

MIRA'S GUIDE TO

# ELECTRIC SHOWERS



**mira**  
SHOWERS

# SHOWERING PERFECTION ONLINE

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This guide to electric shower installation has been produced by Kohler Mira Limited, the UK's longest-established and foremost supplier of showers for both domestic and business customers.

Its aim is to provide professional installers with a source of reference for essential information covering electrical and plumbing requirements for a wide range of electric shower designs, including 10.8kW models.

The first section concentrates on the design and installation of the electrical supply. It gives guidance on circuit design and installation in accordance with recommendations contained in the current edition of the IET Wiring Regulations (BS 7671).

This is supported by a detailed guide to plumbing system requirements. Compiled by the Customer Service Department at Kohler Mira, this explains the influence of supply pressures on shower performance, details pressure testing procedures, and advises on the selection of pipes and fittings.

Further sections deal with commissioning the unit, fault diagnosis and performance characteristics, siting the shower and the different types of shower enclosure available.

Obviously, installation requirements and testing procedures will vary from one manufacturer's model to another. In all cases, any specific instructions supplied by the manufacturer with the unit must be followed in full. Where a proposed installation raises particular questions not covered by this publication, the Customer Service Department at Kohler Mira will be pleased to provide further assistance.

This booklet is not intended to replace the IET Wiring Regulations, Building Regulations, Local Electricity Company Regulations, Local Water Bye-laws (Scotland), Water Regulations, Kohler Mira Limited will not be held responsible for any installation which does not comply with the Regulations. In the case of any doubt concerning an electric shower installation, the full text of the current Regulations should be consulted.

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### Introduction

Electrical installations in the UK and certain other countries overseas should be carried out in accordance with the current edition of BS 7671 'Requirements for Electrical Installations' published by the Institution of Engineering and Technology, commonly known as the IET Wiring Regulations.

BS 7671 is the national Standard for safety of electrical installations especially from electric shock, fire, burns and injury from mechanical movement of electrically actuated equipment. Installations complying with this Standard are deemed to satisfy the relevant requirements of the Electricity Safety, Quality and Continuity Regulations, Electricity Safety, Quality and Continuity Regulations (Northern Ireland) and the Building Standards (Scotland) Regulations.

The current requirements are contained in the current edition of the IET Wiring Regulations. Installers should be aware of, and take into account, all the requirements of the IET Wiring Regulations and any subsequent amendments.

The Regulations are not intended to take the place of a detailed specification or to instruct untrained persons or to provide for every circumstance. Regulation 134.2.1 states that;

"During erection and on completion of an installation or an addition or alteration to an installation, and before it is put into service, appropriate inspection and testing shall be carried out by an electrically competent person to verify that the requirements of this Standard have been met."

It is therefore recommended that all electrical installation work should be entrusted to a suitably qualified and competent electrical engineer enrolled with a certification body such as NICEIC.

The electrical installation may be subject to the requirements of Part P of the Building Regulations for England & Wales and may require notification the local authority building control.

### Design

Before commencing the design and erection of any electrical installation, however simple, an assessment of general characteristics must be made as indicated in Part 3 of the IET Wiring Regulations.

- i. **Maximum demand** - equal to the nominal rating of the unit.
- ii. **Number of live conductors** - single phase and neutral.
- iii. **Nominal voltage** - 230V.\*
- iv. **Nature of current and frequency** - A.C.; 50Hz
- v. **Type and rating of overcurrent device at origin** - up to 100A fuse to BS 1361 Part 2 or BS 88 Part 3.
- vi. **Circuit arrangements** - unit supplied by a radial circuit from a separate overcurrent device (a fuse or circuit-breaker normally forming part of a consumer unit).

**\*Note:** The standard voltage for electricity supply in the UK is now 230V +10% -6% (253V to 216V). As the previous standard voltage of 240V +6% effectively falls within this band, there is likely to be no significant change in existing supplies for some years.

The following characteristics need to be ascertained or determined for each installation:

- vii. **Type of earthing arrangement.**
- viii. **Prospective short-circuit current at origin.**
- ix. **Adequacy of the supply for the load.**
- x. **External earth fault loop impedance.**

These characteristics are considered in detail below.

### Type of Earthing Arrangement

The exposed conductive parts of electrical equipment (other than double-insulated equipment) are connected by means of protective conductors (or earth wires) to a main installation earthing terminal which, in turn, is connected by the earthing conductor to the means of earthing.

For most installations, the means of earthing is an earthing terminal provided by the District Network Operator (DNO) and connected either to the metal sheath of the supply cable or the continuous earth wire of an overhead supply (TN-S system) or to the neutral conductor (TN-C-S system) in accordance with the statutory requirements for protective multiple earthing of the neutral (PME).

Where the DNO is unable to provide an earthing terminal, the exposed metalwork of the installation must be connected to an independent earth electrode, such as a driven rod or buried plate (TT system). In this case the incoming electricity supply and where appropriate the individual circuit should be connected through a residual current device (RCD) as described under '**External earth loop impedance**'.

### Prospective Short-circuit Current

The prospective short-circuit current (PSCC) at the origin of the installation depends on the configuration of the supply network and the characteristics of the service line to the premises. Assessment of the PSCC is necessary to permit the selection of overcurrent protective devices having adequate fault-breaking capacity.

In general, for domestic installations, the PSCC at the origin of the installation is likely to be up to 16kA. However, it may vary across different regions depending on the length of the service line. An estimated value may be ascertained by contacting your local DNO.

If the overcurrent device selected for the installation is a cartridge fuse to BS 1361, BS 88 Part 2 or BS 88 Part 3, the breaking capacity is adequate for all normal conditions and no further assessment of PSCC is needed.

Where it is intended to use semi-enclosed (rewireable) fuses to BS 3036 or circuit-breakers to BS EN 60898, it must be ensured that their breaking capacity is not less than the PSCC at their point of installation.

For fuses to BS 3036, the breaking capacity is indicated by the following code:

S1A - 1 kA breaking capacity

S2A - 2kA breaking capacity

S4A - 4kA breaking capacity

For circuit-breakers, the breaking capacity is indicated by a number inside a rectangle, generally printed on the front of the device, for example, 6000 indicates that the circuit-breaker has a short-circuit breaking capacity of 6,000 amperes (6kA).

Many circuit-breakers intended for domestic and similar installations are rated at 6kA but it is now possible also to obtain MCBs rated at 16kA for use in installations where the PSCC is at that level.

### Adequacy of Supply

The normal capacity of the supply to modern domestic and similar premises is 100A. In many cases, this is adequate to supply a shower unit of 10.8kW (43A at 230 V) in addition to the normal requirements of the electrical installation when diversity is taken into account.

However, if this assessment indicates that there is insufficient spare capacity in the existing supply, it will be necessary to consult the DNO regarding the availability of an increased supply.

### External Earth Loop Impedance

The external earth loop impedance,  $Z_e$  may be determined by measurement, provided that a supply is available, but the measured value may change as a result of subsequent alterations to the supply network.

Where it is intended to use the DNO earthing terminal, the typical maximum values of  $Z_e$  that may be adopted for design purposes, are as follows:

Installations earthed to a PME or PNB earthing terminal  
(TN-C-S system) - 0.35 ohm.

Installation earthed by cable sheath or continuous earth wire  
(TN-S system) - 0.8 ohm.

If actual measurements indicate higher values, the DNO should be consulted before proceeding with the design.

Where the DNO does not provide an earthing terminal, thus necessitating an independent earth electrode (TT system) one or more residual current devices (RCDs) must be installed as stated in Regulation 411.5.2.

A separate RCD for a shower circuit must have a rated current not less than the current demand of the shower unit and should have a rated residual operating current of 30mA so as to afford additional protection as required by regulation 701.411.3.3. RCDs should comply with BS 4293, BS EN 61008 or BS EN 61009.

### Main Switchgear

Where the shower unit is being provided as part of a new installation, provision should be made in the consumer unit for a separate way for this purpose.

Where it is proposed to add a shower unit circuit to an existing installation, it is unlikely that a spare way will be available in the existing consumer unit in which case the following options are possible:

Replace the existing consumer unit by a new unit having additional ways.

Install a separate switch fuse or circuit-breaker together with suitable tails and a connector block for subsequent connection by the DNO.



### Circuit Design

As it is not practicable to consider in detail every possible combination of wiring system and current demand, the recommendations which follow relate specifically to shower units with the following loadings:

7.5kW, 8.5kW, 9.0kW, 9.5kW, 9.8kW, 10.8kW @ 240V

(6.9kW, 7.8kW, 8.3kW, 8.7kW, 9.0kW, 9.9kW @ 230V)

and one of the following wiring systems:

PVC-insulated and sheathed cables (twin & earth), either clipped direct to a surface or buried in non-thermally insulating plaster.

PVC-insulated single-core cables in steel or plastic conduit or trunking using a separate circuit protective conductor having a cross-sectional area equal to that of the phase conductor (referred to hereafter as 'conduit').

Each shower unit must be fed by a separate final circuit.

### Selection of Overcurrent Protective Device

An overcurrent device must be fitted at the origin of the final circuit to afford short circuit protection for the cables but it is not necessary to consider overload protection because the cables are not likely to have to carry overload current (see Regulation 433.3.1 (ii)).

It is recommended that the overcurrent device should be either a fuse to BS 1361 or BS 1361 or BS 88 Part 3, or a circuit-breaker to BS EN 60898. Alternatively, a general purpose fuse to BS 88 Parts 2 and 6 or a semi-enclosed (rewireable) fuse to BS 3036 may be selected but the use of the latter is not recommended because of inadequate short circuit capacity and the need for increased conductor size (see Regulation 433.1.3).

### Selection of Shock Protection Device

An overcurrent protective device may be selected to afford protection against electric shock provided that disconnection within 0.4 seconds can be assured for circuits where the protective device rating is no greater than 32A, or 5 seconds if the protective device is rated greater than 32A.

For an electrical installation that has a TT earthing arrangement, table 41.1 of the IET Wiring Regulations should be referred to.

Tables 41.2, 41.3 and 41.4 of the IET Wiring Regulations give the maximum values of earth loop impedance, at any point in an installation, which will allow sufficient fault current to flow so as to cause the fuse or circuit-breaker to operate within the specified time. Where the earth fault loop impedance exceeds the tabulated value for a particular device, it is not permissible to use that device for shock protection.

In that event, it is necessary either to select a different type of overcurrent device or to install a residual current circuit-breaker (RCD). The circuit impedance is then limited only by the need to avoid excessive voltage drop. As recommended above, the RCD should have a residual operating current of 30 mA or less.

### **Selection of Wiring System**

As explained under "Circuit Design" above, this publication deals with two wiring systems referred to as 'twin & earth' and 'conduit'. Other possible wiring systems include mineral-insulated cables or armoured cables for which reference should be made to the IET Wiring Regulations (BS 7671).

### **Minimum Cross-sectional Area**

To determine the minimum cross-sectional area (csa) of the cable required, it is necessary to take account of the following:

- i. Maximum current demand
- ii. Effective current-carrying capacity of conductors taking account of ambient temperature, bunching of circuits and presence of thermal insulation
- iii. Voltage drop
- iv. Disconnection time for protection against shock (fault protection).
- v. Avoidance of damage to insulation on the occurrence of a fault.

Details of the method for determining minimum csa are to be found in the IET Wiring Regulations; for the shower unit ratings and wiring systems covered in this publication, it is recommended that the minimum csa should be 6mm<sup>2</sup> under normal conditions of installation as explained under "Circuit Design" above. However for 8kW units and larger a minimum csa of 10mm<sup>2</sup> should be provided. However, for shower units rated higher than 8kW, it is recommended that the minimum csa should be 10mm<sup>2</sup> under normal conditions of installation. This approach will reduce the likelihood of having to upgrade the wiring should the shower unit be upgraded to one of a higher rating in the future.

To avoid the need to increase conductor size, the shower circuit should be separated from other circuits by at least twice the diameter of the cable or conduit and it should not be run through thermally-insulating material or in locations where the ambient temperature is likely to exceed 30°C.

If any of these conditions are unavoidable, it is necessary to carry out the full calculations.

### Length of Cable Runs

To avoid unnecessary power loss due to voltage drop, the length of run should be as short as possible. The following table demonstrates the effect of voltage drop.

Power at Nominal Voltage 240V	Power at 5 Volts drop	Power at 10 Volts drop
kW	kW	kW
7.5	7.2	6.9
8.5	8.2	7.8
9.0	8.6	8.3
9.5	9.1	8.7
9.8	9.4	9.0
10.8	10.4	9.9

It is also necessary to satisfy the disconnection time and thermal constraints which mean that, for any given combination of current demand, voltage drop and cable cross-sectional area; there is a maximum permissible length of circuit.

The following tables show the maximum lengths of run of 6mm<sup>2</sup> and 10mm<sup>2</sup> cables, both twin and earth and in conduit to feed shower heaters of:

7.5, 8.5, 9.0, 9.5, 9.8, 10.8kW rating at 230V 50Hz rms

Using:

- i. Shock protection afforded by a fuse or circuit-breaker (MCB)
- ii. Shock protection afforded by a residual current circuit-breaker (RCD) in addition to an overcurrent protective device (fuse or circuit-breaker)

For wiring in conduit, it is assumed that the protective conductor has the same cross-sectional area as the phase and neutral conductors, namely 6mm<sup>2</sup> or 10mm<sup>2</sup>. Where reduced protective conductors are used, the figures for twin & earth cables should be applied.

Where it is necessary to install circuits of greater length than those given, cables of a larger cross-sectional area must be selected.

## Cable Runs Where Shock Protection is Provided by a Fuse or Circuit-breaker

### Shower Unit: 7.5kW 6.0mm² cable†

Protective Device	TN-C-S		TN-S	
	Twin & Earth	Conduit	Twin & Earth	Conduit
40A Circuit-breaker Type B	m	m	m	m
40A Fuse BS 88-2	48	48	11	19
45A Fuse BS 88-3	48	48	26	45
45A Fuse BS 88-3	45	48	3	5

### Shower Unit: 7.5kW 10.0mm² cable†

Protective Device	TN-C-S		TN-S	
	Twin & Earth	Conduit	Twin & Earth	Conduit
40A Circuit-breaker Type B	m	m	m	m
40A Fuse BS 88-2	80	80	18	32
40A Fuse BS 88-2	80	80	43	76
45A Fuse BS 88-3	74	80	4	8

### Shower Unit: 8.5kW 10.0mm² cable†

Protective Device	TN-C-S		TN-S	
	Twin & Earth	Conduit	Twin & Earth	Conduit
40A Circuit-breaker Type B	m	m	m	m
40A Fuse BS 88-2	70	70	18	32
40A Fuse BS 88-2	70	70	43	70
45A Fuse BS 88-3	70	70	4	8

### Shower Unit: 9.0kW 10.0mm² cable†

Protective Device	TN-C-S		TN-S	
	Twin & Earth	Conduit	Twin & Earth	Conduit
40A Circuit-breaker Type B	m	m	m	m
40A Fuse BS 88-2	66	66	18	32
40A Fuse BS 88-2	66	66	43	66
45A Fuse BS 88-3	66	66	4	8

## Shower Unit: 9.5kW 10.0mm<sup>2</sup> cables†

Protective Device	TN-C-S		TN-S	
	Twin & Earth	Conduit	Twin & Earth	Conduit
50A Circuit-breaker Type B	m	m	m	m
50A Fuse BS 88-2	59	63	-	-
45A Fuse BS 88-3	63	63	4	8
	63	63	4	8

## Shower Unit: 9.8kW 10.0mm<sup>2</sup> cables†

Protective Device	TN-C-S		TN-S	
	Twin & Earth	Conduit	Twin & Earth	Conduit
50A Circuit-breaker Type B	m	m	m	m
50A Fuse BS 88-2	59	61	-	-
45A Fuse BS 88-3	61	61	4	8
	61	61	4	8

## Shower Unit: 10.8kW 10.0mm<sup>2</sup> cables†

Protective Device	TN-C-S		TN-S	
	Twin & Earth	Conduit	Twin & Earth	Conduit
50A Circuit-breaker Type B	m	m	m	m
50A Fuse BS 88-2	55	55	-	-
63A Fuse BS 88-3	55	55	4	8
	35	55	-	-

## Cable Runs Where Shock Protection is Provided by an RCD†

Shower Unit kW	Cable CSA mm <sup>2</sup>	Maximum length of cable
7.50	6.00	48
	10.00	80
8.50	10.00	70
9.00	10.00	66
9.50	10.00	63
9.80	10.00	61
10.80	10.00	55

**'The above values are based on a cable clipped direct to a surface, where a cable is to be run through a layer of thermal insulation it is recommended that additional design calculations are carried out'.**

**All electrical installation work should be entrusted to a suitably qualified and competent electrical engineer enrolled with a certification body such as NICEIC.**

### **Isolation and Switching**

A circuit supplying a shower unit must have a means of isolation to disconnect the unit from the electrical supply and a means of interrupting the full load current of the unit.

It is recommended that this should be achieved by an isolating switch located near the shower so that it is under the control of any person (e.g. electrician or plumber) who may have reason to dismantle the unit for maintenance or repair. If, for any reason, it is necessary to locate the isolating switch elsewhere, it must either be lockable in the 'off' position or have other means of preventing inadvertent reclosure.

The isolating switch should be a linked two-pole switch having a contact separation of at least 3mm when in the 'off' position. Additionally, either the contacts must be visible or the switch must provide reliable indication when the separating distance has been achieved.

This latter requirement implies a mechanical indicator rather than a neon lamp which cannot indicate the degree of separation.

### **Location of Switches**

Switches and other means of electrical control or adjustment, such as thermostat knobs and fuses, must be inaccessible to a person using the shower with the following exceptions;

Insulating cords of cord-operated switches (the actual switch is not exempt).

Controls of a shower unit.

Shaver units complying with BS EN 61558-2-5.

Switches of separated extra-low voltage circuits at a nominal voltage not exceeding 12V a.c. rms or 30 V ripple-free d.c.

### **Location of Equipment**

Electrical equipment is only permitted in the actual shower basin if it is proof against the ingress of water, to Degree of Protection IPX7 to BS EN 60529.

Any equipment which may be subjected to splashing within the shower area, and in an area up to 600mm around the shower basin, up to a height of 2.25m from the floor must be of suitable corrosion-resistant construction and be proof against the ingress of water, to Degree of Protection IPX4 to BS EN 60529. In a shower area which could be subject to washing down using hoses, such as a shower area in a football or cricket pavilion wash room, this requirements is increased to IPX5.

Similar requirements apply to bathrooms; when a shower is installed in an existing bathroom, it must be ensured that the requirements in respect of the bathroom are not thereby impaired.

Socket outlets are not recommended in shower rooms or bathrooms, however in larger bathrooms they are permitted providing that they are located at least 3m horizontally from the perimeter of the bath or shower cubicle and is protected by a 30mA RCD.

Similarly, it must be ensured that any lamp holders within reach of the shower cubicle are constructed of, or shrouded in, insulating material and preferably be totally enclosed luminaires to Degree of Protection IPX4 to BS EN 60529.

### **Earthing and Bonding**

Where a shower unit is installed as part of a new electrical installation for the premises, earthing and bonding should be effected in accordance with the IET Wiring Regulations which contain particular requirements for local supplementary bonding in bathrooms and shower rooms.

Where a shower unit is to be installed in a house or other premises having an existing electrical installation to an earlier Edition of the Regulations, the following items should be checked and, if necessary, altered as indicated:

#### **a) Main earthing conductor**

The main earthing conductor from the main installation earthing terminal to the DNO earthing terminal (TN-S or TN-C-S system) should have a csa of at least 16mm<sup>2</sup>.

For the connection of an independent earth electrode (TT system) where shock protection is afforded by an RCD, the earthing conductor may have a minimum csa of 2.5mm<sup>2</sup> provided that, where buried in the ground, it is sheathed for protection against corrosion and protected against mechanical damage. For other conditions of installation, refer to Table 54.1 of the IET Wiring Regulations.

#### **(b) Main bonding conductors**

Main bonding conductors are required from the main earthing terminal to all incoming metallic services (e.g. water, gas and oil) other than telecommunications and to accessible structural steelwork, if any.

The minimum csa depends on the system:

TN-S or TT system - Not less than half the csa of the main earthing conductor (minimum csa 6mm<sup>2</sup>).

TN-C-S system - 10mm<sup>2</sup> where the csa of the supply neutral conductor is 35mm<sup>2</sup> or less. For larger supply neutral conductors, refer to Table 54.8 of the IET Wiring Regulations.

### (c) **Supplementary bonding**

Local supplementary bonding conductors of at least 4mm<sup>2</sup> if not mechanically protected (2.5mm<sup>2</sup> if mechanically protected) are required in a bathroom or shower room, to connect together all simultaneously accessible exposed conductive parts of electrical equipment and extraneous-conductive-parts that are likely to introduce earth potential.

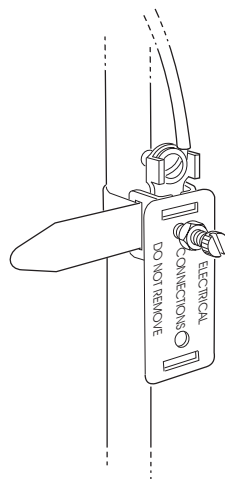
Extraneous-conductive-parts may include the following;

- Metal baths
- Taps
- Exposed metal pipes for hot or cold water
- Exposed metal waste pipes
- Centrally heated radiators and towel rails
- Exposed central heating pipework

Where it can be ensured that the above items have an effective electrical contact with their pipework under the floor of the room it is acceptable to make the bonding connections in that location, provided that the points of connection are accessible for inspection by the removal of a 'trap', or short section of floorboard, secured with screws.

Bonding connections to pipes should be made using clamps complying with BS951 (as illustrated on the right).

Where the main water, gas or oil supplies to the property enter in the room containing a bath or a shower then they are required to be bonded as described in b) above. This includes metallic waste and soil pipes entering the room which are in direct contact with the ground.





### **RCD Protection in a Room Containing a Bath or a Shower**

Since 2008 the IET Wiring Regulations have had an additional requirement that all electrical circuits in a room containing a bath or a shower should be additionally protected by one or more RCD's. It is permissible to omit the supplementary bonding in such a location providing all the following have been achieved for the location:

- disconnection of circuits within the required time as set by the IET Wiring Regulations has been achieved
- all circuits are protected by one or more RCD's
- main bonding as referred to in the previous paragraph has been achieved where required.

## Introduction

Plumbing installations in the UK must comply with the requirements of the UK Water Regulations/Bye-laws (Scotland), Building Regulations or any particular regulations and practices, specified by the local water company or water undertakers. In order to ensure that the best possible performance is obtained from an instantaneous electric shower, it is important to appreciate the effect of variables on the showering temperature and flow rate.

These variables, listed below, are considered in the text, which follows:

- i. Flow rate of the shower
- ii. Water pressure of the incoming supply
- iii. Water temperature of incoming supply
- iv. Showering temperature of water
- v. Voltage of incoming supply

## Supplies

Instantaneous electric showers are either fed by:

- (a) a mains water supply with a maintained pressure above the minimum for the product, or
- (b) a dedicated cistern or independent distributing pipe for products with an integral pump.

For (a) to comply with the backflow prevention requirements of Water Regulations, every fitting shall be installed in such a manner as to prevent backflow of fluid from the appliance. Mira provide a hose retaining ring, which, if fitted according to the installation instructions will meet the requirements. However, there will be occasions when the hose retaining ring will not provide a suitable solution. In these instances an outlet double check valve or equivalent device must be fitted. Check valves, single or double, should not be fitted in the supply to the appliance as this can cause a pressure build up when water warms from cool outside temperatures. In such cases, provision must be made to accommodate the expansion.

For (b) no additional measures are required.

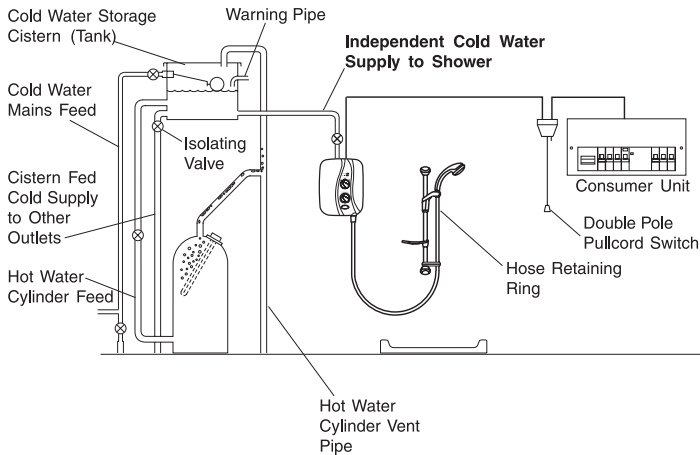
When installed in very hard water areas (above 200 ppm temporary hardness) the installation of a water treatment device, to reduce limescale problems, is recommended.

The local Water Company will be able to advise the hardness of water in the area.

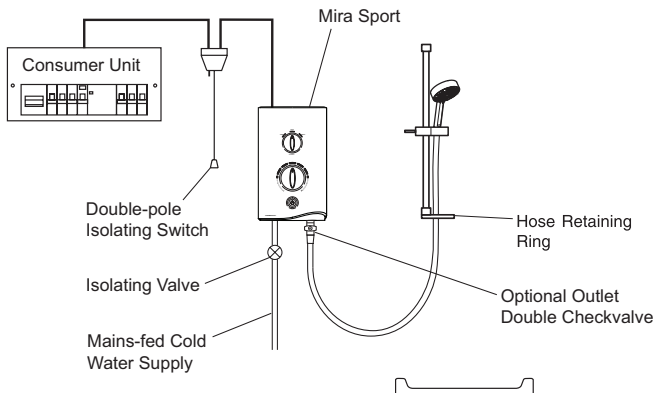
Supply pipes are normally 15 mm copper but increasing use is made of plastic pipe. Where the incoming mains water pressure is well above the appliance's minimum requirements, 10 mm flexible microbore pipe can be used (see **Pressure requirements**).

### Plumbing and Electrical Schematic Diagrams

#### Mira Elite - Cistern Fed Instantaneous Electric Shower

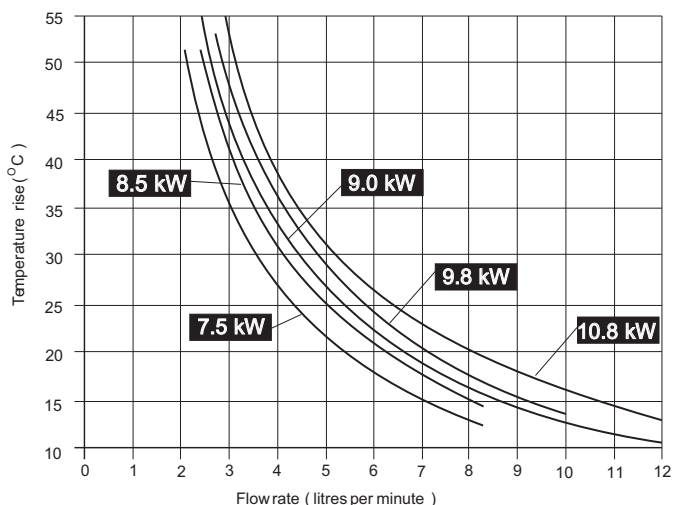


#### Mira Sport - Mains Fed Instantaneous Electric Shower



### Flow Rates

The flow rate of an electric shower, and therefore the force of the spray, at showering temperature can be determined from the accompanying graph. It can be seen that the flow rate at a typical showering temperature of around 41°C, from a heater of given power output, is determined by the temperature of the incoming water supply. Showering temperature flow rates during summer months are therefore substantially higher than in winter when a greater water temperature rise is required. Mains electrical voltages in the winter are likely to be lower than the summer especially at periods of peak demand. A lower mains voltage results in a lower shower flow rate.



- i. These curves are for the specified outputs at 240V
- ii. All heaters have a manufacturing tolerance. Thus flow rates can be above or below those indicated
- iii. The left-hand scale is temperature rise

**Example:** For a Mira Sport 9.0kW on full power setting with incoming water supply at 10°C, to achieve a showering temperature of 42°C (a temperature rise of 32°C), the flow rate will be 4 l/min.

### Pressure Requirements

The manufacturer's specification supplied with each unit should state the required minimum maintained pressure and maximum static pressure. Pressures are those present at the inlet to the appliance either whilst running (maintained) or in the off state (static). A nearby tap, connected to the same proposed feed pipe as the appliance can be used to measure the static pressure. No other fitting should be in use at this time.

Water pressures, like supply voltages vary throughout the day, naturally being lowest at a period of peak demand. Thus, although a pressure may be suitable at the time of measurement, this could subsequently drop below the minimum required by the appliance, and the performance of the appliance may be degraded. The maintained pressure should therefore ideally be checked at a time of peak demand.

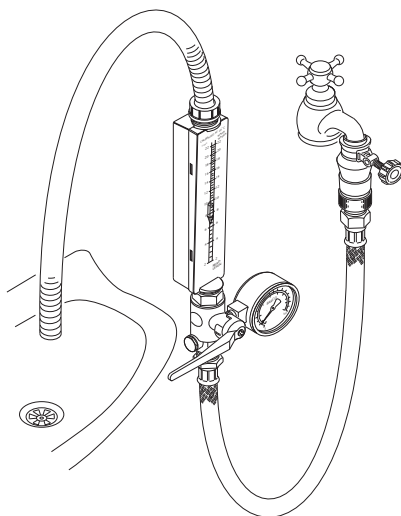
A rough idea of the pressure drop caused by another fitting on the same feed pipe being turned on when the proposed shower is in use, can also be obtained.

It may also be necessary to consider the effect of pressure drop where several properties have a communal supply.

Flow regulators can be fitted to taps and float valves to reduce the maximum demand and this results in a higher maintained system pressure under times of peak demand.

The figure overleaf gives a basic idea of a pressure measuring device which can easily be assembled from proprietary parts to measure static pressure, running pressure and pressure drop:

- i. **To measure static pressure:** Connect the pressure gauge to a tap on the same feed at the same level as the proposed draw off. Turn on the tap and measure the static (no flow) pressure.
- ii. **To measure maintained pressure:** With the pressure gauge fitted as above, turn on an adjacent outlet and set a flow of about 8 l/min. (Typical maximum flow of an electric shower in the summer). Measure the pressure. This is the maintained pressure, which can also be called, running, dynamic, flow, system pressure.
- iii. **To measure pressure drop:** The pressure drop is the difference between the two pressures. As an additional measure, increase the flow to 16 l/min. to simulate a W/C being flushed, and again work out the pressure drops. The maintained pressure must always be above the minimum for the product that is intended to be installed.



Most showers have a recommended maximum static pressure of 10 bar and it is rare for this pressure to be exceeded for any length of time. If necessary a droptight pressure reducing valve can be fitted after the inlet stop valve to the property and must be sized for the necessary draw-off rate.

The inclusion of a device that prevents the expansion of water back into the main, e.g. check valve, loose jumpered stop tap, frozen pipe may lead to the build up of excessive pressures. Properties fitted with water meters are all fitted with check valves.

To guard against such over-pressurisation the use of a mini expansion vessel, typically sized at 0.16 litres, is recommended. As with any vessel under pressure they require annual checking and if necessary recharged to the specified value on the label.

Where the supply pressure is well above the minimum requirement for the appliance, the supply pipe for convenience or ease of installation can be 10 mm microbore. If, however, the maintained pressure is likely to drop to near the minimum recommended for the heater then the pressure loss due to friction in the pipe should be taken into account. For example, for flow rates of 4 l/min, the average for a 9.0 kW heater, the pressure loss per metre of 10 mm pipe is 0.02 bar. If a 3 m length is used the total loss will thus be 0.06 bar, equivalent to 0.6 m head of water. The velocity of water along the pipe is a modest 1.3 metres per second, well below the maximum recommended of 2.5 metres per second for copper pipe; above which unacceptable noise levels may result. Where the supply pressure is insufficient a cistern fed pump can be used.

Most instant electric heaters incorporate a means of compensation for the variations in mains supply pressures to achieve an even flow and thus a stable showering temperature. The device used may be one of the following:

- i. Flow regulator
- ii. Pressure reducing valve
- iii. Fully modulating solenoid valve to accurately control the flow as in the Mira Advance ATL

Instantaneous electric showers should be fitted with a pressure relief device or some no less effective device. This is a built-in safety feature to prevent excessive heater tank pressures, which could be caused by either freezing or a blocked outlet pipe. If a unit is suspected of being frozen it must not be used and must be allowed to thaw before use.

The regulator regulates the flow of water using a soft rubber 'O' ring that fits over a tapered insert. The water flow squeezes the ring onto the taper and so reduces the hole size, thus reducing and regulating the flow rate. It is not too affected by a back pressure change, e.g. raising or lowering the handset, and requires higher pressures than other devices to make it work effectively. The regulator can suffer from hysteresis, i.e. it does not always return to the same flow after a pressure fluctuation, resulting in a slight change in the shower temperature.

The pressure reducing valve keeps a constant flow by the action of a spring on a diaphragm. It is affected by back pressure, but recovers well after supply pressure changes.

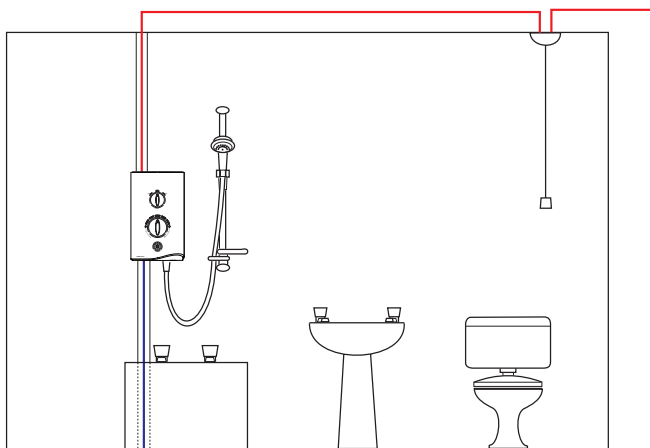
Modulating solenoid valve keeps a constant showering temperature by varying the flow rate of water to accommodate changes in:

- iv. The supply pressure
- v. The supply temperature of cold water
- vi. The mains electrical voltage.

This is achieved by measuring the flow rate, incoming and outgoing temperatures of the water and computing the correct flow rate for the conditions.

### Pipework

The pipework can be taken from the rising main supply at low level to the showering area or from the loft space and dropped down to the shower. The pipe must be insulated in the loft to prevent freezing during winter months. For aesthetic reasons the exposed pipework in the bathroom can be fitted in electrical type mini trunking. If the water supply rises to the shower heater and the electric supply cable drops from the ceiling or vice versa, a length of mini trunking from ceiling to floor can be placed to the most suitable side of the unit and the two services brought to the shower unit. Alternatively the wall can be chased out and the pipe suitably recessed. Mark its position so that any fixing screws do not pierce it when the unit is fitted.



Ideally, an isolation tap or ball valve should be fitted in a convenient position in the supply pipe to allow the heater to be serviced, if necessary, at a later date.

Pipe connections can be made by:

- (a) Compression fitting, generally the easiest
- (b) Soldered fittings incorporating a solder ring.

**Note!** The connection to the product **MUST NOT** be soldered.

- (c) End feed fittings
- (d) Brass or plastic 'push-fit' connectors

The feed pipe can be either copper or plastic, with the associated fittings. When using soldered or end feed fittings near the heater, extra care should be taken to avoid damage by the blow torch.

All pipework must be flushed out to remove debris before the unit is connected.



### Commissioning Procedure

The commissioning procedure will vary depending upon the make and model of instantaneous electric shower installed. The manufacturer's Installation and User Guide should be followed.

The purpose of commissioning is to:

- Perform the correct filling and initial start up of the product.
- Perform some tests to ensure that the product is operating correctly.

Some products can be operated with a cold flow of water without being connected to an electrical supply. This feature allows the two installer trades to operate independently with the plumber initially fitting and testing the product for leaks.

A typical commissioning procedure could be:

- To operate the shower on full cold to fill the heater tank without energising the heater elements. The purpose of this is to prevent the appliance from being operated dry. The operation of the flow regulator often labelled as the temperature control should produce a variation in the flow rate.
- To operate in turn the power selector switches and check for an incremental rise in the output temperature. This checks the operation of the heating elements.
- If appropriate, the operation of the thermal switch can be checked by turning the temperature control to full hot with full power on. With a low powered product and a cold incoming water supply the temperature rise may not be sufficient to test this feature.

### Fault Finding

With such a wide range of heaters available, only a general fault finding guide can be given. Most manufacturers supply fault finding guidance with each shower unit, which should allow the installer to find and rectify any fault.

The following extracts relate, in general, to the majority of instantaneous electric showers.

For specific information the product's Installation and User Guide should be followed, including the Safety Information

## Plumbing Requirements

Malfunction	Cause & Remedy
No change in water temperature between high and low settings (manual switch type)	Low/high switch faulty – check continuity Heating element open circuit – check
Unit fails to operate in any switch position	Supply fuse or miniature circuit breaker (MCB) tripped – replace or reset Residual current device off – reset Water pressure too low Double pole switch (wall or ceiling mounted) off On/off microswitch faulty – check continuity
Power and water reaching heater but no warm water in low heat position	High/low switch faulty – check continuity Pressure switch microswitch faulty – check continuity Element faulty – check continuity
Warm water only on high setting	Check continuity of elements
Very low flow rate from handset	Spray plates blocked – remove and clean Cold water pressure too low Inlet filter blocked – remove and clean
Temperature regulating knob has little or no effect	Regulator not operating – clean and replace or fit new unit
Unit fails to shut off in STOP/OFF position	Solenoid valve faulty On/off microswitch faulty
Some shower units may not be fitted with some of the above mentioned devices and as such, the chart can only be taken as a guide.	

### **Shower Installations and Accessories**

Showering offers a refreshing, economical and time-saving addition to the bathing facilities in any household. For these benefits to be enjoyed to the full, customers should be given clear guidance on the range of options open to them in siting the shower unit.

The most fundamental decision will be the choice between installing the unit over-the bath, or in a separate shower enclosure or cubicle. Both have their respective merits and disadvantages; generally, over-the-bath installations will be the least expensive, whilst shower cubicles will almost certainly give the greatest flexibility in use.

#### **Over-the-bath installations**

An instant electric shower calls for connection to mains water and electricity supplies, together with suitable drainage to the soil waste system. With over-the-bath installations two of these requirements can be met at minimum cost; drainage is provided via the existing bath waste (the bath doubling as a shower tray), and access to the rising cold mains water supply is almost certain to be close by.

The major drawback with this approach is that the shower installation does not allow both the bath and shower to be used at the same time, and makes no contribution to increasing the bathing facilities. Since it offers the most economical installation, many people opt for an over-the-bath installation for their 'first' shower. In small 'starter' homes, this may also represent the only option.

#### **Practical Considerations**

In an over-the-bath installation, the location of the shower unit will be influenced by the positioning of the bath and by the general bathroom layout.

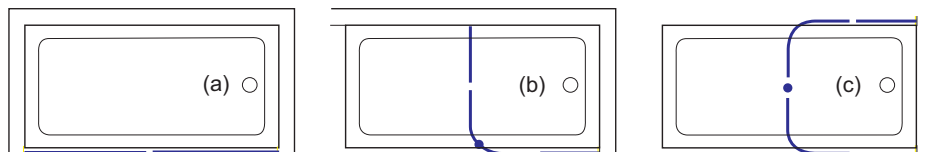
In most bathrooms, the bath will be fitted into a corner or it may be enclosed on three sides.

In these cases a waterproof shower enclosure can simply be provided by the use of shower curtaining or screening (see overleaf).

Where the bath is 'walled' on three sides (a), a straight curtain or screen can be installed to enclose the full bath area.

If only two sides are enclosed by walls (b), 'L shaped curtaining or screening can be used to enclose a small showering area at one end of the bath, or the complete bath. Shower screens or enclosures must comply with EN 14428.

Where the bath is fitted against a single wall (c), or is freestanding, more extensive curtaining/screening and rail systems are available which meet virtually every requirement.



### Waterproofing

Existing walls enclosed by the showering area must be made completely waterproof using waterproof paints or tiling. Tiles should be fitted using waterproof grouting. It is also vitally important to ensure an effective seal between bath sides and walls or screens. Acrylic baths may require increased support to prevent distortion rupturing any sealing arrangements.

### Locating the Shower Unit

It is generally most convenient to site the shower at the tap end of the bath, but if this is below a window, then the shower can be installed at the other end. Since showers are very convenient for hairwashing, the unit could be positioned so that the handset can also be used at the washbasin, but this requires additional back flow protection such as an outlet double check valve. Methods of fixing and positioning of the shower heater will vary from model to model, and in all cases individual manufacturers' recommendations should be followed. In general, mount the heater unit closest to the open side of the bath, so that the unit can be turned on without the user being sprayed.

### Concealing Supplies

Concealed water and electrical supplies give a much more attractive installation, and ease cleaning problems. In many cases, the end wall of the bath will also be the wall of an airing cupboard, and will be timber studding with plasterboard surface. This allows supplies to be easily concealed within the airing cupboard. Even where this is not the case, it is quite simple to construct a 'false' stud wall at one end of the bath to conceal water and electrical supplies.

Alternatively supplies can be chased into the plaster, in trunking, or enclosed in surface mounted plastic trunking. If an exposed mains water supply is used, stainless steel pipes give an attractive finish to the installation.

### Fitting Accessories

Most electric shower units are supplied with a slide bar mounted handset and flexible hose. This offers the greatest flexibility in use, and is fully adjustable for height, spray direction and spray angle. It should be mounted adjacent to the heater unit, close to the centre line of the showering area. Height will depend on the range of adjustment and on the height of the users. For someone 1.83 m tall, for example, the spray head should be at least 1.75 m from the bottom of the bath to allow for a shoulder height shower - higher for a full length shower.

Other designs of shower spray include wall mounted handsets with a flexible hose, and fixed position spray heads. Where these are used, follow the manufacturers' instructions carefully with regard to fixing height.

### Fixings

Both the appliance and accessories should be firmly fixed to the wall. Fixings are often supplied for solid walls but these may not be suitable for other applications, for example dry lined structures. There is now a wide range of fixings available to suit different structures and the most appropriate should be selected to provide a firm fixing.

### Separate Installations

Although separate shower enclosures or cubicles may represent a more expensive installation, they effectively double the household's bathing capacity, allowing both bath and shower to be used at the same time. In larger bathrooms they can take advantage of the close proximity of existing water supply and waste pipes.

Where this is not possible, the small space required by a separate enclosure or cubicle - typically a 0.76 m<sup>2</sup> floor area by 1.83 m in height - means that it can be installed virtually anywhere. They can for example, be incorporated ensuite in a bedroom, in a corner on a landing, in a utility room, or in a disused larder. In larger master bedrooms, a 1 m wide strip can be partitioned off at one end to enclose a shower, washbasin and WC. In each case the major consideration will be the ease and cost of providing suitable drainage and supplies.

For minimal installation costs, look for an alcove or cupboard that will provide three ready-made enclosure sides, but large enough to accept a proprietary shower tray, or consider a 'quadrant' design of cubicle for a corner site.

The shower should be fixed to a side wall of the enclosure so that the spray projects parallel to the entrance and not towards it.

### Shower Trays

These are generally constructed of acrylic plastic, resinstone (Mira shower trays) glazed ceramics and enamelled steel. The first two are the most popular, with the Acrylic designs needing support to prevent distortion. Resinstone, although heavier is very rigid and has upstands that can be tiled over to eliminate leakage from between the shower tray and the wall. Ceramic trays are extremely durable, but heavy. Sizes are typically 0.6 - 0.9 m square, with the larger sizes providing more 'elbow room' and greater convenience in use.

### Drainage

Shower trays must be fitted with a waste trap connected to the soil drainage system in accordance with relevant Building Regulations.

Since the waste trap may become blocked, or joints may develop a leak at some stage, it is very important that access is provided for maintenance and repair. The simplest answer where the tray design does not allow for it, is to raise the shower tray 0.15 m above the floor level on timber supports, designed to give access to the trap via concealed side panels. For a neat appearance, side panels can be tiled to match the shower installation. Recent designs of some waste traps allow them to be cleaned by removing a cartridge from the top side of the waste trap.

### Walls

Where existing walls form part of the shower enclosure, they must be covered with a waterproof laminate or tiling to a height of at least 1.83 m from the base. Waterproof adhesives should be used throughout, and all joints must be effectively sealed with flexible sealant; tiles requiring waterproof grouting. The joints between walls and shower tray must be totally watertight to prevent moisture penetration.

### Screens

These can be custom built, or purchased as ready-made screens, as two-sided or three-sided units or as complete cubicles. Construction methods and materials vary enormously, but beware of 'flimsy' structures that are likely to flex excessively in use. Shower screens and enclosures must comply with EN 14428, and if being custom made, glass used must comply with EN 12150. If a high powered electric shower is to be used then the enclosure should be capable of handling higher water flow rates without leakage. Screens for pumped shower systems (Power showers) are suitable for this. The Mira range of shower screens cover these needs.

### Avoiding Condensation Problems

Where showers are not installed in such 'wet' environments as the bathroom, condensation can prove a very real problem. In ensuite installations in bedrooms, it is therefore very important to contain the moisture vapour generated by the shower by using a fully enclosed cubicle. It may also be advisable to install an extractor fan. It can be electrically linked to a suitable shower enclosure light. Some contain a timer and this has the benefit of running on for a pre-set period, typically up to 30 minutes, to remove excess humidity. Additionally a humidity sensor can be linked to the fan for additional ventilation.

### Pumps

Where there is insufficient or unreliable mains water pressure to operate the appliance then the resolution can be:

- A pumped gravity system may be used to supply the shower providing the minimum required water pressures can be maintained.
- To fit an integrally pumped appliance, for example, the Mira Elite ST. The cistern should have a capacity of at least 120 litres where the cistern supplies water to other draw offs (hot or cold), to reduce the risk of running out of water. In the case of a dedicated cistern a much smaller capacity is desirable to limit deterioration of the water quality.

### Showers for the Disabled and Infirm

For many physically disabled people, or the elderly or infirm, showering can be both simpler and safer than bathing. For these categories of user, safety provisions and ease of use become the prime considerations.

In these circumstances the fitting of a thermostatic mixing valve with maximum temperature stop or the thermostatic Mira Advance ATL is recommended for the best protection against accidental misunderstanding or misuse. The Mira Advance ATL features as standard, a safe 'maximum temperature' setting, but also benefits from a special feature allowing the maximum shower temperature to be limited to temperature ranging between 37°C - 48°C. It has push button operation and is available with lever temperature control.

Anyone who may have difficulty understanding or operating the controls of any shower should be attended whilst showering. Particular consideration should be given to the young, the elderly, the infirm or anyone inexperienced in the correct operation of the controls.

From a shower performance viewpoint, it is essential that only electric shower designs with effective temperature stabilisation are used. If temperatures rise unexpectedly the user may find it difficult to respond quickly by adjusting the shower unit, or moving out of the spray area. Of equal importance are shower controls that can easily be gripped and operated by hands that are frail, or affected by muscular conditions such as arthritis.

The installation itself can be tailored to meet specific needs, but in general it should incorporate a non-slip floor and a number of conveniently placed grab rails. Fold-down wall-mounted shower seats are also available. For wheelchair users there is an extensive range of specialist equipment, and guidance on both equipment and shower area design can be obtained from the Local Authority. They will also advise on any grant support that may be available.



## Measurement Conversions

Feet	Metres or Feet	Metres	Gallons	Litres or Gallons	Litres
3.28	1	0.305	0.22	1	4.55
6.56	2	0.610	0.44	2	9.09
9.84	3	0.914	0.66	3	13.64
13.12	4	1.219	0.88	4	18.18
16.41	5	1.524	1.10	5	22.73
19.69	6	1.829	1.32	6	27.28
22.97	7	2.134	1.54	7	31.82
26.25	8	2.438	1.76	8	36.37
29.53	9	2.743	1.98	9	40.91
32.81	10	3.048	2.20	10	45.46

## Temperature Conversions

Farenheit to Centigrade

Centigrade to Farenheit

$$^{\circ}\text{C} = 5/9 \times (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{F} = (9/5 \times ^{\circ}\text{C}) + 32$$

## Pressure Equivalents

0.1 bar is equivalent to 1 metre head

1 bar = 14.5 psi - 100 kPa

1 bar = 33 feet head = 1kg/cm<sup>2</sup>

## Showering Costs

Costs per shower = Appliance rating (kW) x usage time (hours) x cost of electricity

### Example:

10.8 kW shower used for 5 minutes with a 16p tariff =  $10.8 \times 5/60 \times 16 = 14.4\text{p}$

10.8 kW shower used for 5 minutes with a 7p tariff =  $10.8 \times 5/60 \times 7 = 6.3\text{p}$

7.5 kW shower used for 10 minutes with a 16p tariff =  $7.5 \times 10/60 \times 16 = 20\text{p}$

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Kohler Co. is one of the world leaders in bathroom design, setting the standard for innovation, craftsmanship and new technology across the globe since 1873.

Kohler in the UK encompasses its market leading domestic brands - KOHLER®, MIRA® and RADA®, offering an inspirational collection of bathroom sanitaryware, bathroom furniture, taps, showers and shower enclosures.

- Mira, established in 1921, we have been leading the way in UK showering for decades. In 1937 we introduced the world's first ever thermostatic shower, designed specifically for hospitals and schools. Mira mixer valves quickly became the standard equipment for the shower market and in 1959 we unveiled the first thermostatic shower for domestic use. Ever since then our showers have remained firm favourites with households across the UK.
- Rada controls, the commercial sector of Mira, manufacture mixer valves, washroom products, electronic products, shower fittings and accessories suitable for Health Care, Commercial and Industrial applications.
- Designer bathroom suites from Kohler UK span contemporary and traditional styles with a wide range of sinks and washbasins, taps, showers and shower enclosures, bathroom accessories and bathroom furniture, fitted and freestanding. The collection includes decorated and handcrafted bathroom sinks and washbasins, which can be pedestal-mounted, furniture-mounted or wall-hung. Also, monobloc taps and wall-mounted taps as well as back-to-wall WCs and wall-hung toilets and bidets. In addition, we offer everything for the spa bathroom: whirlpool spa baths and bath tubs with hydrotherapy and chromatherapy.

For more information about our range of products, or to register your guarantee, download additional user guides, diagnose faults, purchase our full range of accessories and popular spares, refer to our FAQ's and request a service visit please call us or visit the Web sites below.

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## IMPORTANT INFORMATION

We recommend that you should read the Installation and User Guide (IUG) supplied with each product before installing it. If you are in any doubt, give our customer services team a call on 0844 571 5000 (UK & NI) or 01 531 9337 (ROI).

We are constantly looking to improve our products wherever we can, so we reserve the right to make product changes without prior notice.

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