CABLE SIZING

OR Doing it in Groups

in a high temperature

with a bit of thermal on the side

To navigate through the slides….

press either the ▶ to move forward

Or the ◀ to move backwards

CORRECTION FACTORS

Grouping	**Cg**
Ambient temperature	**Ca**
Thermal insulation	**Ci**
Rewireable fuses	**Cr**

GROUPING

- **Appendix 4**
- **Table 4C1 / 4C2**
- **Table 4C3 / 4C4**
- **Table 4C5 / 4C6**
- **Page 396- 400**

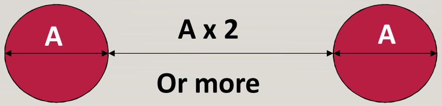
QUESTION

- FROM TABLES **4C1** / 4C2 / 4C3 / 4C4 / 4C5 / 4C6
- IDENTIFY THE CORRECTION FACTORS FOR

  6 PVC/PVC TWIN CABLES BUNCHED TOGETHER
- **0.57**

GROUPING NOTE

- **Cables do not have to have Grouping Factors** applied if the *distance between the cables is greater than twice their overall diameter*



AMBIENT TEMPERATURE

- ✓ Appendix 4
- ✓ Table 4B1 / 4B2
- ✓ Table 4B3 / 4B4 / 4B5
- ✓ Pages **394 to 395**

QUESTION **AMBIENT**

- From **Table 4B1**
- Identify the **correction factor** for **PVC single insulated cable, non-armoured**, with or without sheath, run in an **ambient temperature of 60˚C**
- **0.50**

THERMAL INSULATION

Cables in thermal insulation 523.9 Pages 143 to 144

"A cable should preferably not be installed in a location where it is liable to be covered by thermal insulation..." and it is "...likely to be applied it shall, **wherever practicable be fixed in a position such that it will not be covered by the thermal insulation."**
"Where fixing in such a position is impracticable the cross-sectional area of the cable shall *be selected to meet the requirements of Chapter 43.* Where necessary , the nature of the load (e.g., **cyclic...Fatigue** (material) In materials science, **fatigue is the weakening of a material caused by repeatedly applied loads**. It is the progressive and localized structural damage that occurs when a material is subjected to cyclic loading.) and diversity shall be taken into account."
"For a cable installed in a thermally insulated wall or above a thermally insulated ceiling, the cable being in contact with a thermally conductive surface on one side, current-carrying capacities are tabulated in Appendix 4..."

THERMAL INSULATION

Cables in thermal insulation 523.9 Pages 143 to 144

"…For a single cable likely to be totally surrounded by thermally insulating material over a length of more than 0.5 m or more the current-carrying capacity shall be taken, in the absence of more precise information, as 0.5 times the current-carrying capacity for that cable clipped direct to a surface and open (Reference Method C)…" *Page 339 referring to (Installation Methods 101 to 103) Page 390 Flat Twin & Earth (PVC/PVC + CPC)*

"…Where a cable is to be totally surrounded by thermal insulation for less than 0.5 m the current-carrying capacity of the cable shall be reduced appropriately depending on the size of cable, length in insulation and thermal properties of the insulation…"

THERMAL INSULATION

Cables in thermal insulation 523.9 Pages 143 to 144

"…The derating factors in Table 52.2 are appropriate to conductor sizes up to $10mm^2$ in thermal insulation having a thermal conductivity (k) greater than $0.04Wm^{-1} K^{-1}$."

Table 52.2 – Cable surrounded by thermal insulation

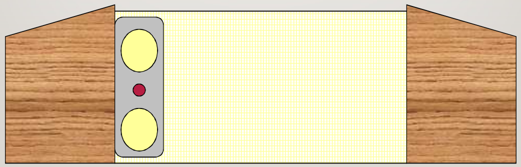
Length in insulation (mm)	Derating factor
50	0.88
100	0.78
200	0.63
400	0.51

THERMAL INSULATION

Cables in thermal insulation 523.9

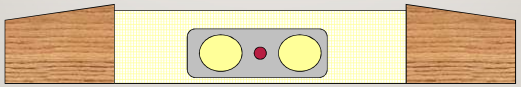
- **Where a cable touches only one side of thermal insulation only reference method C should be used.**
- **Where a cable is totally surrounded by thermal insulation for more than 0.5m a correction factor of 0.5 should be applied.**

THERMAL INSULATION – PART COVERED



Installation Method 100 to 102

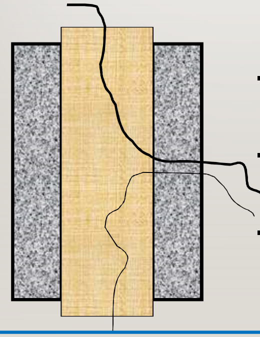
THERMAL INSULATION – COMPLETELY COVERED



Installation Method 103

Correction Factor – 0.5

THERMAL INSULATION – CAVITY WALL INSULATION



Correction Factor is 0.5

REWIREABLE FUSES

From Appendix 4 Page 377

Correction factor of 0.725

“The size needed for a conductor protected against overload by a **BS 3036 semi-enclosed fuse** can be obtained by the use of a correction factor, **1.45/2=0.725**, which results in the same degree of protection as that afforded by other overload protective devices. This factor is to be applied to the nominal rating of the fuse as a divisor, thus indicating **the minimum value of I_t** required of the conductor to be protected. In this case also, the choice of conductor size is dictated by the overload conditions and the **current-carrying capacity (I_z) of the conductors** cannot be fully utilised.”

REWIREABLE FUSES

BS 3036 SEMI-ENCLOSED FUSE

EXAMPLE

A cable supplies an **immersion heater**, which takes a **design current** (I_b)of **12.5A**.

The cable is a **Twin & Earth (PVC/PVC cable)** **clipped to a beam** and the protection is provided by a **BS 3036** fuse.

REWIREABLE FUSES

BS 3036 SEMI-ENCLOSED FUSE

ANSWERS

- Fuse size................................... **15A**
- Installation Method...................... **18th Method C** ***(16th Method 1)***
- Correction Factors....................... **0.725**
- Table & Column.......................... **Page 409 4D5 Col 6**
- Cable Current Rating
- $I_z = \frac{I_n}{C_r} = \frac{15}{0.725} = 20.68\ A$
- Minimum Cable size = **2.5mm² (27A)**

REWIREABLE FUSES

BS 3036 SEMI-ENCLOSED FUSE

QUESTION

A load taking a current of **17A** is supplied by a **PVC/PVC cable** which is being run in a cavity wall filled with thermal insulation.

Determine

1. Fuse Rating
2. Insulation Method
3. Correction Factor
4. Table & Column
5. Cable Current Rating
6. Minimum Cable size

REWIREABLE FUSES

BS 3036 SEMI-ENCLOSED FUSE

QUESTION & ANSWERS

A load taking a current of **17A** is supplied by a **PVC/PVC cable** which is being run in a cavity wall filled with thermal insulation < 100mm thick.

Determine

1. **Fuse** Rating	**20A**	
2. **Reference Method**	**18th Method 100 /*102 (16th Method 15)***	
3. **Correction Factor**	**0.5**	**18th Method 100 above a plasterboard** **18th Method *102 in a stud wall***
4. Table & Column	N/A	
5. **Cable Current Rating**	**40A (20A/0.5)**	
6. **Minimum Cable size**	**6mm² (45A/*47A*)**	

VOLT DROP

LIGHTING ***(3 % in 18th Edition 6.9V)*** and *Other Uses*

- *Maximum permissible volt drop is ..4.% 525 Page 100* ***BS7671 16th EDITION i.e., 9.2V LIGHTING + OTHER USES***
- *Maximum permissible volt drop is ..5.% 525 Page 145 & Appendix 4, 6.4 Table 4Ab BS7671 18th EDITION 11.5V*
- The formula for calculating voltage drop in a circuit is:-

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

VOLT DROP

VOLT DROP IS ..4..% = 9.2V (or 5 % 11.5V 18th) OTHER USES

Determine the volt drop in a **6mm²** cable (**PVC in conduit**) which is carrying **35A** for a length of run, which is ***65m long***. **U_o = 230v**

From column 3 table 4D1A Pages 401 – 402 mV/A/m = **7.3mV/A/m**

Calculate Volt Drop = $\frac{mV / A / m \times L \times I_b}{1000 \text{ (to convert to volts)}}$

Calculation = $\frac{7.3 \times 65 \times 35}{1000}$ *= 16.6V*

Is this OK? NO

Therefore we need to determine the size of the cable which will satisfy the regulations

VOLT DROP

VOLT DROP IS ..4..% = 9.2V (or 5 % 11.5V 18th) OTHER USES

Increase cable to **10mm**, making **mV/A/m 4.4. millivolts**

Volt Drop = $\frac{65 \times 35 \times 4.4}{1000}$ = *10.01V*

Is this OK? NO

18th YES

16th…still need to determine the size of the cable which will satisfy the regulations i.e., < 9.2V

Increase cable to **16mm**, making **mV/A/m 2.8. millivolts**

Volt Drop = $\frac{65 \times 35 \times 2.8}{1000}$ = *6.37V*

16th volt drop acceptable? YES

VOLT DROP

VOLT DROP IS ..4..% = 9.2V (or 5 % 11.5V 17th) OTHER USES

An Alternative method –

If we transpose the formula in order to find the ***16th Edition maximum mV/A/m*** we find that…

$$mV/A/m = \frac{9.2 \times 1000}{L \times Ib} = \frac{9{,}200}{65 \times 35} = 4.04\ mV/A/m$$

VOLT DROP

VOLT DROP IS ..4..% = 9.2V (or 5 % 11.5V 18th) OTHER USES

An Alternative method –

If we transpose the formula in order to find the ***18th Edition maximum mV/A/m*** we find that…

$$mV/A/m = \frac{11.5 \times 1000}{L \times Ib} = \frac{11{,}500}{65 \times 35} = 5.05\ mV/A/m$$