continental sites where your UK 3 pin connector (which is to European Standard EN60309-2) will not fit. Accurate information is not easy to come by, but in Belgium, Germany and Denmark all the sites should, by now, be fitted with EN60309-2 hook-ups. Spain, France and Italy are gradually changing over, but older style hook-ups may still be encountered. The main alternatives to EN60309-2 connectors are:

French - a two pin plus earth socket - this is the most common type of adaptor available from UK caravan accessory shops.

Typical 'French' style adaptor



German - the 2 pin plus two earth strips - found in Holland, Norway and Sweden (possibly still Germany).

Danish - smaller 3 pin plug used only, as far as we are aware, in Denmark. (but most now should be EN60309-2).

Adaptors to accommodate the older German and Danish arrangements can often be borrowed from the campsite office.

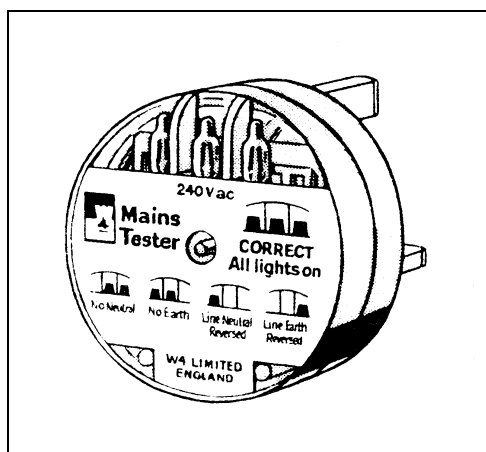
If the site does not have a modern EN60309-2 supply, ask to see the electrical protection for the socket outlet and ascertain from site operator that it is safe to use. If there is a device marked with $I_{\Delta n} = 30\text{mA}$, then the risk is minimised.

Note that some continental connection arrangements involve plugging your cable in inside a connection box. Sometimes, opening this box gives access to live components of the site supply, and hence particular caution should be used. If in any doubt, seek assistance from the site staff.

11.03 Hooking up to Continental Mains

Follow the hooking-up procedure given in your UK Sites Directory and Handbook, but note that few sites use the Club style bollard and there may be no need to turn the plug to connect, or to press the button to release.

11.04 Reversed Polarity



Even when the site connector is to EN60309-2, UK caravanners can still encounter the problem known as *reversed polarity*. This is where the site supply's 'live' line connects to the caravans 'neutral' and vice versa and is due to different standards of plug and socket wiring that exist in other countries. We therefore recommend checking the polarity immediately on connection, using a polarity tester. One tester available from most caravan accessory shops is made by W4.

The caravan mains electrical installation **should not be used** whilst a reversed polarity situation exists. Frequent travellers to the continent who are electrically competent often make themselves up an adaptor, clearly marked *reversed polarity*, with the live and neutral wires reversed. This can be tried in place of the standard connector, to see if the electricity supply then reverts to 'normal'. (The 'German' plug can simply be turned upside down, so no further adaptor is required.) If these steps do not rectify the reverse polarity situation, the site supply may be quite different from that used in the UK and we recommend for your own safety you disconnect from the mains and **do not use this facility**. **Never use a site without an earthing system.**