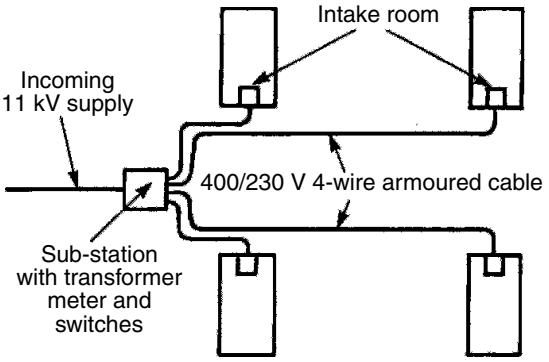
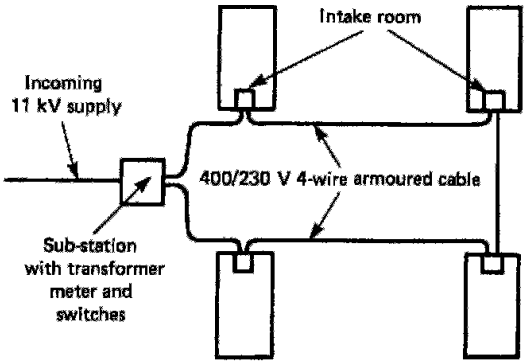
For large developments containing several buildings, either radial or ring distribution systems may be used.

Radial system – separate underground cables are laid from the sub-station to each building. The system uses more cable than the ring system, but only one fused switch is required below the distribution boards in each building.

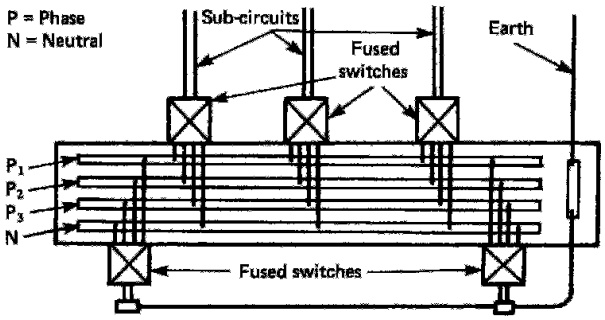


Radial distribution (block plan)

Ring circuit system – an underground cable is laid from the sub-station to loop in to each building. To isolate the supply, two fused switches are required below the distribution boards in each building. Current flows in both directions from the intake, to provide a better balance than the radial system. If the cable on the ring is damaged at any point, it can be isolated for repair without loss of supply to any of the buildings.



Ring distribution (block plan)

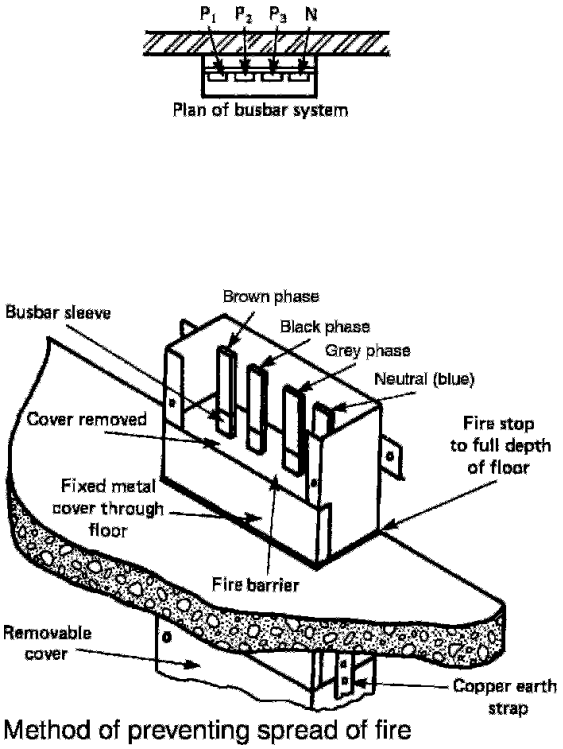


Detail of equipment in the intake room for the ring distribution

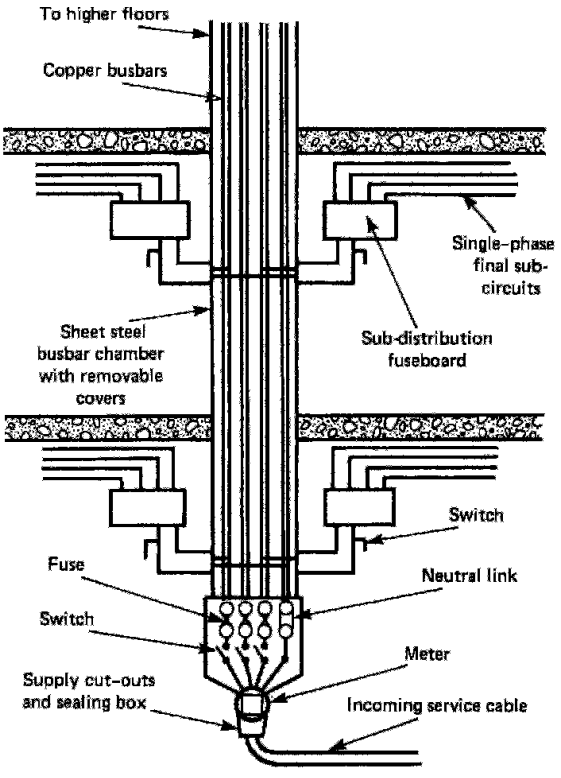
Rising Main Electricity Distribution

The rising main supply system is used in high rise offices and flats. Copper busbars run vertically inside trunking and are given support by insulated bars across the trunking chamber. The supply to each floor is connected to the rising main by means of tap-off units. To balance electrical distribution across the phases, connections at each floor should be spread between the phase bars. If a six-storey building has the same loading on each floor, two floors would be supplied from separate phases. Flats and apartments will require a meter at each tap-off unit.

To prevent the spread of fire and smoke, fire barriers are incorporated with the busbar chamber at each compartment floor level. The chamber must also be fire stopped to the full depth of the floor.



Method of preventing spread of fire



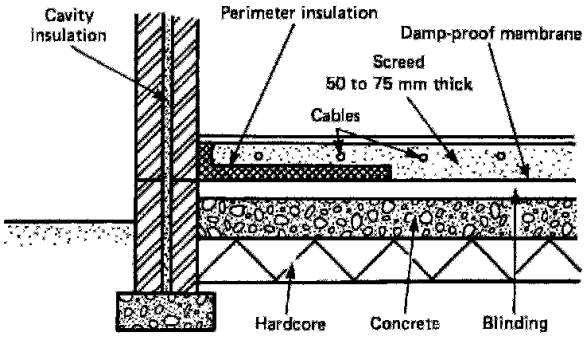
Detail of rising main system

Ref: Building Regulations, Approved Document B3: Internal fire spread (structure).

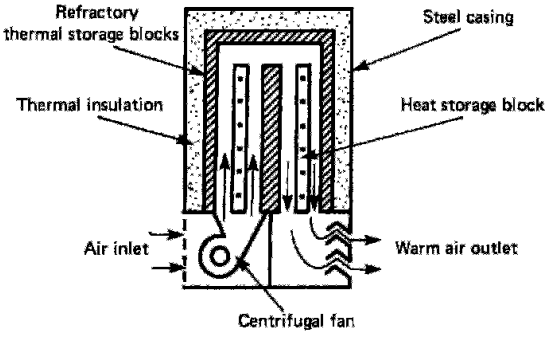
It is uneconomic to shut down electricity generating plant over night, even though there is considerably less demand. To encourage the use of off-peak energy, the electricity supply companies offer it at an inexpensive tariff. A timer and white meter or economy 7 (midnight to 0700) meter controls the supply to an energy storage facility.

Underfloor – makes use of the thermal storage properties of a concrete floor. High resisting insulated conductors are embedded in the floor screed at 100 to 200 mm spacing, depending on the desired output. This is about 10 to 20 W/m of cable. To be fully effective the underside of the screed should be completely insulated and thermostatic regulators set in the floor and the room.

Block heaters – these are rated between 1 kW and 6 kW and incorporate concrete blocks to absorb the off-peak energy (see next page).

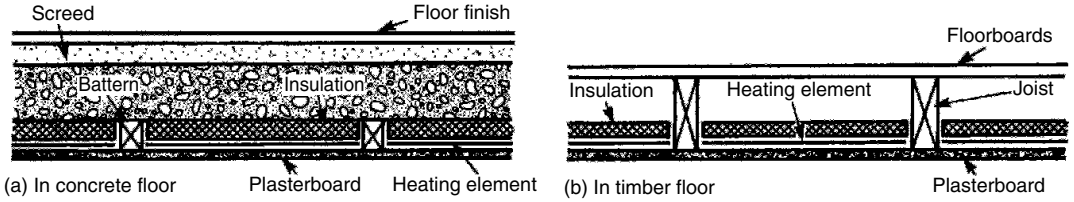


Section through solid ground floor with heating cables



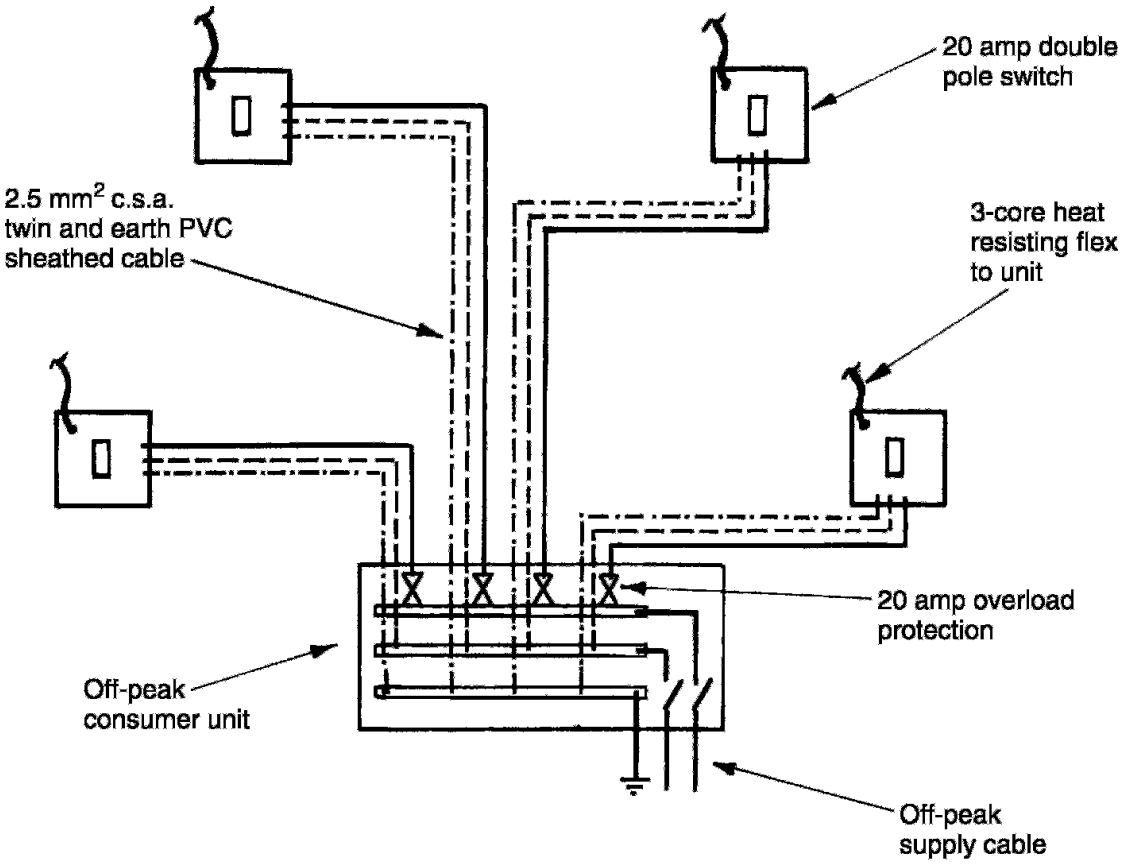
Block storage heater with fan

Electrically heated ceilings use standard tariff electricity supply. The heating element is flexible glasscloth with a conducting silicone elastomer.



Ceiling heating

Night storage heaters – these have developed from very bulky cabinets containing concrete blocks which effectively absorb the overnight electrical energy and dissipate it gradually during the next day. Improvements in storage block material have considerably reduced the size of these units to compare favourably with conventional hot water radiators. They contain a number of controls, including a manually set input thermostat on each heater, an internal thermostat to prevent overheating and a time programmed fan. Manufacturers provide design tables to establish unit size. As a rough guide, a modern house will require about 200 W output per square metre of floor area. Storage heaters are individually wired on radial circuits from the off-peak time controlled consumer unit.

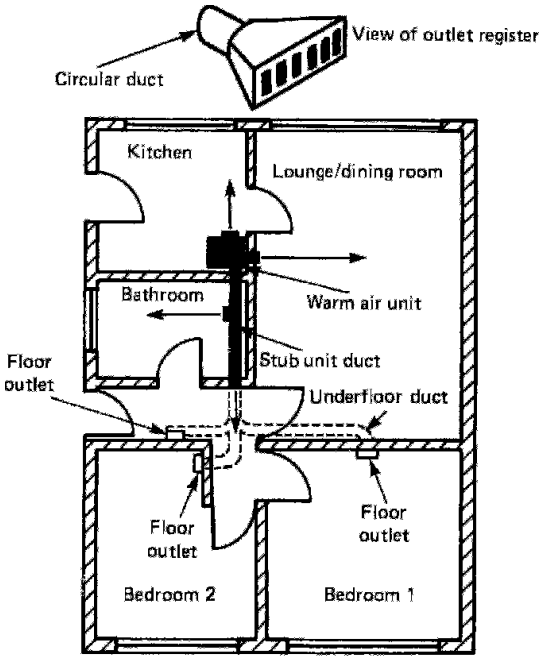


Radial supply to storage heaters

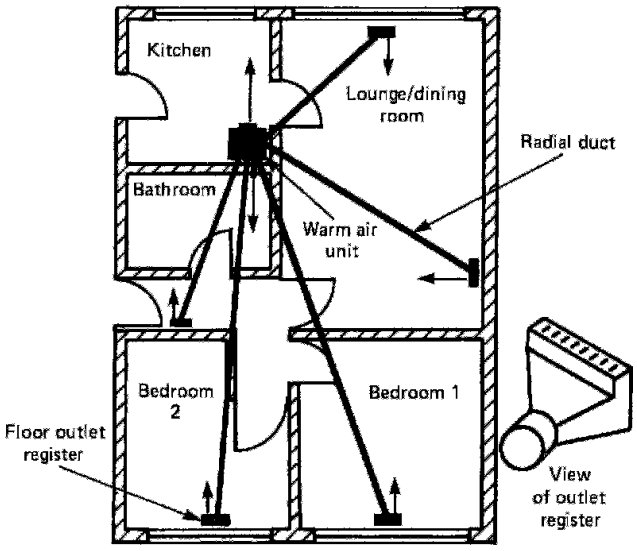
Electrically heated warm air systems are a development of the storage heater concept – see previous two pages. A central unit rated from 6 kW to 12 kW absorbs electrical energy off-peak and during the day delivers this by fan to various rooms through a system of insulated ducting. A room thermostat controls the fan to maintain the air temperature at the desired level. Air volume to individual rooms is controlled through an outlet register or diffuser.

Stub duct system – the unit is located centrally and warm air conveyed to rooms by short ducts with attached outlets.

Radial duct system – warm air from the unit is supplied through several radial ducts designated to specific rooms. Outlet registers are located at the periphery of rooms to create a balanced heat distribution.



Plan of a bungalow showing a 'stub' duct warm air system



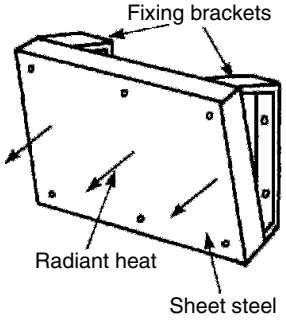
Plan of a bungalow showing a 'radial' duct warm air system

There are numerous types of independent heat emitters for use with 13 amp power sockets or fused spur sockets.

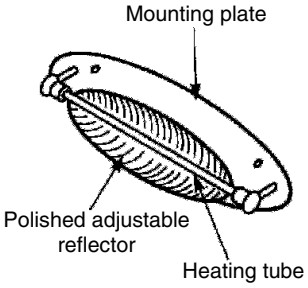
Panel heater – the heat output is mainly radiant from a surface operating temperature of between 204°C and 240°C. For safety reasons it is mounted at high level and may be guarded with a mesh screen.

Infra-red heater – contains an iconel-sheathed element or nickel chrome spiral element in a glass tube, backed by a curved reflector. May be used at high level in a bathroom and controlled with a string pull.

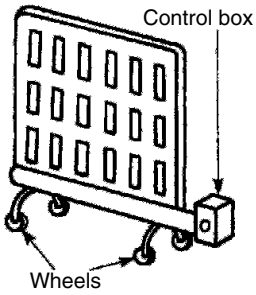
Oil-filled heater – similar in appearance to steel hot water radiators, they use oil as a heat absorbing medium from one or two electrical elements. Heat is emitted by radiant and convected energy. An integral thermostat allows for manual adjustment of output.



Wall-mounted radiant panel heater



Wall-mounted infra-red heater

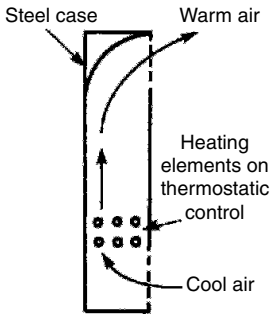


Oil-filled portable heater

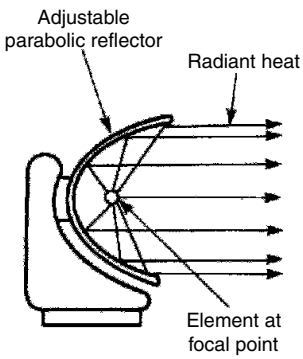
Convector heater – usually has two electrical elements with independent control to vary the output. May be used where a constant level of background warmth is required.

Parabolic reflector fire – has the heating element in the focal point to create efficient radiant heat output.

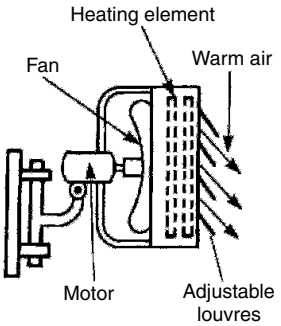
Wall-mounted fan heaters – usually provided with a two-speed fan to deliver air through a bank of electrical elements at varying velocities. Direction is determined by adjustable louvres.



Convector heater



Portable parabolic reflector fire



Wall-mounted fan heater

Controls vary from simple switches and sensors integrated with appliances, to overall system management programmed through time switches and optimisers:

- Manual charge control – set by the user to regulate energy input and output. The effect can be variable and unreliable as it does not take into account inconsistencies such as daily variations in temperature.

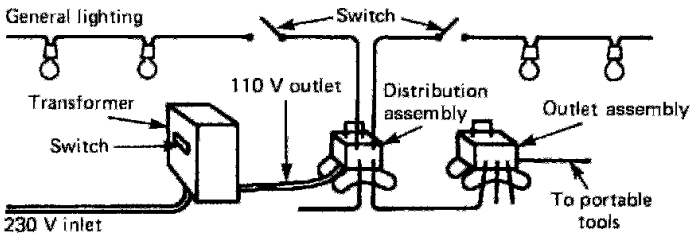
- Automatic charge control – sensors within the heater and room are pre-set to regulate the electrical input charge. When room temperature is high, the sensor in the heater reduces the energy input. Conversely, the energy input is increased when the room temperature is low.

- Heat output control – this is a damper within the heater casing. It can be adjusted manually to regulate heat emission and prevent a room overheating. A variable speed fan can be used to similar effect or to vary the amount of heat emission and its distribution.

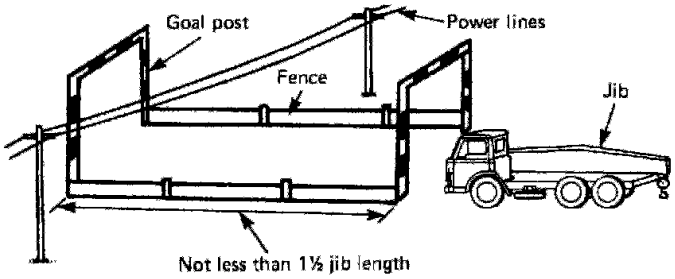
- Time switch/programmer and room thermostat – the simplest type of programmed automatic control applied individually to each heater or as a means of system or group control. Where applied to a system of several emitters, individual heaters should still have some means of manual or preferably automatic regulation. This type of programmed timing is also appropriate for use with direct acting thermostatically switched panel-type heaters.

- `CELECT-type' controls – this is a type of optimiser control which responds to pre-programmed times and settings, in addition to unknown external influences such as variations in the weather. Zones or rooms have sensors which relate room information to the controller or system manager, which in turn automatically adjusts individual storage heater charge periods and amount of energy input to suit the room criteria. This type of control can also be used for switching of panel heaters.

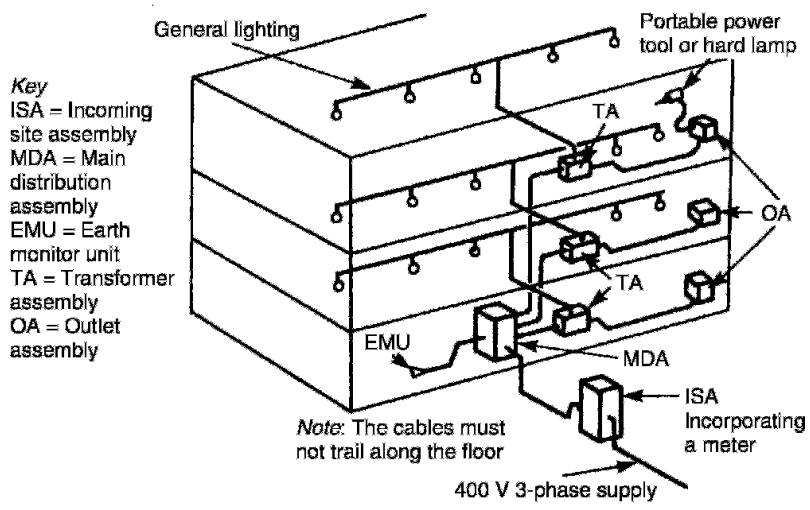
A temporary supply of electricity for construction work may be obtained from portable generators. This may be adequate for small sites but most developments will require a mains supply, possibly up to 400 volts in three phases for operating hoists and cranes. Application must be made in good time to the local electricity authority to ascertain the type of supply and the total load. The incoming metered supply provided by the electricity company will be housed in a temporary structure constructed to the authority's approval. Thereafter, site distribution and installation of reduced voltage transformers is undertaken by the developer's electrical contractor subject to the supply company's inspection and testing.



Reduced voltage distribution



Goal posts (or barrier fences) give protection against contact with overhead power lines



Typical arrangement of distribution units and equipment

Equipment:

Incoming site assembly (ISA) – provided by the local electricity supply company. It contains their switchgear, overload protection, transformers and meters for a 400 volt, three-phase supply at 300, 200 and 100 amps.

Main distribution assembly (MDA) – contains three-phase and single-phase distribution boards, overload protection and lockable switchgear. May be combined with the ISA to become an ISDA.

Transformer assembly (TA) – supplied from the MDA to transform voltage down to 110 V, 50 V and possibly 25 V for use in very damp situations.

Earth monitor unit (EMU) – used where mobile plant requires flexible cables at mains voltage. A very low-voltage current is conducted between plant and EMU and earth conductor, so that if this is interrupted by a fault a monitoring unit disconnects the supply.

Socket outlet assembly (SOA) – a 110 volt supply source at 32 amps with switchgear and miniature circuit breakers for up to eight 16 amp double pole sockets to portable tools.

Cable colour codes and corresponding operating voltage:

Colour	Voltage
Violet	25
White	50
Yellow	110
Blue	230
Red	400
Black	500/650

Refs: BS 4363: Specification for distribution assemblies for reduced low-voltage electricity supplies for construction and building sites.
BS 7375: Code of practice for distribution of electricity on construction and building sites.
BS EN 60439-4: Low-voltage switchgear and control assemblies. Particular requirements for assemblies for construction sites.