



Wellington Mills Estate
Lambeth
London

Report on Electrical Main Intake and Sub-mains
Installation Proposals

August 2018

Project: Wellington Mills Estate
comprising:
Holst Court, Oakey Lane, Mead Row
Lambeth
London
SE1 7JG

Client: Wellington Mills Housing Co-operative
24 Mead Row
Lambeth
London
SE1 7JG

Document: Report on Electrical Main Intake and Sub-main
Installation Proposals

Date: 24th August 2018

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Checked by: Robert Wilson

Approved by: Graham Champion

Revision	Date	Description	Prepared	Checked	Approved
-	24/08/2018	Initial Report	RE	RW	GC

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1.0 EXECUTIVE SUMMARY

Green Building Design Consultants have been appointed by the Estate Management Team, led by Isaac Essuman at the Wellington Mills Housing Co-operative to comment on proposals for an update of electrical services supplying the residential properties at the Wellington Mills Estate in Lambeth, South London, and to comment on the proposed works.

Following on from our review of the information supplied we make comment on our findings in Section 4. There has been no agreement concerning the maximum demand or diversity which may be applied to the reduced service supplies. Actual demand must be discussed and agreed with all parties including the electrical distributor.

The works on the electrical systems are planned to commence without detailed electrical design for the sub-mains or the containment.

The existing consumer units/ fuseboards in each property may not be suitable for the proposed Prospective Fault Current.

No addition or alteration, temporary or permanent, shall be made to an existing installation, unless it has been ascertained that the rating and condition of any existing equipment, including that of the distributor, will be adequate for the altered circumstances. BS7671:2008+A3:2015

2.0 GENERAL

2.1 Purpose of Report

Green Building Design Consultants have been appointed by the Board of the Estate Management Team, led by Isaac Essuman, at the Wellington Mills Housing Co-operative to comment on proposals for an update of the electrical sub-main infrastructure to the flats at Wellington Mills Estate in Lambeth, South London, and to comment on the proposed method.

There would appear not to have been a suitable duty of care applied to the current works.

2.2 Reservations

Green Building Design Consultants have not carried out a full survey of the site, and this report is based on a review of the documentation listed below which has been received from the Estate Management Team, and a limited on-site review.

We have been supplied with the following tender drawings for Mead Row and Holst Court:

Frankham 225494-WM-(34)-60-01-(T) Holst Court Landlords Electrical Services
Frankham 225494-WM-(34)-60-02-(T) Holst Court Landlords Electrical Services
Frankham 225494-WM-(34)-60-03-(T) Holst Court Landlords Electrical Services
Frankham 225494-WM-(34)-SC-01-(T) Holst Court Landlords Electrical Services
Frankham 225494-WM-(34)-SC-02-(T) Holst Court Landlords Electrical Services
Frankham 225494-WM-(36)-60-01-(T) Mead Row (1-16) Landlords Electrical Services
Frankham 225494-WM-(36)-60-02-(T) Mead Row (1-16) Landlords Electrical Services
Frankham 225494-WM-(36)-60-03-(T) Mead Row (1-16) Landlords Electrical Services
Frankham 225494-WM-(36)-SC-01-(T) Mead Row (1-16) Landlords Electrical Services
Frankham 225494-WM-(37)-60-01-(T) Mead Row (17-40) Landlords Electrical Services
Frankham 225494-WM-(37)-60-02-(T) Mead Row (17-40) Landlords Electrical Services
Frankham 225494-WM-(37)-60-03-(T) Mead Row (17-40) Landlords Electrical Services
Frankham 225494-WM-(37)-SC-01-(T) Mead Row (17-40) Landlords Electrical Services

At the time of the audit no drawings were made available for the Oakey Lane blocks.

2.3 Record Drawings and Maintenance Manuals

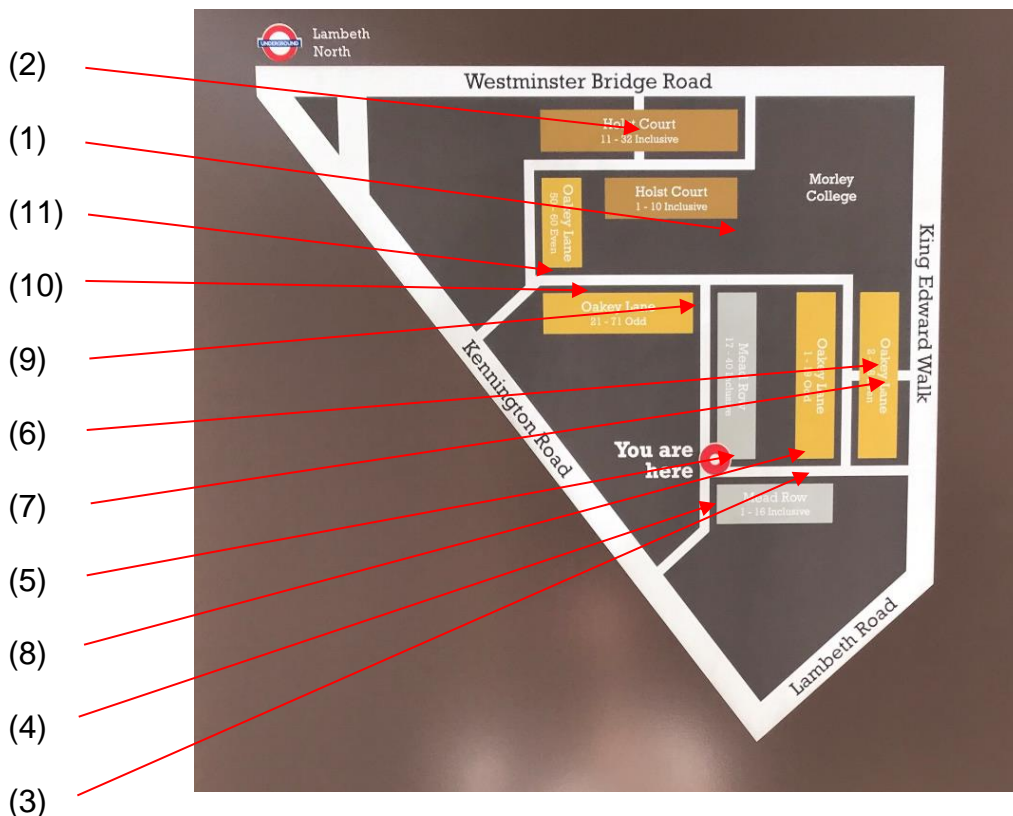
We have not seen the O&M information on site, but understand that the electrical services consisting of mains intake distribution and sub-mains are consistent with being original services from the building construction c.1975-76.

3.0 ELECTRICAL SERVICES

The Wellington Mills Estate is a series of apartment blocks built in approximately 1974-76 by the Greater London Authority. These are now a mix (60/40) of leasehold and council-tenanted properties. The estate comprises 8no. blocks of two and three storey flats and maisonettes on a roughly triangular site between Kennington Road, Westminster Bridge Road and King Edward Walk in Lambeth. Electrical distribution is via Distribution Network Operator (DNO) mains intakes operated by EDF Energy, situated locally at each block, with one or two intakes per block to reduce the length of sub-main cable runs.

These public supply services are presented at:

- (1) 1-10 Holst Court, ground floor.
- (2) 11-32 Holst Court, car park/ basement.
- (3) 5-11, 14-16 Mead Row, South East end, ground floor.
- (4) 1-4, 13-14 Mead Row, North West end, ground floor.
- (5) 17-40 Mead Row, North West end, ground floor.
- (6) Even numbers, Oakey Lane, car park/ basement.
- (7) Even numbers, Oakey Lane, second floor Lobby.
- (8) Odd numbers 1-19, Oakey Lane, South end ground floor
- (9) Odd numbers (21-37) Oakey Lane/ 22-24, 30-32, 38-40 Mead Row, Basement.
- (10) Odd numbers (39-71) Oakey Lane, North West ground floor.
- (11) 50-60 Oakey Lane, South end, ground floor.



3.1 Service Heads

The service heads are 200Amp Triple Pole and Neutral (TPN) units. The distribution is provided by unswitched Ryefield 'J' Pattern multiway TPN fuseboards with GRP fuse carriers.

Supply characteristics are as follows:

Voltage U/U_o; 400/230volts

Earthing System; TN-S

External Earth Loop Impedance Z_e/ Prospective Fault Current (PFC single phase)

1	0.16Ω	1.5kA
2	0.14Ω	2.1kA
3	0.18Ω	1.4kA
4	0.15Ω	1.7kA
5	0.17Ω	1.5kA
6	0.18Ω	1.3kA
7	0.19Ω	1.3kA
8	0.18Ω	1.4kA
9	0.14Ω	1.7kA
10	0.15Ω	1.7kA
11	0.12Ω	2.2kA

Readings taken at source.

Between 17 August and 23 August, we have carried out electrical testing for External Earth Loop Impedance (Z_e) and Prospective Fault Current (PFC) to each Mains Intake and a selective audit of a number of flats where suitable access was available.

3.2 Existing Sub-Mains

The existing sub-mains run in steel trunking and conduit through the structure of the building and are generally not exposed or accessible for maintenance and inspection.

A single-phase (two wire system) supply consisting of two 10mm² PVC single insulated line conductors supplies each flat, with the Circuit Protective Conductor (CPC) provided by the steel cable containment.

Protection from fault or overload for each sub-main is believed to be provided by one BS1362 60Amp HRC fuse (NiBlock 23/08/2018) provided at the Ryefield TPN Fuseboards.

Each property is provided with a metal meter cabinet in the hall. The meter cabinet is installed in the main escape route from the properties. The sub-mains are terminated into the Utility meter, and a Main Earth Terminal is provided, fixed to the case of the meter cabinet. In the original installation Wylex 'M' Series 60 Range' BS3036 rewirable skeleton fuse boards were installed in the meter cabinet. These pre-1977 fuseboards are believed to have a fault current capacity of 1-1.5kA.

The extent of the works to the sub-mains is limited to the replacement of the Ryefield fuseboards at the main intakes, installation of cable containment and installation of single cables comprising Line conductors and CPC (three wire system). Existing meters and residents' consumer units are not currently planned for inspection or replacement.

3.3 Maximum Demand/ Design Current

No formal communication has been received to indicate the proposed Maximum Demand, however NiBlock have indicated during the Co-Op meeting of 23 August 2018 that the sub-mains are protected by 60Amp BS1361 HRC fuses.

During the works the Mains Intakes at Mead Row blocks 1-16 (4), Oakey Second Floor (7) and Mead Row 17-40 (9) will be removed, increasing sub-main cable lengths and reducing the building intakes to one each (a 50% reduction).

A communication on 19 July 2018 (5.0 B1) from Gary Collard from Lambeth, indicates that a design current I_b of 40Amps would be used to calculate Volt Drop.

NB: BS7671:2008+A3:2015 on-site guide gives us the guidance for diversity of 100% of the largest circuit, 40% of all others. In the standard property it would equate to 48.8 Amps. A number of leasehold properties may have an increased demand due to installation of additional electrical equipment.

Given the reduction in Intakes at Oakey Lane and Mead Row the following design current to the service intakes will be assumed.

- (3) Mead Row, 1-16 South East end, ground floor. Additional Load: + 6 Flats
- (4) removed
- (5) 17-40 Mead Row, North West end, ground floor. Additional Load: + 9 Flats
- (9) 22-24, 30-32, 38-40 Mead Row, Basement: - Removed
- (6) Even numbers, Oakey Lane, car park/ basement. Additional Load: + 12 Flats
- (7) Removed
- (9) Odd numbers Oakey Lane, Basement. Change in Load source: + 8 Flats
- (10) Removed

Each main intake incorporates 3no. 200Amp service fuses.

1. Intake	2. No. of Flats 'n' (Demand Factor- 'g' in brackets)	3. Available-Amps per flat from 200Amp TP&N Supply	4. Demand @40Amps [†] - I _b Amps	5. Application of Diversity* Amps
1	10 (0.21)	60	133 (0.66x)	47.01
2	22 (0.18)	27	293 (1.46x)	92.39
3	16 (0.2)	37.5	213 (1.06x)	65.06
4	0-6 flats	Removed		
5	24 (0.17)	25	320 (1.60x)	82.63
6	22 (0.18)	27	293 (1.47x)	92.39
7	0-12 flats	Removed		
8	10 (0.21)	100	133 (0.66x)	47.01
9	28 (0.17)	21.4	373 (1.86x)	90.93
10	0-8 Flats	Removed		
11	6 (0.23)	100	80 (0.40x)	34.97

[†]I_b as speculated by Lambeth for calculating Volt Drop. Service Head fuse, I_n of 200Amps/phase, fusing occurs at 1.25x fuse rating (i.e. 250A)

*Diversity taken from IET Electrical Installation Design Guide. 3.0 Maximum Demand and Diversity. Figure 3.4, curve 'b'- where $I_d + g(n-1)I_d$. where I_b is calculated (BS7671:2008+A3:2015 on-site guide) at 48.8amps per flat. The diversified load represents our predicted load on an intake using these guidelines.

Actual demand must be discussed and agreed with all parties including the electrical distributor.

Currently an electrical design has not been completed. A detailed review of the cable design, routes to and inside each flat, and sizing of containment to include the appropriate space factors at all points is required.

"No addition or alteration, temporary or permanent, shall be made to an existing installation, unless it has been ascertained that the rating and condition of any existing equipment, including that of the distributor, will be adequate for the altered circumstances." BS7671:2008+A3:2015

4.0 CONCLUSION

From the information we have and subject to Lambeth producing a detailed electrical design there are two main areas of concern.

At this time Lambeth Council have not carried out a Maximum Demand and Average loading assessment. While EDF have attended site, this was only a visual inspection. There should be a formal discussion with all parties about appropriate application of diversity and likely demand.

“No addition or alteration, temporary or permanent, shall be made to an existing installation, unless it has been ascertained that the rating and condition of any existing equipment, including that of the distributor, will be adequate for the altered circumstances.” Source BS7671:2008+A3:2015

At this stage we recommend a full detailed electrical design is completed to calculate the correct size of line conductors to provide the most economic use of cable sizing and containment. Based on the comments from Lambeth Council's representative at the meeting of the 23 August, 16mm² Line and CPC conductors will be used up to a length of 22 metres. This is not based on any calculation and will require larger containment on landings and raisers than may be required. Our calculation indicates that 16mm² LSF conductors could be used at increased lengths reducing cable and containment costs.

Comments:

- Energy and maximum demand reports have not been carried out. Actual demand must be discussed and agreed with all parties including the electrical distributor.
- A detailed electrical design should be completed in order that economically sized sub-main cables for the installation and appropriately sized containment are selected. It is expected that the increase of sub-main cables to 25mm is not required, will be more expensive and will require an unnecessary increase in containment sizes. Representative cable calculations for a minimum and maximum length are to be found in Appendix A.
- Having carried out a selective audit on properties across the estate, all those with the original Wylex 'M Series 60 Range' Skeleton Fuseboard with the original rewirable fuses or retro-fit miniature circuit breakers (MCB) may not be able to support the current Prospective Fault Currents >1.3kA. This will be made worse by the planned sub-main works. It is recommended that all the original boards are replaced before works commence.
- No addition or alteration, temporary or permanent, shall be made to an existing installation, unless it has been ascertained that the rating and condition of any existing equipment, including that belonging to the distributor, will be adequate for the altered circumstances.
- On completion of the works, and after changing the supply characteristics, an Electrical Installation Completion certificate should be provided to each property.

- No addition or alteration, temporary or permanent, should be made to an existing installation, unless it has been ascertained that the rating and condition of any existing equipment, including that belonging to the distributor, will be adequate for the altered circumstances.
- We have not received drawings for the installation of containment being provided for the Oakey Lane blocks. Assumptions have been made in line with Holst Court.
- Attention is drawn to the use of cables and cable containment systems used in escape routes: to include individual properties, corridors, halls, stairs. These should comply with BS7671:2008+A3:2015 in that they shall be non-fire propagating (422.2.1), and shall offer suitable support in the event of a fire (521.11.201)
- Access to Main Intake Risers is uncontrolled. A number of uncontrolled keys are available allowing meter replacement without due control of the EDF equipment.
- There is uncontrolled access to Ryefield fuseboards. This is dangerous and in breach of the Electricity at Work Regulations. Access to the Ryefield TPN fuseboards while live is not recommended by the manufacturers. This should be controlled to allow access to appropriately competent and authorised persons only.
- Mains Intake Risers do not contain suitable signage or drawings as directed by Electrical Safety, Quality and Continuity (ESQC) Regulations and recommendations from the HSE.
- Main Intake Risers were found with failed or broken light fittings.
- Mains Intake Risers were found not to have emergency lights.
- Mains Intake Risers were found to have rubbish and materials not used directly in the riser.
- Two fire extinguishers were found not to have been tested in the last twelve months.
- Two Mains Intake Risers were found to have evidence of rodents. Two Ryefield fuseboards had evidence of dead rats inside. This access was afforded by missing trunking covers or holes in the trunking.

Appendix A - Projected Cable Calculations

16mm² Line and CPC at 11 metres Ze 0.12Ω

Cable Analysis Report			
Cbl_SM-1			
Project Reference:	Wellington Mills	Job Number:	5311
Document No:		Created On:	29/08/2018
Created By:	Rob	Revised By:	
		Rev Date:	
		Revision:	

CIRCUIT DETAILS	
Cable Reference	Id No.: Cbl_SM-1 Name:
Connection	From: Source-1 To: CU-1
Load	Consumer Unit Design Current Ib (A): 48.8 A

PROJECT SETTINGS	
Source	Id No.: Source-1
400V/230V 50Hz	Name: Type: TN Public
Voltage Drop Limits (%)	Lighting = 5.00 Other = 5.00 Setting: User Defined
Switching Scenario	N/A

CABLES	
Phase and Neutral	Type: Single-core, 90°C thermosetting insulated, non-arm, LSF Cu Table 4E1 Length (m): 11
CPC	Qty. & Size (mm ²): Phase = 1 x 16 [f] Neutral = 1 x 16 [a] Size (mm ²): Separate 16

CABLE SIZING		Calculations based on BS 7671:2008 (2015) Appendix 4, Section 6 and PD CLC/TR 50480:2011 Section 13	
Cable Type:	Single-core, 90°C thermosetting insulated, non-arm, LSF Cu Table 4E1	Size (mm²):	16 [f]
Installation Method:	6 - In horizontal trunking on a wooden/masonry wall	Ref. Method =	B
Cables in Parallel:	No		
Grouping Details:	Subject to simultaneous overload = No		
	Total Number of Grouped Circuits = 5	Derating for 5 circuits/cables	

Rating Factor	Condition	Table	Parameter	Rule
Ca = 1.00	Air Temperature (°C) = 30.0	4B1	Ib = 48.8 A	Diversified load current in highest loaded phase
Cg = 0.60		4C1	In = 60 A	In >= Ib
			Ir = N/A	--
			Iz = 81.3 A	BS 7671, App. 4, Equations 3/4 [per parallel cable]
			It = 100.0 A	It >= Iz [per parallel cable]
Ch = 1.00	3rd Harmonic = 0.00 %	11A		
Ci = 1.00	Run Through Insulation = No	52.2		

VOLTAGE DROP							Calculations based on BS 7671:2008 (2015) Appendix 4, Section 6 and PD CLC/TR 50480:2011 Section 13			
Cable Data							Design Current Ib (A/PF)			
Impedance:	r =	x =	Length (m)	Ca	Cg	It	L1	L2	L3	N
mV/A/m:	2.9	0	11	1.00	0.60	100.0 A	48.8/1.00	0.0/0.00	0.0/0.00	48.8
Total mΩ:	32	0	Correction Factor (Ct) = 0.9772				Voltage Drop (V/%)			
Temperature (°C):	Max. Normal (tp) = 90			Actual = 69.7			L1	L2	L3	
Cable Energy Loss (W):	At Design Current = 69.8			Fully Loaded = 76			1.52 / 0.66	0.00 / 0.00	0.00 / 0.00	

KEY: [a] = Auto setting; [f] = Fixed setting; [m] = Maximum setting; [d] = double neutral * denotes Error condition Page 1 of 2

Project: WM 16mm 11m.p17x Printed on: 29/08/2018
 Created using: v2017.0.2.556 BS 7671:2008 (2015) - Green Building Design Consultants © 1996-2017 Trimble Inc.

CIRCUIT DETAILS

Cable Reference	Id No.: Cbl_SM-1	Name:
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PROTECTIVE DEVICES

Overcurrent	Type:	Generic BS 1361 Fuse Domestic HBC	Rating In (A): 60
	Settings:	Phase fault discrimination check required	
Earth Fault	Type:	Generic BS 1361 Fuse Domestic HBC	Rating (A): 60
	Settings:	N/A	

OVERCURRENT PROTECTION Calculations based on BS 7671:2008 433.1, 434.5.1, 536.1 Para. 3

Protective Device	Type:	Generic BS 1361 Fuse Domestic HBC		
	Overload:	Rating In (A): 60	Overload Setting Ir (A): N/A	
		Motor Rating (A): N/A	Design Current Ib (A): 48.8 A	
	Breaking Capacity (kA):	Icu = 33	Cascaded = No	Ics = 33
Max. Fault Current (kA):	Source End = 16.000	Load End = 7.248	Source End Earth Fault Current (kA):	1.92
Line Conductor Adiabatic Check	CPD Energy Let-through (A ² s):	38.00 x 10 ³	Minimum Load End Fault Current Ifmin (kA) = 6.033	
	Adiabatic Limit k ² S ² (A ² s):	5.23 x 10 ⁶	Phase Conductor Section S (mm ²) = 16	

EARTH FAULT PROTECTION Calculations based on BS 7671:2008 411.3.2, 411.3.3, 411.4, 411.5, 543.1

Protection:	Generic BS 1361 Fuse Domestic HBC				Rating (A): 60		
Earth Fault Loop Impedance (Ω)					Circuit Protective Conductor (CPC) Details		
Ze	Z1	Z2	Zs	Max Zs	Conductor	k Value	Section (mm ²)
External	Phase	CPC	Total	inc. Cmin (exc. Cmin)	Phase 143	(k1)	Actual Equivalent
0.12000	0.01595	0.01595	0.13165	0.65971 (0.69443)	Separate 143	(k2)	16 Actual x (k2/k1) = 16.00
					Total = 16.00		
Earth Fault Disconnection Time (s)			Earth Fault Current (kA)		Adiabatic Check: Minimum Section CPC S = √(I²t)/k		
Actual from characteristic = 0.02			(Uo x Cmin)/(Zs x 1000) = 1.66		I ² t = 38.00 x 10 ³ A ² s Min. S (mm ²) = 1.36		
Maximum for circuit type = 5.00			Uo/(Zs x 1000) = 1.75				

ERRORS

Calculated in accordance with BS 7671:2008 (2015)	
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COMMENTS

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KEY: [a] = Auto setting; [f] = Fixed setting; [m] = Maximum setting; [d] = double neutral * denotes Error condition Page 2 of 2

Project: WM 16mm 11m.p17x Printed on: 29/08/2018
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Appendix A - Projected Cable Calculations

16mm² Line and CPC at 75 metres Ze 0.19Ω

Cable Analysis Report		Cbl_SM-1								
Project Reference:	Wellington Mills	Job Number:	5311	Rev Date:						
Document No:		Created On:	29/08/2018	Revision:						
Created By:	Rob	Revised By:								
CIRCUIT DETAILS										
Cable Reference	Id No.: Cbl_SM-1		Name:							
Connection	From: Source-1		To: CU-1							
Load	Consumer Unit		Design Current Ib (A): 48.8 A							
PROJECT SETTINGS										
Source	Id No.: Source-1									
400V/230V 50Hz	Name:	Type: TN	Public							
Voltage Drop Limits (%)	Lighting = 5.00	Other = 5.00	Setting: User Defined							
Switching Scenario	N/A									
CABLES										
Phase and Neutral	Type: Single-core, 90°C thermosetting insulated, non-arm, LSF Cu Table 4E1				Length (m): 75					
	Qty. & Size (mm ²): Phase = 1 x 16 [f]		Neutral = 1 x 16 [a]							
CPC	Size (mm ²): Separate 16									
CABLE SIZING Calculations based on BS 7671:2008 (2015) Appendix 4, Section 6 and PD CLC/TR 50480:2011 Section 13										
Cable Type:	Single-core, 90°C thermosetting insulated, non-arm, LSF Cu Table 4E1			Size (mm ²): 16 [f]						
Installation Method:	6 - In horizontal trunking on a wooden/masonry wall		Ref. Method = B	Trunking: Metal						
Cables in Parallel:	No									
Grouping Details:	Subject to simultaneous overload = No									
	Total Number of Grouped Circuits = 5		Derating for 5 circuits/cables							
Rating Factor	Condition	Table	Parameter	Rule						
Ca = 1.00	Air Temperature (°C) = 30.0	4B1	Ib = 48.8 A	Diversified load current in highest loaded phase						
Cg = 0.60		4C1	In = 60 A	In >= Ib						
			Ir = N/A	--						
			Iz = 81.3 A	BS 7671, App. 4, Equations 3/4 [per parallel cable]						
Ch = 1.00	3rd Harmonic = 0.00 %	11A	It = 100.0 A	It >= Iz [per parallel cable]						
Ci = 1.00	Run Through Insulation = No	52.2								
VOLTAGE DROP Calculations based on BS 7671:2008 (2015) Appendix 4, Section 6 and PD CLC/TR 50480:2011 Section 13										
Cable Data				Design Current Ib (A/PF)						
Impedance:	r =	x =	Length (m)	Ca	Cg	It	L1	L2	L3	N
mV/A/m:	2.9	0	75	1.00	0.60	100.0 A	48.8/1.00	0.0/0.00	0.0/0.00	48.8
Total mΩ:	218	0	Correction Factor (Ct) = 0.9772				Voltage Drop (V/%)			
Temperature (°C):	Max. Normal (tp) = 90		Actual = 69.7				L1	L2	L3	
Cable Energy Loss (W):	At Design Current = 475.9		Fully Loaded = 518				10.37 / 4.51	0.00 / 0.00	0.00 / 0.00	

KEY: [a] = Auto setting; [f] = Fixed setting; [m] = Maximum setting; [d] = double neutral

* denotes Error condition

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Project: WM 16mm max.p17x

Printed on: 29/08/2018

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CIRCUIT DETAILS

Cable Reference	Id No.: Cbl_SM-1	Name:
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PROTECTIVE DEVICES

Overcurrent	Type:	Generic BS 1361 Fuse Domestic HBC	Rating In (A): 60
	Settings:	Phase fault discrimination check required	
Earth Fault	Type:	Generic BS 1361 Fuse Domestic HBC	Rating (A): 60
	Settings:	N/A	

OVERCURRENT PROTECTION

Calculations based on BS 7671:2008 433.1, 434.5.1, 536.1 Para. 3

Protective Device	Type:	Generic BS 1361 Fuse Domestic HBC		
Overload:	Rating In (A):	60	Overload Setting Ir (A):	N/A
	Motor Rating (A):	N/A	Design Current Ib (A):	48.8 A
Breaking Capacity (kA):	Icu =	33	Cascaded =	No
Max. Fault Current (kA):	Ics =	33	Source End Earth Fault Current (kA):	1.21
	Source End =	16.000	Load End =	1.321

Line Conductor Adiabatic Check	CPD Energy Let-through (A²s):	38.00×10^{-3}	Minimum Load End Fault Current Ifmin (kA) =	1.038
	Adiabatic Limit k²S² (A²s):	5.23×10^6	Phase Conductor Section S (mm²) =	16

EARTH FAULT PROTECTION

Calculations based on BS 7671:2008 411.3.2, 411.3.3, 411.4, 411.5, 543.1

Protection:	Generic BS 1361 Fuse Domestic HBC				Rating (A):	60
Earth Fault Loop Impedance (Ω)					Circuit Protective Conductor (CPC) Details	
Ze	Z1	Z2	Zs	Max Zs	Conductor	k Value
External	Phase	CPC	Total	inc. Cmin (exc. Cmin)	Phase 143	(k1)
0.19000	0.10875	0.10875	0.32260	0.65971 (0.69443)	Separate 143	(k2)
					Actual	Equivalent
					16	Actual x (k2/k1) = 16.00
					Total = 16.00	
Earth Fault Disconnection Time (s)			Earth Fault Current (kA)		Adiabatic Check: Minimum Section CPC S = $\sqrt{I^2t}/k$	
Actual from characteristic = 0.25			(Uo x Cmin)/(Zs x 1000) = 0.68		I²t = 114.90 x 10³ A²s	
Maximum for circuit type = 5.00			Uo/(Zs x 1000) = 0.71		Min. S (mm²) = 2.37	

ERRORS

Calculated in accordance with BS 7671:2008 (2015)

COMMENTS

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KEY: [a] = Auto setting; [f] = Fixed setting; [m] = Maximum setting; [d] = double neutral * denotes Error condition Page 2 of 2

Project: WM 16mm max.p17x Printed on: 29/08/2018
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