



Gower College Swansea
Coleg Gŵyr Abertawe

Design of Electrical Installations

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Contents

Introduction	3
Room Measurements and references	4
Light Installation.....	8
Power Distribution (Sockets)	18
Cookers, Lifts and Appliances	30
Emergency Lighting.....	37
Supply to distribution boards	43
Data Sheets	55
Cable calculations showing formulas.....	59
References	64

Introduction

The task I have been assigned is the design of electrical installations for a new sheltered accommodation block. The block consists of a communal dining room, kitchen and utility room, 6x1 bedroom accommodation and 1 x 2 bedroom accommodation over two floors. The design must include:

- Appropriate lighting systems for all areas including wiring diagrams
- Appropriate power distribution design including wiring diagrams
- Cable size calculations. Also, determine the minimum cross sectional area of protective conductor for the cooker in the communal kitchen
- Circuit protection designs.
- Emergency lighting design
- An outline of suitable cable support systems used throughout the installation

The incoming supply is 400 / 230 V 50Hz three phase four-wire, which together with the installation forms part of a TN-C-S system.

The power requirements are shown in the tables below.

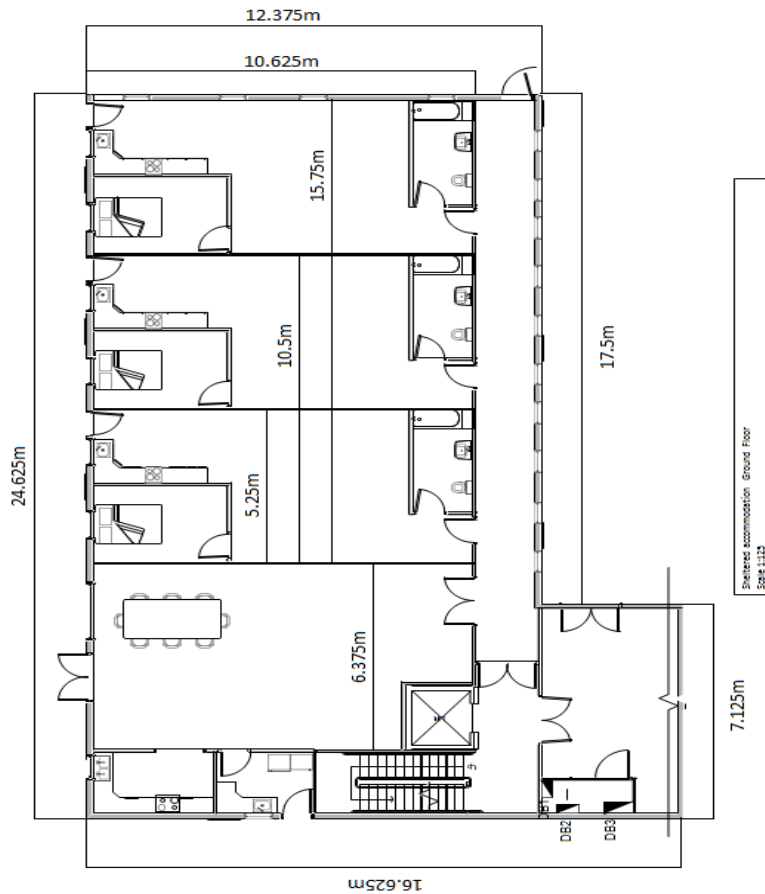
Reference	Phase	Power/no. of sockets	Allow for diversity
Kitchen cooker	3	7 kW	Apply diversity where applicable within the installation
Washing machine	1	3.6 kW	
Tumble dryer	3	6.4 kW	
Lift	3	6.9 kW	
Communal room	1	10 off 13A sockets	
Communal kitchen	1	3 off 13A sockets	
Utility room	1	2 off 13A sockets	
Ground floor Room 1	1	Select an appropriate number of sockets per room taking into account general requirements and usage	
Ground floor Room 2	1		
Ground floor Room 3	1		
First floor Room 1	1		
First floor Room 2	1		
First floor Room 3	1		
First floor Room 4	1		
All room cookers			

Room Measurements and references

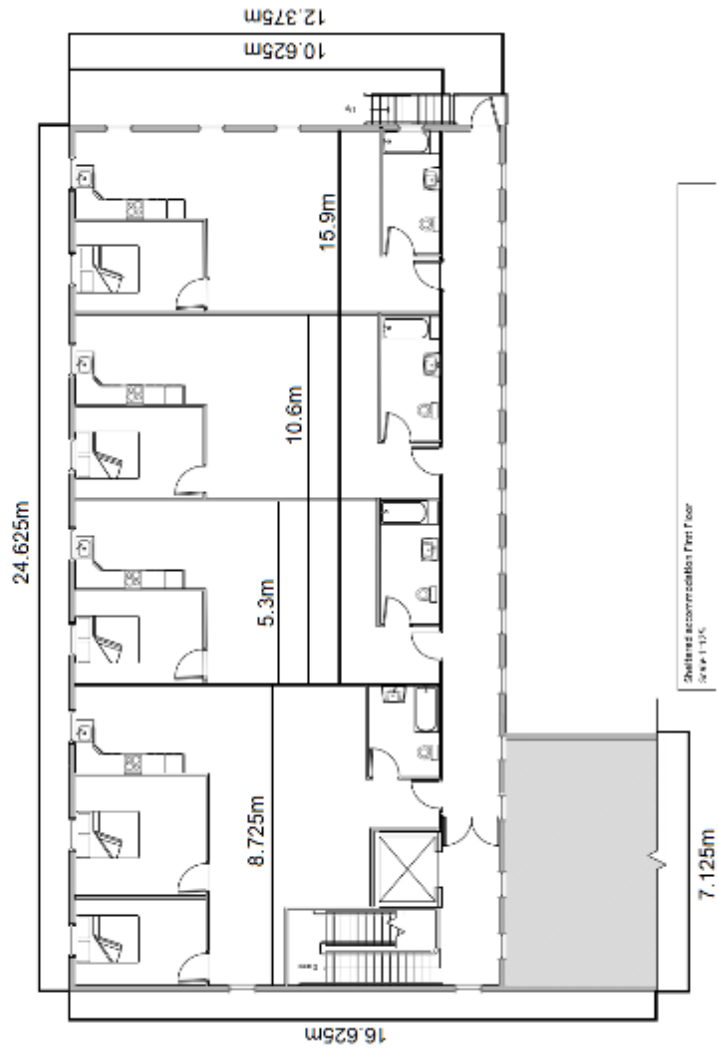
For ease of reading, I have drawn scaled measurements of the two stories. I have also given each room a reference for ease of locating them. All rooms are scaled 1:125

They are below as follows:

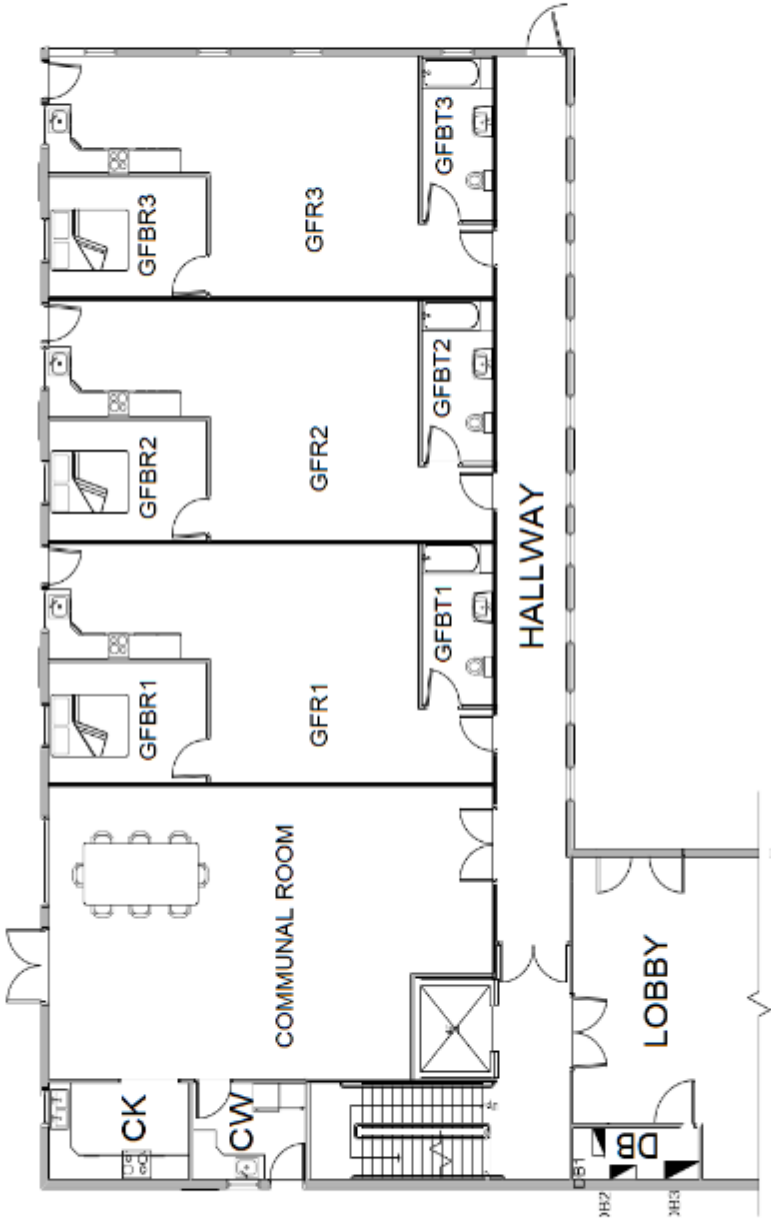
GROUND FLOOR MEASUREMENTS



1ST FLOOR MEASUREMENTS

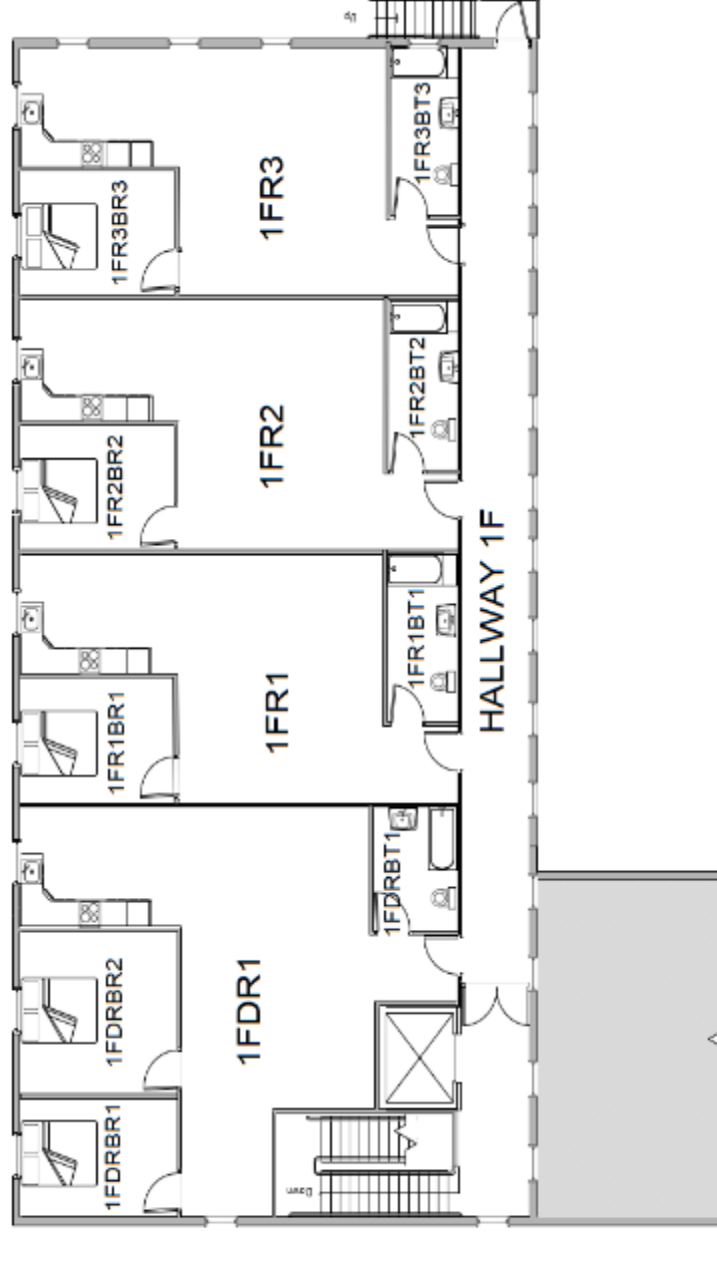


GROUND FLOOR REFERENCES



Sheltered accommodation Ground Floor
Scale 1:125

1ST FLOOR REFERENCES



Sheltered accommodation First Floor
Scale 1:125

Light Installation

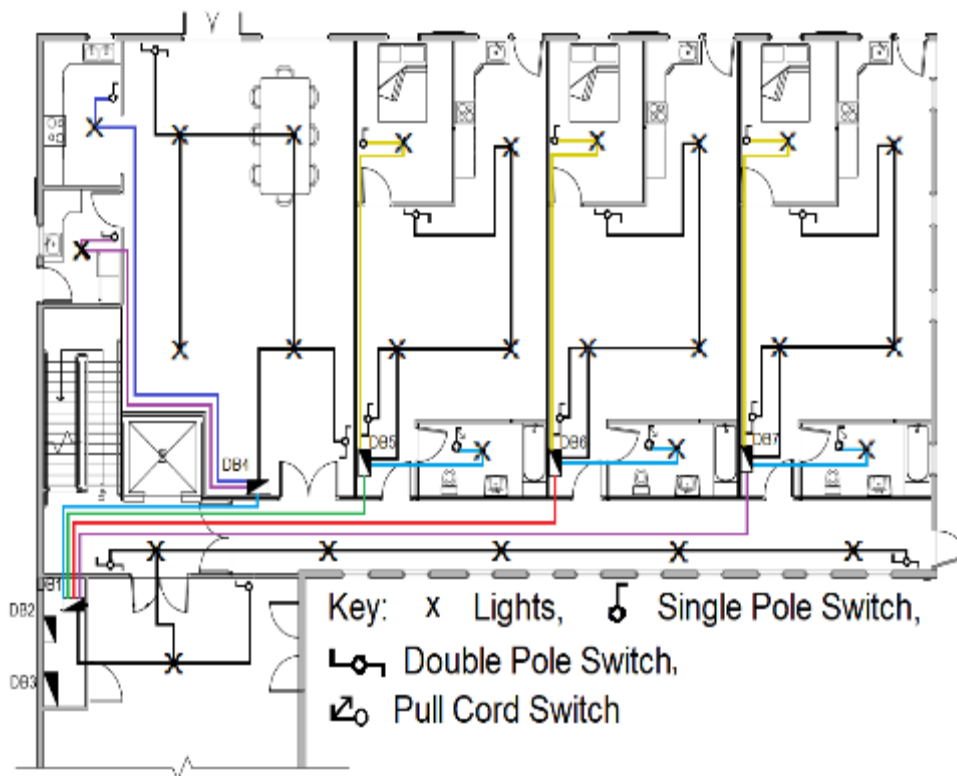
The brief asks to design appropriate lighting systems for all areas including wiring diagrams. Throughout the design I have chosen 3 different sets of lights. To help me choose the lights, I used the (Electrical counter, 2019) website, which gives you an average lux level expected for each room.

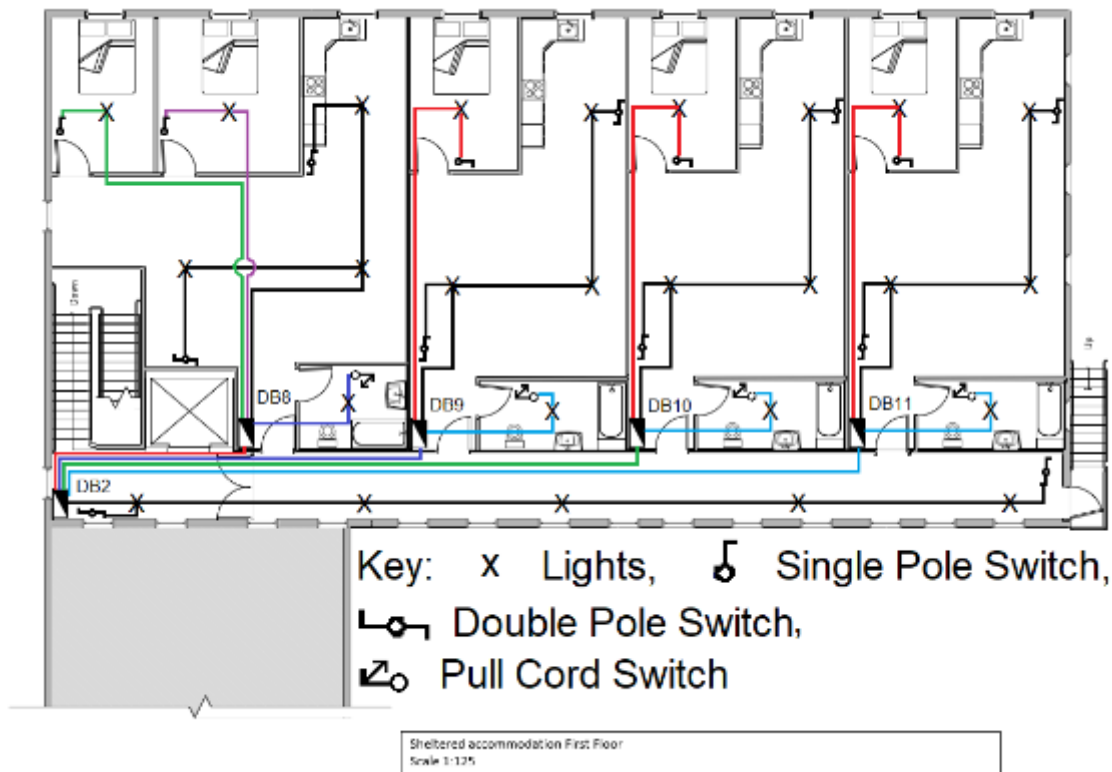
The lights I have chosen, are as follows:

(LED Matt ceiling light, 2019)
(Sylvania Sylcircle ceiling light, 2019)
(Ready LED Ceiling Light, 2019)

The lights have been distributed evenly to allow good lighting in all areas of the building. All switches and sockets must be installed at a “minimum height of 450mm and a maximum height of 1200mm from the finished floor level,” as stated in (Linsley, 2019).

Below are the lighting wiring diagrams for both ground floor and 1st floor respectively.





I also considered the fact that there needs to be pull cords for the lights in the bathroom, and I have included double pole switches in the larger rooms. It was also stipulated in the brief that there must be no more than 4 circuits grouped, hence the 1st floor double rooms have extra circuits for lighting.

As you can see each room now has an individual DB from DB4-11. Each DB is a Wylex 10 Way Dual Split Load High Integrity Metal Consumer Unit with 10 MCBs, (Wylex Consumer unit, 2019). All have circuit breakers which are calculated for in the cable calculations below.

Circuit:	Single Room Lighting, GFR1, GFR2, GFR3 from DB 5,6 & 7 respectively			
	Nominal Voltage	V	230	
	Power	W	300	
	Design Current	I _b	1.30	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	12	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.45	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.43	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.70	
	Maximum Earth Loop Impedance	Z _{s (max)}	5.82	BS7671 Table 41.3
	Fault Current	I _f	326.30	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.90	

Circuit:	Single Room Lighting, GFBT1, GFBT2, GFBT3 from DB 5,6 & 7 respectively			
	Nominal Voltage	V	230	
	Power	W	100	
	Design Current	I _b	0.43	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	3.75	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.05	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.14	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.41	
	Maximum Earth Loop Impedance	Z _{s (max)}	5.82	BS7671 Table 41.3
	Fault Current	I _f	566.64	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	1.56	

Circuit:	Single Room Lighting, GFBR1, GFBR2, GFBR3 from DB 5,6 & 7 respectively			
	Nominal Voltage	V	230	
	Power	W	100	
	Design Current	I _b	0.43	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	9.38	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.12	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.34	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.61	
	Maximum Earth Loop Impedance	Z _{s (max)}	5.82	BS7671 Table 41.3
	Fault Current	I _f	377.09	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3

	Min Cross Sectional Area Of CPC (mm ²)	S	1.04	
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Circuit:	Communal room lighting supplied from DB4			
	Nominal Voltage	V	230	
	Power	W	100	
	Design Current	I _b	0.43	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	22.5	
	Insulation		None	
	Ambient Temperature	°C	28	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.28	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.82	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	1.09	
	Maximum Earth Loop Impedance	Z _{s (max)}	5.82	BS7671 Table 41.3
	Fault Current	I _f	211.90	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3

	Min Cross Sectional Area Of CPC (mm ²)	S	0.58	
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Circuit:	Communal room kitchen supplied from DB4			
	Nominal Voltage	V	230	
	Power	W	100	
	Design Current	I _b	0.43	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	13.2	
	Insulation		None	
	Ambient Temperature	°C	30	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	44	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.25	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.48	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.75	
	Maximum Earth Loop Impedance	Z _{s (max)}	5.82	BS7671 Table 41.3
	Fault Current	I _f	307.34	
	Disconnection Time	t	0.1	BS7671 Graph

	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.85	

Circuit:	Communal laundry room supplied by DB4			
	Nominal Voltage	V	230	
	Power	W	100	
	Design Current	I _b	0.43	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	13.2	
	Insulation		None	
	Ambient Temperature	°C	30	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.17	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.48	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.75	
	Maximum Earth Loop Impedance	Z _{s (max)}	5.82	BS7671 Table 41.3
	Fault Current	I _f	307.34	
	Disconnection Time	t	0.1	BS7671 Graph

	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.85	

Circuit:	Ground floor lobby and hallway from DB1			
	Nominal Voltage	V	230	
	Power	W	600	
	Design Current	I _b	2.61	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	32.5	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	2.46	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	1.18	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	1.45	
	Maximum Earth Loop Impedance	Z _{s (max)}	5.82	BS7671 Table 41.3
	Fault Current	I _f	158.86	
	Disconnection Time	t	0.1	BS7671 Graph

	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.44	

The circuit breaker for all the lighting systems are BSEN 61009 Type B 6A. This is enough for each circuit and meets the British Standards. The light circuits are all radial as they do not need to return to the relevant DB. This is also easier when it comes to fault finding as when, for example there is a wire break in a radial circuit, nothing after the break will work. This makes it easily identifiable.

As all of the lights are single phase, the nominal voltage is 230V. Although I have chosen LED lights, which are much more efficient and use less power than a standard 100W bulb, we still must use 100W as a reference as the bulbs are still being used.

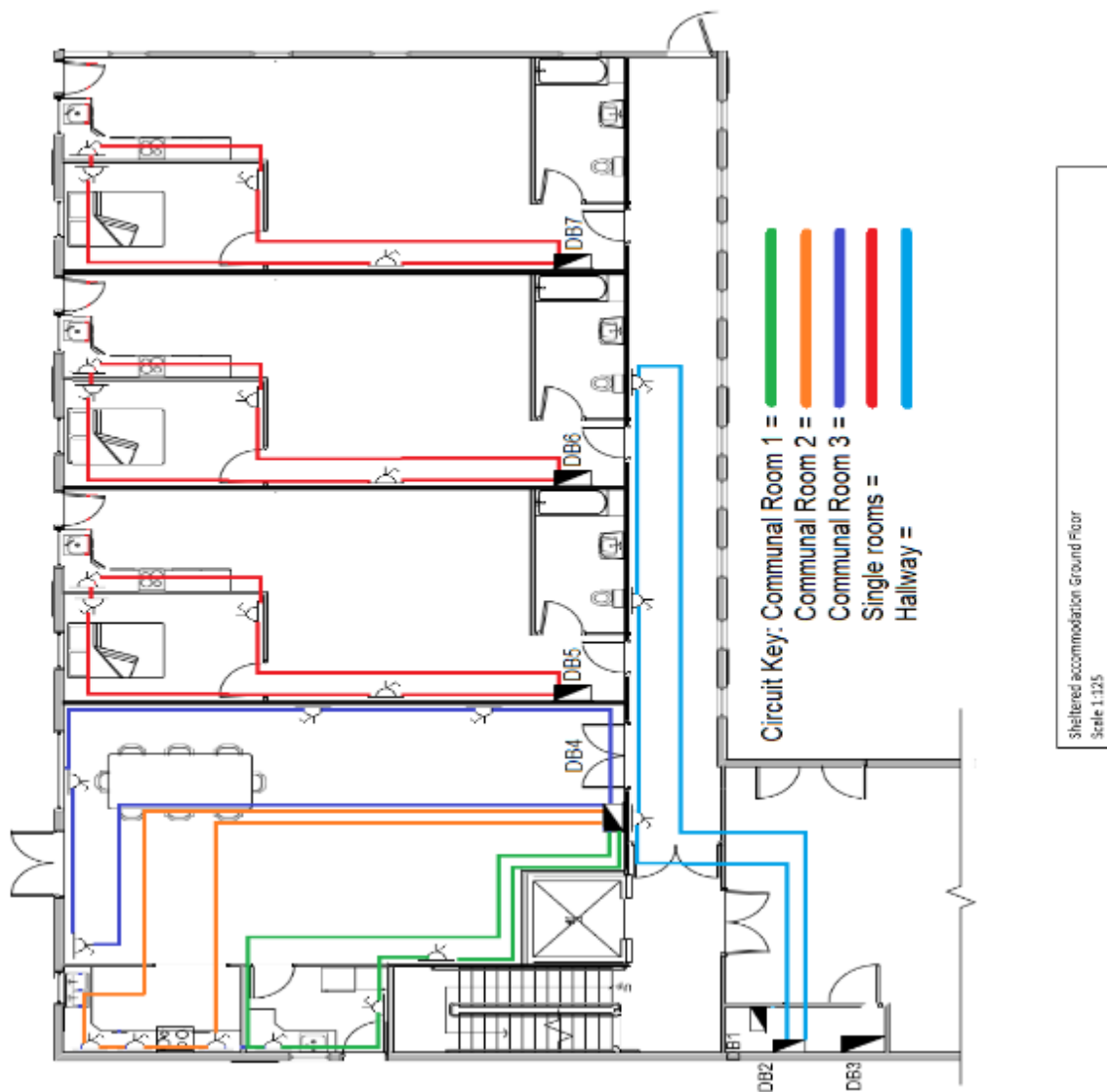
I have decided to use 70°C Thermoplastic flat with protective conductor for the lighting circuits. It is relatively cheap, more than able to withstand the temperature and are non-hazardous.

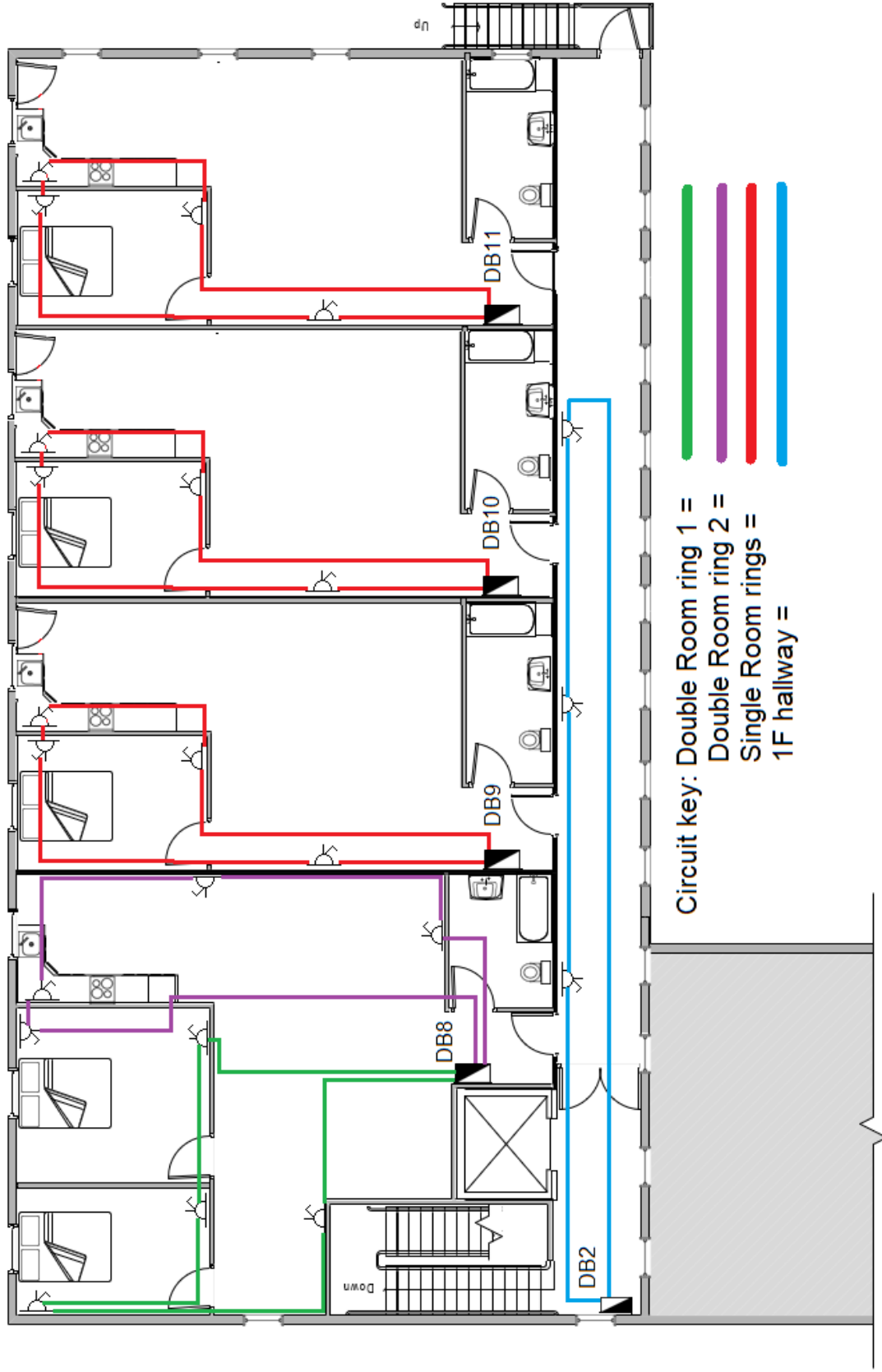
The length of the cable is measured using the 1:125 scale, and we have made the assumption that the length of the cable from the switch to the ceiling is also included in the measurement. All cables throughout the building will be transferred using reference method E, which is cable tray. The advantaged of using cable tray installation in this design is that it again comes at a lower installation cost, allows you to have a flexibility in your wiring system design and is very simple.

In the cable calcs, the references to BS7671 are all from the 18th Edition (Institute of Engineering and Technology, 2018) and all OSG references are from the On site guide (Institute of Engineering and Technology, 2018).

Power Distribution (Sockets)

Now that we have our lighting design in place, the next thing I will need to do is design the power distribution for all sockets and appliances. First thing we will display is the single phase 230V sockets throughout the building.





Circuit key: Double Room ring 1 =
 Double Room ring 2 =
 Single Room rings =
 1F hallway =

As you can see from the diagrams, every room has a sufficient number of sockets. I have decided to use ring circuits throughout the build as they are the most commonly used. As mentioned earlier, there is a limit of 4 circuits per ring, therefore the downstairs communal room has 3 ring circuits and the 1st floor double room has 2 ring circuits. There are also a number of sockets in both hallways, I have made the decision to fit these so cleaners can operate hoovers, etc.

As you will notice on the cable calculations below, each ring circuit is fitted with a 32A circuit breaker. This is for safety as many of the ring circuits extend to the kitchens where appliances will need to draw a higher amount of current.

All cables will again for the aforementioned reasons, be installed using cable tray systems and between the minimum height of 450mm and maximum height of 1200mm.

70°C Thermoplastic flat with protective conductor is again my choice for the single phase ring circuits for its low installation costs.

Due to some circuits having a maximum of three grouped circuits as opposed to 4, there is a slight difference in cable size between rooms. There is no significant size difference, ranging from 4mm to 6mm.

Circuit:	GF hallway sockets from DB2			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I _b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	32	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		3	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.82	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	37.89	
	Tabulated Value of Cable Carrying Capacity	I _t	40	BS7671 Table 4D2A
	Selected Cable Size	mm ²	4	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	11	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	11.26	
	Resistance Of Line and CPC	r ₁ +r ₂	12.02	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.46	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.73	
	Maximum Earth Loop Impedance	Z _{s (max)}	1.36	BS7671 Table 41.3
	Fault Current	I _f	314.39	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.86	

Circuit:	Single room sockets, GFR1, GFR2 & GFR3 from DB5, 6 & 7 respectively			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I _b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	23.75	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	40.35	
	Tabulated Value of Cable Carrying Capacity	I _t	51	BS7671 Table 4D2A
	Selected Cable Size	mm ²	6	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	7.3	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	5.55	
	Resistance Of Line and CPC	r ₁ +r ₂	10.49	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.30	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.57	
	Maximum Earth Loop Impedance	Z _{s (max)}	1.36	BS7671 Table 41.3
	Fault Current	I _f	404.24	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	1.11	

Circuit:	Communal Room 1 from DB4			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I _b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	22.5	
	Insulation		None	
	Ambient Temperature	°C	30	
	Maximum No. Of Circuits Grouped		3	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.82	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	37.89	
	Tabulated Value of Cable Carrying Capacity	I _t	40	BS7671 Table 4D2A
	Selected Cable Size	mm ²	4	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	11	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	7.92	
	Resistance Of Line and CPC	r ₁ +r ₂	12.02	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.32	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.59	
	Maximum Earth Loop Impedance	Z _{s (max)}	1.36	BS7671 Table 41.3
	Fault Current	I _f	386.85	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	1.06	

Circuit:	Communal Room 2 from DB4			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I _b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	30.5	
	Insulation		None	
	Ambient Temperature	°C	28	
	Maximum No. Of Circuits Grouped		3	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.82	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	37.89	
	Tabulated Value of Cable Carrying Capacity	I _t	40	BS7671 Table 4D2A
	Selected Cable Size	mm ²	4	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d(max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	11	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	10.74	
	Resistance Of Line and CPC	r ₁ +r ₂	12.02	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.44	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.71	
	Maximum Earth Loop Impedance	Z _{s(max)}	1.36	BS7671 Table 41.3
	Fault Current	I _f	323.97	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.89	

Circuit:	Communal Room 3 from DB4			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I _b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	31.5	
	Insulation		None	
	Ambient Temperature	°C	28	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	40.35	
	Tabulated Value of Cable Carrying Capacity	I _t	51	BS7671 Table 4D2A
	Selected Cable Size	mm ²	6	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d(max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	7.3	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	7.36	
	Resistance Of Line and CPC	r ₁ +r ₂	10.49	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.40	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.67	
	Maximum Earth Loop Impedance	Z _{s(max)}	1.36	BS7671 Table 41.3
	Fault Current	I _f	345.07	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.95	

Circuit:	1F hallway sockets from DB2			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I _b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	32.5	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		3	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.82	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	37.89	
	Tabulated Value of Cable Carrying Capacity	I _t	40	BS7671 Table 4D2A
	Selected Cable Size	mm ²	4	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	11	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	11.44	
	Resistance Of Line and CPC	r ₁ +r ₂	12.02	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.47	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.74	
	Maximum Earth Loop Impedance	Z _{s (max)}	1.36	BS7671 Table 41.3
	Fault Current	I _f	311.32	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.86	

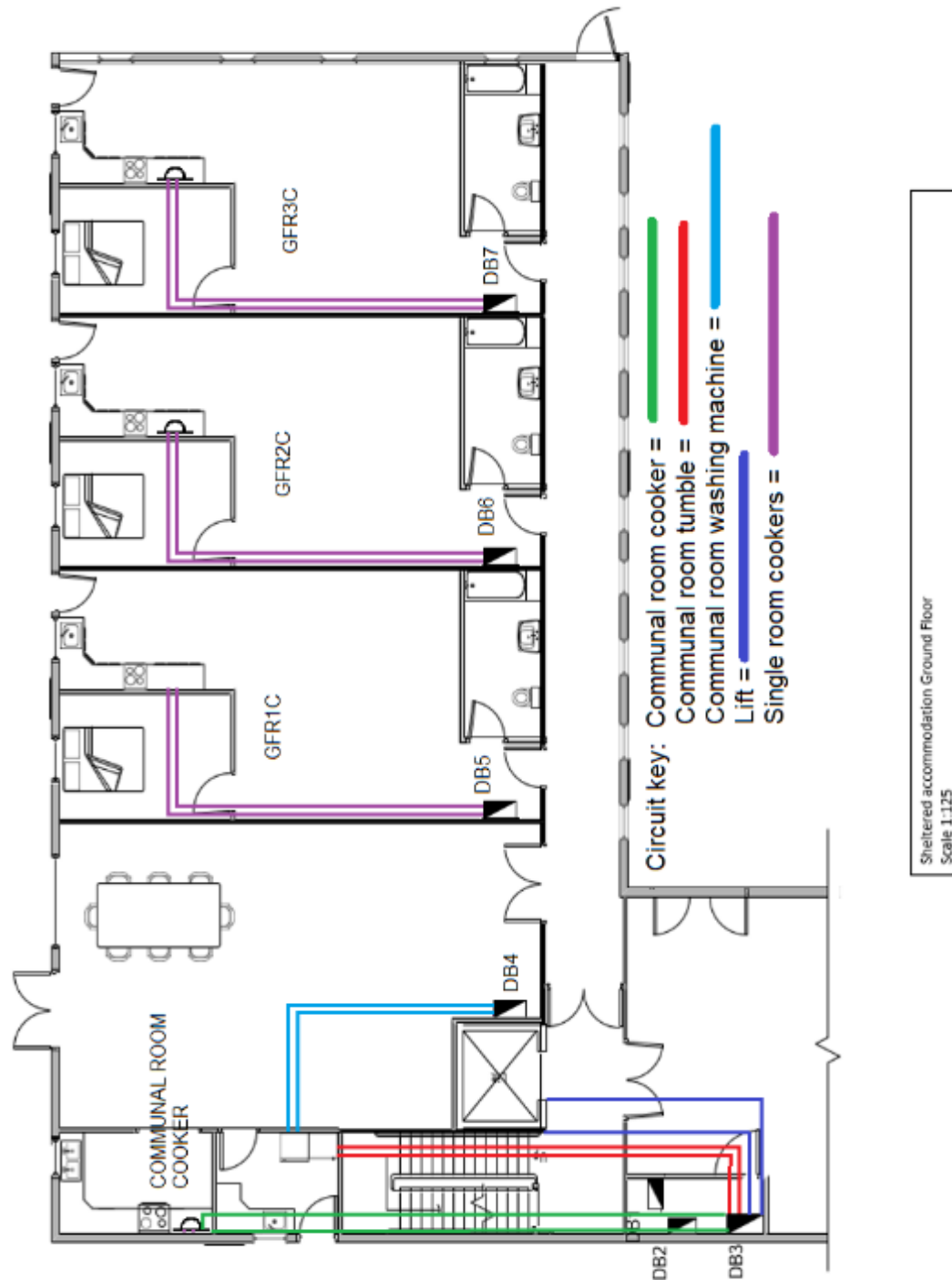
Circuit:	Double room ring 1 from DB8			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I _b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	26.25	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	40.35	
	Tabulated Value of Cable Carrying Capacity	I _t	51	BS7671 Table 4D2A
	Selected Cable Size	mm ²	6	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	7.3	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	6.13	
	Resistance Of Line and CPC	r ₁ +r ₂	10.69	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.34	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.61	
	Maximum Earth Loop Impedance	Z _{s (max)}	1.36	BS7671 Table 41.3
	Fault Current	I _f	379.08	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	1.04	

Circuit:	Double room ring 2 from DB8			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I_b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I_n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	26.25	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C_a	1.03	BS7671 Table 4B1
	Grouping Factor	C_g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C_i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C_f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C_c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I_z	40.35	
	Tabulated Value of Cable Carrying Capacity	I_t	51	BS7671 Table 4D2A
	Selected Cable Size	mm ²	6	BS7671 Table 4D2A
	Maximum Voltage Drop	$V_{d(max)}$	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	7.3	BS7671 Table 4D1B
	Actual Voltage Drop	V_d	6.13	
	Resistance Of Line and CPC	$r1+r2$	10.69	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	$R1+R2$	0.34	
	External Earth Loop Impedance	Z_e	0.27	
	Earth Fault Loop Impedance	Z_s	0.61	
	Maximum Earth Loop Impedance	$Z_{s(max)}$	1.36	BS7671 Table 41.3
	Fault Current	I_f	379.08	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	1.04	

Circuit:	Single room rings from DB9, 10 & 11 respectively			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I_b	32.00	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I_n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	24.5	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C_a	1.03	BS7671 Table 4B1
	Grouping Factor	C_g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C_i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C_f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C_c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I_z	40.35	
	Tabulated Value of Cable Carrying Capacity	I_t	51	BS7671 Table 4D2A
	Selected Cable Size	mm ²	6	BS7671 Table 4D2A
	Maximum Voltage Drop	$V_{d(max)}$	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	7.3	BS7671 Table 4D1B
	Actual Voltage Drop	V_d	5.72	
	Resistance Of Line and CPC	r_1+r_2	10.69	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R_1+R_2	0.31	
	External Earth Loop Impedance	Z_e	0.27	
	Earth Fault Loop Impedance	Z_s	0.58	
	Maximum Earth Loop Impedance	$Z_{s(max)}$	1.36	BS7671 Table 41.3
	Fault Current	I_f	393.64	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	1.08	

Cookers, Lifts and Appliances

The next part of the design to be included is the installation of cookers, a lift and all appliances as shown in the diagrams below.



The below cable calculations contain a mixture of single phase and three phase appliances. All kitchen room cookers and the washing machine are single phase and therefore supplied with 230V. The single room cookers draw 4KW of power, and the washing machine 3.6KW. The lift, communal cooker and tumble dryer are all three phase appliances and are supplied with 400V. You will notice that all three phase appliances are distributed from DB3. This is because we have allocated DB3 to solely distribute power to the three phase appliances in an effort to try and balance the load of power.

The lift, which draws 6.9KW of power is powered by a TEC IE2 7.5kW Aluminium Three Phase Motor from (Inverter Drive Supermarket, 2019). It has an efficiency rating of 88.1% and a power factor of 0.89 when connected to 50Hz.

As mentioned in the brief, we were asked to determine the minimum cross-sectional area of protective conductor for the cooker in the communal kitchen. With the cable calculation it allows us to do this. So, from the calculation the minimum cross-sectional area of protective conductor for the cooker in the communal kitchen is 1.54mm².

The single phase again will have 70°C Thermoplastic flat with protective conductor cable, whereas the 3 phase appliances will be powered using 70°C Thermoplastic Multicore Armoured. Cable tray systems will also be used to support the installation of the cables.

Circuit:	All single room cookers, from DB5, 6, 7, 8, 9, 10 & 11			
	Nominal Voltage	V	230	
	Power	W	4000	
	Design Current	I _b	17.39	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	20	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	18.5	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	25.22	
	Tabulated Value of Cable Carrying Capacity	I _t	30	BS7671 Table 4D2A
	Selected Cable Size	mm ²	2.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	18	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	5.79	
	Resistance Of Line and CPC	r ₁ +r ₂	19.51	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.43	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.70	
	Maximum Earth Loop Impedance	Z _{s (max)}	2.2	BS7671 Table 41.3
	Fault Current	I _f	327.11	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.90	

Circuit:	Communal room cooker from DB3			
	Nominal Voltage	V	400	
	Power	W	7000	
	Power Factor		1	
	Efficiency Factor		1	
	Design Current at full load	I _b	10.10	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	16	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic Multicore Armoured	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit	L	25	
	Insulation		None	
	Ambient Temperature	°C	30	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	20.17	
	Tabulated Value of Cable Carrying Capacity	I _t	26	BS7671 Table 4D1A
	Selected Cable Size	mm ²	2.5	BS7671 Table 4D1A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	15	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	3.79	
	Resistance Of Line and CPC	r ₁ +r ₂	14.82	Table L1 from On Site Guide
	Multiplier		1.2	Table L3 from On Site Guide
	Actual Resistance Of Circuit	R ₁ +R ₂	0.44	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.71	
	Maximum Earth Loop Impedance	Z _{s (max)}	2.73	BS7671 Table 41.3
	Fault Current	I _f	559.75	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.2 - 54.6
	Min Cross Sectional Area Of CPC (mm ²)	S	1.54	

Circuit:	Communal tumble dryer from DB3			
	Nominal Voltage	V	400	
	Power	W	6400	
	Power Factor		1	
	Efficiency Factor		1	
	Design Current at full load	I _b	9.24	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	16	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic Multicore Armoured	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit	L	21	
	Insulation		None	
	Ambient Temperature	°C	28	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	20.17	
	Tabulated Value of Cable Carrying Capacity	I _t	26	BS7671 Table 4D1A
	Selected Cable Size	mm ²	2.5	BS7671 Table 4D1A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	15	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	2.91	
	Resistance Of Line and CPC	r ₁ +r ₂	14.82	Table L1 from On Site Guide
	Multiplier		1.2	Table L3 from On Site Guide
	Actual Resistance Of Circuit	R ₁ +R ₂	0.37	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.64	
	Maximum Earth Loop Impedance	Z _{s (max)}	2.73	BS7671 Table 41.3
	Fault Current	I _f	621.64	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.2 - 54.6
	Min Cross Sectional Area Of CPC (mm ²)	S	1.71	

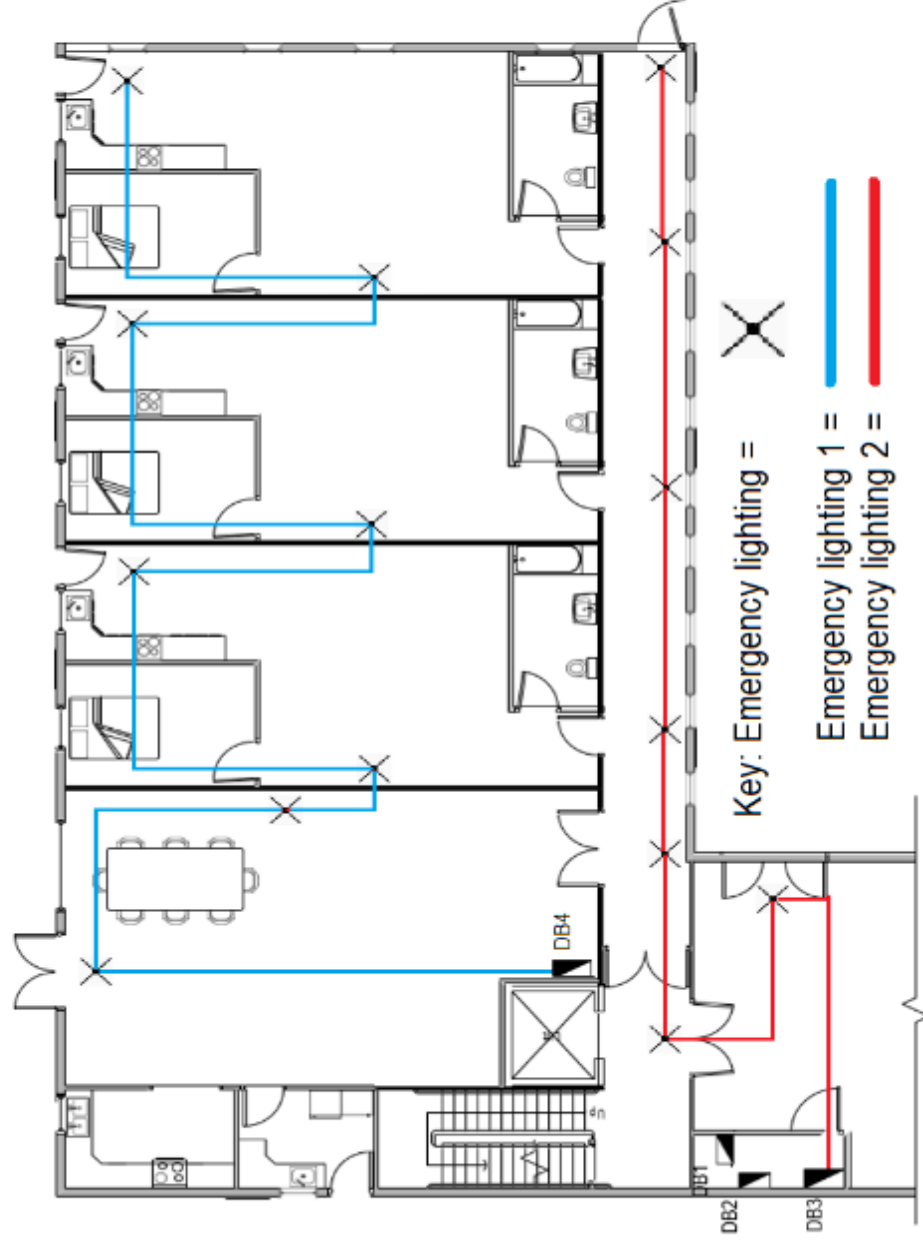
Circuit:	Communal washing machine from DB4			
	Nominal Voltage	V	230	
	Power	W	3600	
	Design Current	I _b	15.65	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	16	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	15	
	Insulation		None	
	Ambient Temperature	°C	28	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	20.17	
	Tabulated Value of Cable Carrying Capacity	I _t	30	BS7671 Table 4D2A
	Selected Cable Size	mm ²	2.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	18	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	4.23	
	Resistance Of Line and CPC	r ₁ +r ₂	19.51	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.35	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.62	
	Maximum Earth Loop Impedance	Z _{s (max)}	2.72	BS7671 Table 41.3
	Fault Current	I _f	370.26	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	1.02	

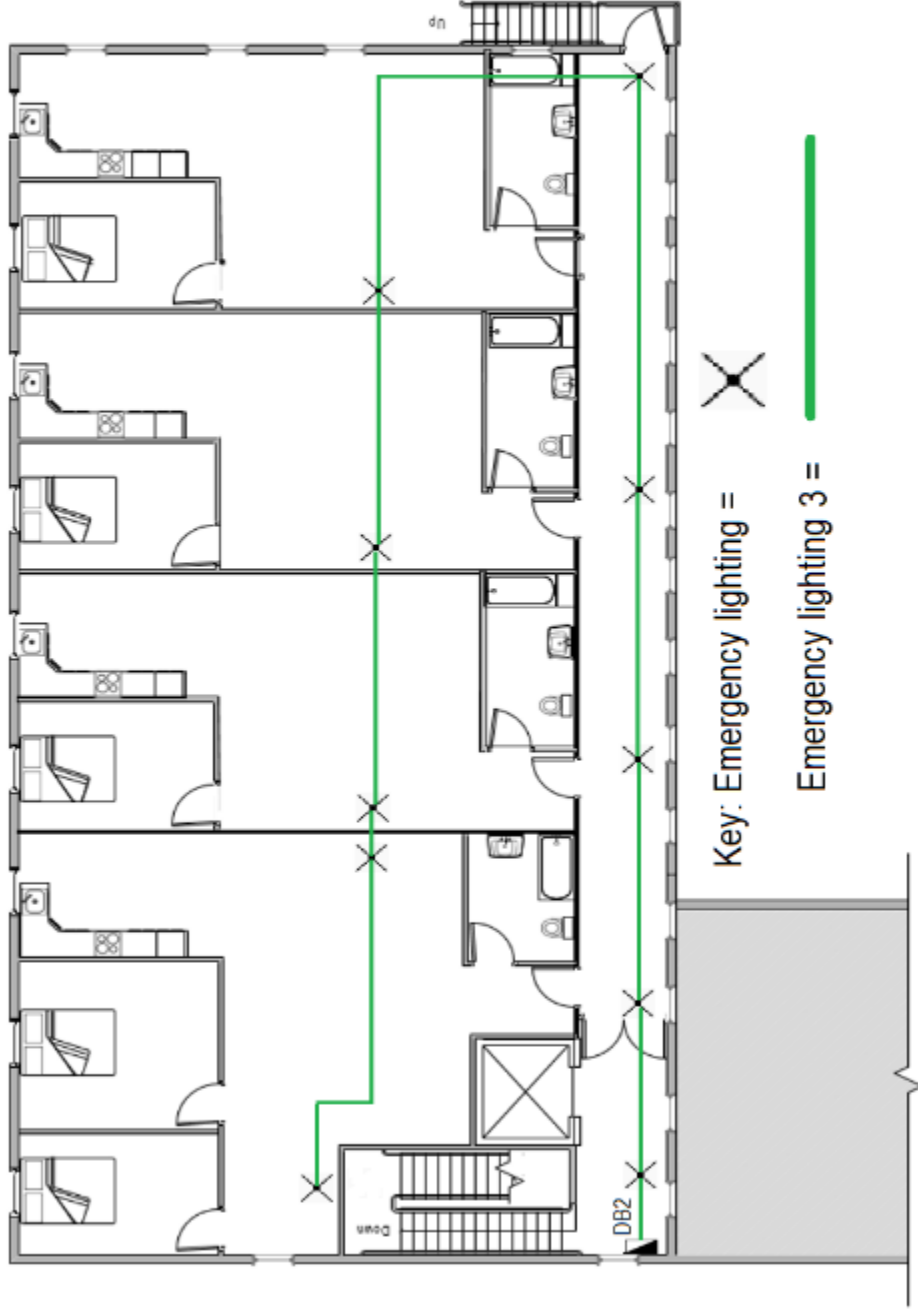
Circuit:	Lift from DB3			
	Nominal Voltage	V	400	
	Power	W	6900	
	Power Factor		0.89	
	Efficiency Factor		0.881	
	Design Current at full load	I _b	12.70	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	16	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic Multicore Armoured	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit	L	14	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	20.17	
	Tabulated Value of Cable Carrying Capacity	I _t	26	BS7671 Table 4D1A
	Selected Cable Size	mm ²	2.5	BS7671 Table 4D1A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	15	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	2.67	
	Resistance Of Line and CPC	r1+r2	14.82	Table L1 from On Site Guide
	Multiplier		1.2	Table L3 from On Site Guide
	Actual Resistance Of Circuit	R1+R2	0.25	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.52	
	Maximum Earth Loop Impedance	Z _{s (max)}	2.72	BS7671 Table 41.3
	Fault Current	I _f	770.75	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.2 - 54.6
	Min Cross Sectional Area Of CPC (mm ²)	S	2.12	

Emergency Lighting

The final thing that needs to be installed as part of the design is emergency lighting. Emergency lighting needs to be installed in case of a mains power failure. The lights are powered by rechargeable back up batteries. These batteries are either located inside the light itself, or there is a central battery located within the building with connections that run to each light. Emergency lighting once illuminated must provide a minimum of 1.5 hours light but can power its luminaire for 3 hours. The law states that if you manage a building, emergency and exit lighting may be required. The emergency lighting should be installed where there are “changes in floor level, corridor intersections, changes in direction, the outside of each final exit, control / plant rooms, lifts, toilet areas over 8m²”. (Safelines, 2019) As you can see from the diagram below, we cover these points by the placement of the emergency lights.

Like normal household lighting, and as indicated in the cable calculation below emergency lighting can be powered from 70°C Thermoplastic flat with protective conductor. Each light will also be counted as 100W each when taking the power into account.





Sheltered accommodation First Floor
Scale 1:125

Circuit:	Emergency lighting 1 from DB3			
	Nominal Voltage	V	230	
	Power	W	700	
	Design Current	I _b	3.04	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	44.5	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	3.93	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	1.61	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	1.88	
	Maximum Earth Loop Impedance	Z _{s (max)}	7.27	BS7671 Table 41.3
	Fault Current	I _f	122.17	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.34	

Circuit:	Emergency lighting 2 from DB4			
	Nominal Voltage	V	230	
	Power	W	800	
	Design Current	I _b	3.48	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	48	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	4.84	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	1.74	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	2.01	
	Maximum Earth Loop Impedance	Z _{s (max)}	7.27	BS7671 Table 41.3
	Fault Current	I _f	114.46	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3

	Min Cross Sectional Area Of CPC (mm ²)	S	0.31	
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Circuit:	Emergency lighting 3 from DB2			
	Nominal Voltage	V	230	
	Power	W	800	
	Design Current	I _b	3.48	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	48	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	7.57	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	6.9	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	4.84	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	1.74	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	2.01	
	Maximum Earth Loop Impedance	Z _{s (max)}	7.27	BS7671 Table 41.3
	Fault Current	I _f	114.46	
	Disconnection Time	t	0.1	BS7671 Graph

	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	0.31	

Supply to distribution boards

Throughout the design, we have installed all necessary lighting and power distribution. To conclude the assignment, below is a breakdown of all power distributed to all 11 DB's

Circuit:	DB1 supply			
	Nominal Voltage	V	400	
	Power	W	62960	
	Power Factor		1	
	Efficiency Factor		1	
	Design Current at full load	I _b	90.87	
	Protective Device		BSEN 60898 Type C	
	Protective Device Rating	I _n	100	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic Multicore Armoured	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit	L	3	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		1	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	1	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	97.09	
	Tabulated Value of Cable Carrying Capacity	I _t	110	BS7671 Table 4D1A
	Selected Cable Size	mm ²	25	BS7671 Table 4D1A
	Maximum Voltage Drop	V _{d (max)}	20	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	0.17	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.05	
	Resistance Of Line and CPC	r ₁ +r ₂	1.454	Table L1 from On Site Guide
	Multiplier		1.2	Table L3 from On Site Guide
	Actual Resistance Of Circuit	R ₁ +R ₂	0.01	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.28	
	Maximum Earth Loop Impedance	Z _{s (max)}	0.44	BS7671 Table 41.3
	Fault Current	I _f	1453.31	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.2 - 54.6
	Min Cross Sectional Area Of CPC (mm ²)	S	4.00	

Circuit:	DB2 supply			
	Nominal Voltage	V	400	
	Power	W	54900	
	Power Factor		1	
	Efficiency Factor		1	
	Design Current at full load	I _b	79.24	
	Protective Device		BSEN 60898 Type C	
	Protective Device Rating	I _n	100	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic Multicore Armoured	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit	L	3	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		1	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	1	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	97.09	
	Tabulated Value of Cable Carrying Capacity	I _t	110	BS7671 Table 4D1A
	Selected Cable Size	mm ²	25	BS7671 Table 4D1A
	Maximum Voltage Drop	V _{d (max)}	20	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	0.17	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.04	
	Resistance Of Line and CPC	r ₁ +r ₂	1.454	Table L1 from On Site Guide
	Multiplier		1.2	Table L3 from On Site Guide
	Actual Resistance Of Circuit	R ₁ +R ₂	0.01	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.28	
	Maximum Earth Loop Impedance	Z _{s (max)}	2.73	BS7671 Table 41.3
	Fault Current	I _f	1453.31	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.2 - 54.6
	Min Cross Sectional Area Of CPC (mm ²)	S	4.00	

Circuit:	DB3 supply			
	Nominal Voltage	V	400	
	Power	W	21000	
	Power Factor		1	
	Efficiency Factor		1	
	Design Current at full load	I _b	30.31	
	Protective Device		BSEN 60898 Type C	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic Multicore Armoured	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit	L	4	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		1	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	1	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	31.07	
	Tabulated Value of Cable Carrying Capacity	I _t	110	BS7671 Table 4D1A
	Selected Cable Size	mm ²	25	BS7671 Table 4D1A
	Maximum Voltage Drop	V _{d (max)}	20	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	0.17	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.02	
	Resistance Of Line and CPC	r1+r2	1.454	Table L1 from On Site Guide
	Multiplier		1.2	Table L3 from On Site Guide
	Actual Resistance Of Circuit	R1+R2	0.01	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.28	
	Maximum Earth Loop Impedance	Z _{s (max)}	2.73	BS7671 Table 41.3
	Fault Current	I _f	1444.15	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.2 - 54.6
	Min Cross Sectional Area Of CPC (mm ²)	S	3.97	

Circuit:	DB4 supply			
	Nominal Voltage	V	230	
	Power	W	26780	
	Design Current	I_b	116.43	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I_n	125	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	4.5	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C_a	1.03	BS7671 Table 4B1
	Grouping Factor	C_g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C_i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C_f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C_c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I_z	157.61	
	Tabulated Value of Cable Carrying Capacity	I_t	192	BS7671 Table 4D2A
	Selected Cable Size	mm ²	35	BS7671 Table 4D2A
	Maximum Voltage Drop	$V_{d(max)}$	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	1.25	BS7671 Table 4D1B
	Actual Voltage Drop	V_d	0.65	
	Resistance Of Line and CPC	r_1+r_2	1.674	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R_1+R_2	0.01	
	External Earth Loop Impedance	Z_e	0.27	
	Earth Fault Loop Impedance	Z_s	0.28	
	Maximum Earth Loop Impedance	$Z_{s(max)}$	0.69	BS7671 Table 41.3
	Fault Current	I_f	824.26	
	Disconnection Time	T	0.1	BS7671 Graph
	CPC Material Factor	K	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	2.27	

Circuit:	DB5 supply			
	Nominal Voltage	V	230	
	Power	W	11860	
	Design Current	I _b	51.57	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	63	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	11	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	79.44	
	Tabulated Value of Cable Carrying Capacity	I _t	83	BS7671 Table 4D2A
	Selected Cable Size	mm ²	16	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	2.4	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	1.36	
	Resistance Of Line and CPC	r ₁ +r ₂	2.3	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.03	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.30	
	Maximum Earth Loop Impedance	Z _{s (max)}	0.69	BS7671 Table 41.3
	Fault Current	I _f	765.75	
	Disconnection Time	T	0.1	BS7671 Graph
	CPC Material Factor	K	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	2.11	

Circuit:	DB6 supply			
	Nominal Voltage	V	230	
	Power	W	11860	
	Design Current	I _b	51.57	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	63	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	16	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	79.44	
	Tabulated Value of Cable Carrying Capacity	I _t	83	BS7671 Table 4D2A
	Selected Cable Size	mm ²	16	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	2.4	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	1.98	
	Resistance Of Line and CPC	r ₁ +r ₂	2.3	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.04	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.31	
	Maximum Earth Loop Impedance	Z _{s (max)}	0.69	BS7671 Table 41.3
	Fault Current	I _f	732.11	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	2.01	

Circuit:	DB7 supply			
	Nominal Voltage	V	230	
	Power	W	11860	
	Design Current	I _b	51.57	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	63	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	21	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	79.44	
	Tabulated Value of Cable Carrying Capacity	I _t	83	BS7671 Table 4D2A
	Selected Cable Size	mm ²	16	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	2.4	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	2.60	
	Resistance Of Line and CPC	r ₁ +r ₂	2.3	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.06	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.33	
	Maximum Earth Loop Impedance	Z _{s (max)}	0.69	BS7671 Table 41.3
	Fault Current	I _f	701.31	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	1.93	

Circuit:	DB8 supply			
	Nominal Voltage	V	230	
	Power	W	19320	
	Design Current	I _b	84.00	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	100	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	6	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	126.09	
	Tabulated Value of Cable Carrying Capacity	I _t	130	BS7671 Table 4D2A
	Selected Cable Size	mm ²	25	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	1.5	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.76	
	Resistance Of Line and CPC	r ₁ +r ₂	1.454	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.01	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.28	
	Maximum Earth Loop Impedance	Z _{s (max)}	0.69	BS7671 Table 41.3
	Fault Current	I _f	820.06	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	2.25	

Circuit:	DB9 supply			
	Nominal Voltage	V	230	
	Power	W	11860	
	Design Current	I _b	51.57	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	63	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	7	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	79.44	
	Tabulated Value of Cable Carrying Capacity	I _t	83	BS7671 Table 4D2A
	Selected Cable Size	mm ²	16	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	2.4	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	0.87	
	Resistance Of Line and CPC	r ₁ +r ₂	2.3	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.02	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.29	
	Maximum Earth Loop Impedance	Z _{s (max)}	0.69	BS7671 Table 41.3
	Fault Current	I _f	794.97	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	2.19	

Circuit:	DB10 supply			
	Nominal Voltage	V	230	
	Power	W	11860	
	Design Current	I _b	51.57	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	63	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	12	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	79.44	
	Tabulated Value of Cable Carrying Capacity	I _t	83	BS7671 Table 4D2A
	Selected Cable Size	mm ²	16	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	2.4	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	1.49	
	Resistance Of Line and CPC	r ₁ +r ₂	2.3	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.03	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.30	
	Maximum Earth Loop Impedance	Z _{s (max)}	0.69	BS7671 Table 41.3
	Fault Current	I _f	758.78	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	2.09	

Circuit:	DB11 supply			
	Nominal Voltage	V	230	
	Power	W	11860	
	Design Current	I _b	51.57	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	63	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	17	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	79.44	
	Tabulated Value of Cable Carrying Capacity	I _t	83	BS7671 Table 4D2A
	Selected Cable Size	mm ²	16	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	2.4	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	2.10	
	Resistance Of Line and CPC	r ₁ +r ₂	2.3	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	0.05	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	0.32	
	Maximum Earth Loop Impedance	Z _{s (max)}	0.69	BS7671 Table 41.3
	Fault Current	I _f	725.74	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	2.00	

Data Sheets

The following are datasheets that I have used to complete this assignment.

(LED Matt ceiling light, 2019)

Eglo Pasteri LED Matt Grey Ceiling Light - 11W

Product code: 164868



2 Reviews Write a Review



Classic style ceiling light with LED light and an outer matt grey shade. The Pasteri ceiling light is a simple and sweet fitting with a grey fabric shade and plastic diffuser. Integrated with a warm white LED, this fitting emits 1020 lumens so would be lovely in a dark hall way or a lounge/bedroom with low ceiling.

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Product details

Depth: 320 mm

Height: 90 mm

Length: 320 mm

Width: 320 mm

Bulb Type: LED

Bulb Supplied: Yes

Average Life Span: 15,000 hrs

Equivalent Wattage: 50 W

Wattage: 11 W

Voltage: 220 V-240 V

Lumens: 950 lm

Colour Temperature: 3000 K

Colour: White

IP Rating: IP20

Dimmable: No

Suitable for: All Living Areas

Number of Bulbs: 1

Pack Quantity: 1

Type: Flush

Manufacturer Model No: 31592

Brand Name: Eglo

(Ready LED Ceiling Light, 2019)

DRIVER INCLUDED

GET OFFER NOW

ReadyLED 7W Fitted LED Downlight 600 Lumens, Standard (Tilt)

Specification Table

Finish:	Satin Chrome
Lumens:	600LM
Power:	7W
Equivalent Wattage:	60W
Input Voltage:	BS-265V AC
Voltage:	27-42V
Height (mm):	42mm
Diameter (mm):	107mm
Cutting Hole (mm):	92mm
Life Hours:	50,000
Beam Angle:	45°
IP Rating:	IP20
Colour:	Warm White (3000K) and Cool White (5000K)
Warranty:	2 Years
Certification:	CE, RoHS
Brand:	Mirrorstone

Product Gallery

◀ ▶

(Sylvania Sylcircle ceiling light, 2019)

Sylvania Sylcircle LED Wall & Ceiling Light 3000K L350 - 6W

Product code: 149560 ★★★★★ (4.5)
2 Reviews. Write a Review

Perfect wall or ceiling mounted solution for hallways, kitchens or applicable zone 2 bathroom and wet areas thanks to its IP44 rating. Even and uniform light distribution with a halo lighting effect on the wall surface. Supplied with integrated LED driver (non-dimmable). IK03 PMMA diffuser. Low maintenance with 30,000 hours LLD life expectancy.

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Product details

Depth: 75 mm Height: 75 mm Width: 160 mm Bulb Type: LED Bulb Supplied: Yes Average Life Span: 30,000 hrs Energy Efficiency Rating: A+	Equivalent Wattage: 60 W Wattage: 6 W Voltage: 220 V-240 V Lumens: 350 lm Colour Temperature: 3000 K Light Colour: Warm White Colour: White	IP Rating: IP44 Dimmable: No Suitable for: All Living Areas & Bathrooms Pack Quantity: 1 Type: Flush Brand Name: Sylvania
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Wylex 80A 10 Way Dual Split Load High Integrity Metal Consumer Unit with 10 MCBs - Fully Loaded

OVERVIEW

- Wylex 80A 10 Way Dual Split Load High Integrity Metal Consumer Unit with 10 MCBs - Fully Loaded
- Contains: 1 x 100A switch disconnector/main switch, 2 x 80A 30mA RCDs, 10 x MCBs (3 x 6A, 2 x 16A, 4 x 32A, 1 x 40A)
- Size: 343 x 264 x 123mm
- 3rd Amendment compliant
- Compact, all metal, low smoke and fume enclosure
- 10 usable ways / 16 module spaces when empty
- Flexible busbar

SPECIFICATION

Amp rating	90	Depth mm	98
Dimensions	343 x 264 x 123mm	Main Switch Rating (A)	100
MCBs Supplied	Yes	No. of Ways	10
No. of MCBs Supplied	10	No. of RCDs Supplied	2
Published Date	01/01/2018	RCD Rating	80
RCD Trip Rating (mA)	30	Sold	Each
Type	High Integrity Dual RCD	Width mm	342

(Inverter Drive Supermarket, 2019)



TEC IE2 7.5kW Aluminium Three Phase Motor 400V 2 Pole 132S Frame B35

7.623TECAB35-IE2 (TECA2-132S2-2-B35)

TEC Electric - 7.5kW 3ph 2 Pole High Efficiency Foot and Flange Mounting (B35) 132S Frame AC Motor for 400V 3 phase supply. Inverter Rated for use with a Variable Frequency Inverter Drive or a fixed frequency mains supply at 50Hz.

Fixed mains supply output: 7.5kW (10HP) x 2910RPM at 400V x 50Hz 3ph

Inverter Supply Output: 14:1 Speed Control range from 291RPM to 4074RPM for 5Hz to 70Hz control, with suitable de-rating at the lower speeds.

Full Load Current - 13.8A at 400V.

Power Factor is 0.89 when mains connected at 50Hz.

Efficiency is 88.1%

262mm Wide x 437mm Long x 318mm high overall in its IP55 enclosure

Foot mount on 12mm holes at 216mm wide x 140mm centres 89mm back from the shaft shoulder and Flange mount on 16mm holes at 265mm PCD with 230mm diameter spigot in the 300mm diameter flange

Shaft is 38mm dia x 80mm with 10mm wide key

Weight is 46.2kg

Rated at 40C Ambient.

Ventilation space required at rear cooling air intake.

Thermistor for over-temperature protection.

Manufacturer Part Number is 7.23TECAB35-IE2. Previous Part Number was - TECA2-132S2-2-B35

Cable calculations showing formulas

Below are three cable calculations, one lighting circuit, one ring circuit and one three phase circuit displaying formulas.

Circuit:	Single Room Lighting, GFR1, GFR2, GFR3 from DB 5,6 & 7 respectively			
	Nominal Voltage	V	230	
	Power	W	300	
	Design Current	I _b	=D4/D3	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	6	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	12	
	Insulation		None	
	Ambient Temperature	°C	24	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	=D7/(D15*D16*D17*D18*D19)	
	Tabulated Value of Cable Carrying Capacity	I _t	22	BS7671 Table 4D2A
	Selected Cable Size	mm ²	1.5	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	=3%*D3	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A/m	29	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	=(D24*D5*D11)/1000	
	Resistance Of Line and CPC	r ₁ +r ₂	30.2	Table L1 OSG
	Multiplier		1.2	Table L3 OSG
	Actual Resistance Of Circuit	R ₁ +R ₂	=(D26*D27*D11)/1000	
	External Earth Loop Impedance	Z _e	0.27	
	Earth Fault Loop Impedance	Z _s	=D29+D28	
	Maximum Earth Loop Impedance	Z _{s (max)}	5.82	BS7671 Table 41.3
	Fault Current	I _f	=D3/D30	
	Disconnection Time	t	0.1	BS7671 Graph

	CPC Material Factor	k	115	BS7671 Table 54.3
	Min Cross Sectional Area Of CPC (mm ²)	S	$=(\text{SQRT}(\text{D32}^2 * \text{D33}))/\text{D34}$	

Circuit:	Communal Room 3 from DB4			
	Nominal Voltage	V	230	
	Power	W	7360	
	Design Current	I _b	$=\text{D152}/\text{D151}$	
	Protective Device		BSEN 61009 Type B	
	Protective Device Rating	I _n	32	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic flat with protective conductor	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit (m)	L	31.5	
	Insulation		None	
	Ambient Temperature	°C	28	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	$=\text{D155}/(\text{D163} * \text{D164} * \text{D165} * \text{D166} * \text{D167})$	
	Tabulated Value of Cable Carrying Capacity	I _t	51	BS7671 Table 4D2A
	Selected Cable Size	mm ²	6	BS7671 Table 4D2A
	Maximum Voltage Drop	V _{d (max)}	$=5\% * \text{D151}$	BS7671 Table 4Ab

Voltage Drop Per Meter	mV/A/m	7.3	BS7671 Table 4D1B
Actual Voltage Drop	V_d	$=(D172 \cdot D153 \cdot D159)/1000$	
Resistance Of Line and CPC	$r1+r2$	10.49	Table L1 OSG
Multiplier		1.2	Table L3 OSG
Actual Resistance Of Circuit	$R1+R2$	$=(D174 \cdot D175 \cdot D159)/1000$	
External Earth Loop Impedance	Z_e	0.27	
Earth Fault Loop Impedance	Z_s	$=D177+D176$	
Maximum Earth Loop Impedance	$Z_{s(max)}$	1.36	BS7671 Table 41.3
Fault Current	I_f	$=D151/D178$	
Disconnection Time	t	0.1	BS7671 Graph
CPC Material Factor	k	115	BS7671 Table 54.3
Min Cross Sectional Area Of CPC (mm ²)	S	$=(SQRT(D180^2 \cdot D181))/D182$	

Circuit:	Communal room cooker from DB3			
	Nominal Voltage	V	400	
	Power	W	7000	
	Power Factor		1	
	Efficiency Factor		1	
	Design Current at full load	I _b	$=D41/((SQRT(3))*D40*D42*D43)$	
	Protective Device		BSEN 60898 Type B	
	Protective Device Rating	I _n	16	BS7671 Table 41.3
	Cable Type		70°C Thermoplastic Multicore Armoured	
	Installation Method		Cable Tray	
	Reference Method		E	
	Length Of Circuit	L	25	
	Insulation		None	
	Ambient Temperature	°C	30	
	Maximum No. Of Circuits Grouped		4	
Correctional Factors	Ambient Temperature Factor	C _a	1.03	BS7671 Table 4B1
	Grouping Factor	C _g	0.77	BS7671 Table 4C1
	Thermal Insulating Factor	C _i	1	BS7671 Table 52.2
	Fuse Factor (BS3036)	C _f	1	BS7671 Reg 433.1.202
	Buried In The Ground Factor	C _c	1	BS7671 Reg 433.1.203
	Cable Current Carrying Capacity	I _z	$=D46/(D54*D55*D56*D57*D58)$	
	Tabulated Value of Cable Carrying Capacity	I _t	26	BS7671 Table 4D1A
	Selected Cable Size	mm ²	2.5	BS7671 Table 4D1A
	Maximum Voltage Drop	V _{d (max)}	11.5	BS7671 Table 4Ab
	Voltage Drop Per Meter	mV/A /m	15	BS7671 Table 4D1B
	Actual Voltage Drop	V _d	$=(D63*D44*D50)/1000$	
	Resistance Of Line and CPC	r1+r2	14.82	Table L1 from On Site Guide

	Multiplier		1.2	Table L3 from On Site Guide
	Actual Resistance Of Circuit	$R1+R2$	$= (D65 * D66 * D50) / 1000$	
	External Earth Loop Impedance	Z_e	0.27	
	Earth Fault Loop Impedance	Z_s	$= D68 + D67$	
	Maximum Earth Loop Impedance	$Z_{s(max)}$	2.73	BS7671 Table 41.3
	Fault Current	I_f	$= D40 / D69$	
	Disconnection Time	t	0.1	BS7671 Graph
	CPC Material Factor	k	115	BS7671 Table 54.2 - 54.6
	Min Cross Sectional Area Of CPC (mm ²)	S	$= (SQRT(D71^2 * D72)) / D73$	

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