Design of an Electrical Installation

Stationary and Movable equipment

Stationary equipment: One can assume that these appliances are fixed. Even if they are replaced in the future, they will be replaced with a similar appliance. Examples include oven, dishwasher, waste disposal units, water heaters, etc.

Movable or portable equipment: They may be connected to any socket outlet and therefore not considered when calculating the design current. Instead, the socket circuits are considered. Remember, during the life span of the electrical installation (house), these appliances will change, and more sophisticated appliances may come into the market.

Socket outlet circuits

A single 30 A or 32 A ring circuit may serve a floor area of up to 100 m^2. Socket outlets for washing machines, tumble dryers, and dishwashers should be located so as to provide reasonable sharing of the load in each leg of the ring, or consideration should be given to separate circuits.

The following table gives socket outlet circuits as defined in Appendix 15 of BS 7671: 2018: IET wiring regulations.

Type of circuit	MCB rating (A)	L & N conductor cross sectional area (mm^2)	Maximum floor area served (m^2)
Ring	30 or 32	2.5	100
Radial	30 or 32	4.0	75
Radial	20	2.5	50

Design current

When obtaining the design current of a standard socket outlet circuit, the IET wiring regulations say 100% of the current demand of the largest point of utilisation plus 40% of the current demand of every other point of utilisation. In the UK, the appliances used are heavy, and for them, 40% is reasonable. In Sri Lanka, designers take 10%, not 40%.

For example, if there are six 13 A plug sockets,

The design current = 13 + (6-1) x 13 x 0.1 = 19.5 A

Therefore, a 20 A MCB could be used (even though it is not defined in IET tables, this is a standard practice in Sri Lanka)

Appendix 15 of the IET Wiring Regulation states that for a ring, the following stationary appliances should not be connected:

- Immersion heaters and electric space heaters
- Cookers, ovens, and hobs with a rated power exceeding 2 kW:

The above appliances should have dedicated radial circuits. When considering the design current for household cooking appliances, take the first 10 A of the rated current plus 30% of the remainder of the rated current, plus 5 A if a socket outlet is incorporated in the control unit. For all other stationary equipment, take the nominal current as the design current.

Ring vs Radial Circuits

Ring circuits are seldom used because the cost is high, and there are not many socket outlets in domestic premises. The following example shows the comparison of a ring and a radial as per Appendix 15 of the wiring regulation.

The following costs are considered (please check these values and update as prices are very different now):

2.5 mm^2 wire	250	Rs/m
2.5 mm^2 Earth wire	250	Rs/m
MCB	800	Rs
Plug socket	900	Rs
Sunk boxes	300	Rs
Conduit	500	Rs/m
Workmanship	1000	per point

Assume that the distance from the distribution point to the farthest plug socket is 30 m.

	For a radial circuit	For a ring circuit
Cost for L & N wires (2.5 mm^2)	15,000	25,000*
Cost for Earth wires (2.5 mm^2)	15,000	15,000
Cost for plug sockets and sunk boxes	7,200	7,200
For conduit (taken as 60% of L&N length)	9,000	15,000
For workmanship	6,000	6,000
Total for Radial	**52,200**	**68,200**

* The length of wires required for the ring is taken as 50 m

It is obvious that the cost to install a ring circuit is much higher. However, the number of socket outlets that can be connected to a ring is not specified, and as far as the area served is 100 m^2, any number of socket outlets can be connected.

Bill of Quantities (BoQ)

This is a demonstration only

In order to obtain rates for different circuits, calculate the cost of the longest circuit and then the shortest circuit. Take the average of the two as the rate.

Assume that there are many radial circuits in your design. The longest one-way run of a radial circuit is 18 m, and the shortest run is 8 m. Based on the rates given above, the cost for these two circuits is calculated.

	For 8 m circuit	For 18 m circuit
Number of socket outlets	5	4
Cost for L & N wires (2.5 mm^2)	600	1350
Cost for Earth wires (2.5 mm^2)	800	1800
Cost for plug sockets and sunk boxes	2400	2400
For conduit (taken as 60% of L&N length)	720	1620
For workmanship	1600	1600
Total for Radial	**6120**	**8770**

Therefore, the rate for a radial socket outlet circuits = (6120 + 8770)/2 ≈ Rs 7500

A typical BoQ would look like

Description	**Rate**	**Qty**	**Total**
Supplying and fixing 13 A, 230 volts radial socket outlet within a sunk box with 10/16 A 'C' series, SP MCB, and wiring for the circuit with 1.5 mm^2 Live and Neutral wire and 2.5 mm^2 Earth wire inside a PVC conduit	7500	6	45,000
Supplying and fixing 13 A, 230 volts ring socket outlet circuit within a sunk box with 10/16 A 'C' series, SP MCB and wiring for the circuit with 1.5 mm^2 Live and Neutral wire and 2.5 mm^2 Earth wire inside a PVC conduit	14500	1	14,500