Institute of Engineering & Technology

Wiring Regulations

BS7671 2018

Lighting Circuit
Cable Calculation
Using
Bs7671
And
On-Site Guide

Calculate Cable size (Twin and Earth) to be used in a lighting circuit

A house has 20 lights
Using thermoplastic insulated and sheathed flat cable (Twin and Earth) Cable run L 25m

The cable is installed above the plasterboard covered by thermal insulation exceeding 100mm in thickness

Calculate the cable size to be used

Taking diversity into consideration
Refer to On Site Guide

Calculating Cable Size

Formula

$I_b \leq I_n \leq I_z$

I_b=

Design current

I_n=

Fuse or Mcb rating Table 41.?

I_z=

Current carrying capacity of cable

Total Power of Lighting Circuit

Standard lamp Watts =
Appendix A (On Site Guide)

100W

20 Lamps x 100W = 2000W

I = P / V

2000W / 230V =

8.6A

Calculate Ib using diversity

Using Diversity = %
Appendix A On site Guide
66% 66% of 2000Watts (20 lamps)

2000 / 100 x 66 =
1320W

Ib= P/V = 1320W / 230V =
5.739 Amps

In = (Protection type and size)
Circuit breaker type B

Tables 41.?
6A

Iz = Cable size (Table 4D5)
Iz = 1mm

Volt Drop

Current carrying capacity and voltage drop for cables can be found in appendix 4 in BS761:2018

When the cable has been chosen the next step is to check the volt drop requirements of BS 7671 are satisfied.

This can be achieved by using the following formula.

$$\text{Volt drop} = \frac{(mV/A/m) \times Ib \times L}{1000}$$

Volt Drop

Volt drop = $\frac{(mV/A/m) \times Ib \times L}{1000}$

For 1mm flat twin and earth (mV/A/m) table 4D5 = 44 (mV/A/m)

Volt drop = $\frac{44 \times 5.7 \times 25}{1000}$

Vd = 6.27

Volt drop for lighting =
Table 4AB (page 383) 3%

3% of 230V = 6.9V

Fault Current

Find fault current I = Uo/Zs

Uo is ? | Zs is ?

Nominal ac voltage to earth 230v | Earth fault loop impedance

Zs =Ze+(R1+R2)

Ze for TTE 0.06 Ohms

(if not known recommended value can be found in (OSG)

(R1+R2) Table i1 (OSG p196) =

36.20 X 25 / 1000 =

0.9Ω

Zs= 0.06 + 0.9 = 0.96Ω

$$I = \frac{230}{0.96} = 240A$$

Fault Current

If the fault prospective current is 240A
Looking at the the time/current characteristic tables in BS 7671 for a type B circuit breaker (Table 3A4)
This would operate?

Instantly

This would be lower than the maximum disconnection time of ??? required for a TN final circuit as stated in table ???

0.4s Table 41.1 Therefore are circuit would meet the required disconnection time.

Example Of Lower Fault Current

If only a fault current of 10A was to occur this would operate in ?

500s

Looking at our Zs value of 0.96Ω

Does this fall below the maximum Zs value for our circuit breaker

Table 41.3

6A circuit breaker Zs = 7.28Ω

Note
For 3 Phase Motors

When calculating the current for a 3 phase motor use the following formula

$IL = Power / \sqrt{3} \times VL \times Cos\varnothing$

There for a 5KW motor having a Voltage of 400 and a Cos∅ factor of 0.80

$IL = 5000 / 1.732 \times 400 \times 0.80$

IL = 9.02 Amps

Ring and Radial Final Circuits

Final circuit
A circuit connected directly to current-using equipment or a socket-outlet or socket-outlets or other outlet points for the connection of such equipment

Appendix 15

This appendix sets out options for the design of ring and radial final circuit for household and similar premises.

The above also refers to regulations 433.1.204 and 433.1

Fig 15A and Fig 15B show typical circuits along with cable sizes, protection devices, fused and unfused spurs, equipment used also reference to associated regulations.

Cables

When choosing cables cables check the insulation type eg

SWA 25mm, 2 core clipped direct.

Table 4D4A

Thermoplastic 70°C insulated cables = 118 Amps.

Table 4E4A

Thermosetting 90°C insulated cables = 146 Amps

Industrial Installations

Earthing

Inspection

Testing

Functional Testing

Diversity

Testing For Dead

Earthing

All equipment must be earthed and bonded

Eg, Motors, panels, welders, drills, control equipment.

Armouring on SWA cable must be earthed this can also be used as the protective earth.

In addition a separate earth can be installed, or additional core in the cable can be used.

It is best practice not to rely on just the armouring of the cable for the protective earthing alone.

See I.E.T Regulations BS7671 and On Site Guide

Earthing

The protective conductor does not necessarily have to be the same as the live and neutral conductors eg

Fig 15A & 15B

Flat twin and earth

1.5mm cpc 1.0mm

2.5mm cpc 1.5mm

4.0mm cpc 1.5mm

See also table 54.7 for all other types of cables.

Inspection & Testing Part 6
Initial Inspection (OSG 9.2)

Connection of conductors

Identification of conductors

Cable sizes

Connection of accessories (including polarity)

Routing of cables

Inspection & Testing Part 6
Initial Inspection (OSG 9.2)

Earth Bonding and Cable sizes

Protective devices and ratings are correct for the circuit being protected.

Additional protection RCD’s

Isolation devices are correct size in correct position and working correctly.

Inspection & Testing Part 6
Test Sequence

Part 6 BS 7671 (On Site Guide 10)

Continuity

Insulation Resistance

Polarity

Earth Fault Loop Impedance (Zs)

Inspection & Testing Part 6
Functional Testing
O.S.G Sections 9 & 10

Testing of RCD’s

Operation of all switchgear

Diversity

Diversity is not usually used in industry when installing industrial equipment and most lighting circuits.

Eg

Motors
Pumps
Control panels
Control equipment
Drills
Welders
Outside lighting, workshop lighting, production lighting.

Testing For Dead

All relevant paperwork must be filled in before and after test

Use a voltage indicator
Test the tester

Testing circuits for 3 phase and single phase
Test between

L1 + L2, L1+ L3, L2+L3	400v
All Lives to Neutral	230v
All Lives to Earth	230v
Neutral and Earth	0v

All test points should be 0v when testing for dead

After completing test **Test the tester**