

C&I New In-Patient Hospital Tunnel

- LV Schematic cabling supplying MPB-GF-01 Main LV panel from the Transformer/Generator.**

1. Primary Supply (Transformer) – SWA/LSZH cable 3x1x4c 400mm + 240mm CPC
Approx. Overall Diameter – 78.1mm
Approx. Bending Radius – 624.8mm (Minimum according to BS 7671 - Multiplied by 8)
Weight (Kg/Km) - 19800
2. Secondary supply (Generator) – FP600 120minute cable 3x1x4c 300mm + 150mm CPC
Approx. Overall Diameter – 72mm
Approx. Bending Radius – 576 mm (Minimum according to BS 7671 - Multiplied by 8)

- Amtech Calculations** – Amtech Calculations indicate that the dept of laying is 1 metre underground. The Tunnel depth exceeds these calculations.

TABLE 4B4 – Rating factors (Ca) for depths of laying other than 0.7 m for direct buried cables and cables in buried ducts

Depth of laying, m	Buried direct	In buried ducts
0.5	1.03	1.02
0.7	1.00	1.00
1	0.97	0.98
1.25	0.95	0.96
1.5	0.94	0.95
1.75	0.93	0.94
2	0.92	0.93
2.5	0.90	0.92
3	0.89	0.91

Protective Device		[a] = Auto, [f] = Fixed, [m] = Max.	
Overcurrent protection:	Schneider Masterpact MTZ ACB MTZ1 16 H1 Micrologic 7.0 X		
	Rating In (A): 1600 [f]	Overload Setting Ir (A): 1280 [f]	
Earth fault protection: 30A		AFDD: N/A	

Conductors		[a] = Auto, [f] = Fixed, [d] = Double	
Multicore, 90°C thermosetting insulated, armoured LSF Cu Table 4E4		3 x 1 x 4c	Size (mm²): 400 [f]
Euro Class: Undefined			Length (m): 145
Neutral: 400 mm ² [a]			
BICC Data - In underground single way ducts			

Rating Factors			
Ground Temperature (°C)	= 15.0	Ctg = 1.00	Cgg = 0.85
Circuits In Group	= 1	Depth of Lay (m) =	0.50 Cd = 1.00
		Thermal Resistivity =	1.20 Cs = 1.000
3rd Harmonics (%)	= 0.00	Ch = 1.00	

- Amtech Cable factors only shows provision for 1 number of circuits and groups. The design shows 3 x 1 x 4c so I would expect 50-100mm gaps between cable runs.

TABLE 4C1 – Rating factors for one circuit or one multicore cable or for a group of circuits, or a group of multicore cables, to be used with current-carrying capacities of Tables 4D1A to 4J4A

Item	Arrangement (cables touching)	Number of circuits or multicore cables												To be used with current-carrying capacities, Reference Method
		1	2	3	4	5	6	7	8	9	12	16	20	
1.	Bunched in air, on a surface, embedded or enclosed	1.00	0.80	0.70	0.65	0.60	0.57	0.54	0.52	0.50	0.45	0.41	0.38	A to F
2.	Single layer on wall or floor	1.00	0.85	0.79	0.75	0.73	0.72	0.72	0.71	0.70	0.70	0.70	0.70	C
3.	Single layer multicore on a perforated horizontal or vertical cable tray system	1.00	0.88	0.82	0.77	0.75	0.73	0.73	0.72	0.72	0.72	0.72	0.72	E
4.	Single layer multicore on cable ladder system or cleats etc.	1.00	0.87	0.82	0.80	0.80	0.79	0.79	0.78	0.78	0.78	0.78	0.78	

- **BS 7671 522.8.3** The radius of every bend in a wiring system shall be such that conductors or cables do not suffer damage and terminations are not stressed. Due to the dimensions of the tunnel and the existing services it will very difficult to achieve bending radius compliant with the BS 7671 regulations and On-site guide.
- **BS 7671 522.8.11** Cable supports, and enclosures shall not have sharp edges liable to damage the wiring system.

Please note - further information required confirming the Strength of existing Concrete within the tunnel. Would expect a pull test prior to installation works to determine if the anchor fixings can take the proposed loads of the 400mm/300mm 3x1x4c SWA/LSZH cable & FP600 cabling

- **529 SELECTION AND ERECTION OF WIRING SYSTEMS IN RELATION TO MAINTAINABILITY, INCLUDING CLEANING 529.3 Provision** shall be made for safe and adequate access to all parts of a wiring system which may require maintenance.
NOTE: In some situations, it may be necessary to provide permanent means of access by ladders, walkways, etc.
- **Other Electrical Services-** Maintaining a sufficient distance between the fire alarm, data, LV supplies etc. Please refer to BS 7671 table A4441. & A444.2 Minimum separation between power and signal cables. The existing Fire Alarm cables in the tunnel should not be mixed with other cables such as data, small power etc. to comply with British Standards.
- **Dura-Steel** – Installing a Dura-steel enclosure around the 750KVA generator 300mm 3x1x4c supply cable may be a difficult exercise due to insufficient space in the tunnel and confirming the strength of the existing tunnel structure. Due to the size of the cables it will

be important to have a clear direct route with no change of turns. In addition, including Dura-steel to the tunnel works will also restrict further access through the tunnel walkway.

- **Primary & Secondary supply** – Further confirmation if it's possible to maintaining a diverse route throughout the cable's length from the Transformer/Generator to MPB-GF-01 LV Switch panel within the tunnel.
- **Future additional cables** - Where additional power cables are to be added to the tunnel, a survey must be carried out in order to assess their impact on the temperature gradient and fire risk throughout the tunnel section. A ventilation assessment and design must take into account the additional heat load before any cable installation takes place. The survey report Identified hot water within the Tunnel which may impact the cable temperature factors.
- **Main Equipotential Bonding** - All equipment shall be bonded as specified in BS 7671. All exposed non-current carrying metallic parts of the installations within the shafts and intake/exhaust structures shall be bonded to the main earth terminal. This includes all pipes, supports, louvres stairways/ladders and walkways.
- **Survey report** - Existing cables have no mechanical protection and are currently laying on the walkway. There is no separation between safety critical cables (fire Alarm system), data and small power.
- **Existing Junction boxes** – Refer to survey report pictures showing Junction boxes are rusty and covered in water/cable joints. I would expect a full cable survey and safe isolation procedure in place to identify all cables. There is water throughout the tunnel walkway with live cables, this is High Risk and will require further investigating.
- **Regulation 411.3.1.2 of BS 7671:2018 states that:**
*"In each installation main protective bonding conductors complying with Chapter 54 shall connect to the **main earthing terminal extraneous-conductive-parts including** the following:*
 - (i) Water installation pipes*
 - (ii) Gas installation pipes*
 - (iii) Other installation pipework and ducting*
 - (iv) Central heating and air conditioning systems*
 - (v) Exposed metallic structural parts of the building.*
- **Supplementary Bonding** - exposed conductive parts and accessible extraneous-conductive-parts
- **Main Equipotential Bonding** - All equipment shall be bonded as specified in BS 7671. All exposed non-current carrying metallic parts of the installations within the shafts and intake/exhaust structures shall be bonded to the main earth terminal. This includes all pipes, supports, louvres stairways/ladders and walkways. Further confirmation required.

- **Electricity @ work act 1989** - Regulation 15 Working space, access, and lighting.

Please see extract below from the Electricity @work act 1989: -

For the purposes of enabling injury to be prevented, adequate working space, adequate means of access, and adequate lighting shall be provided at all electrical equipment on which or near which work is being done in circumstances which may give rise to danger.

230 The defence (regulation 29) is available in any proceedings for an offence under this regulation.

231 The purpose of the regulation is to ensure that sufficient space, access and adequate illumination are provided while people are working on, at or near electrical equipment so that they may work safely. The requirement is not restricted to those circumstances where live conductors are exposed, but applies where any work is being done in circumstances which may give rise to danger. The regulation does not require such space, access or illumination to be provided at times other than when work is being done. (But see guidance under regulation 12(1)(a) (paragraph 186(b)) in respect of safe access to means of cutting off the supply.)

Working space

232 Where there are dangerous exposed live conductors within reach, the working space dimensions should be adequate:

- (a) to allow people to pull back away from the conductors without hazard;
- (b) to allow people to pass one another with ease and without hazard.

233 Among the legal provisions revoked when these Regulations came into force were the Electricity (Factories Act) Special Regulations 1908 and 1944. Regulation 17 of those Regulations specified minimum width and height dimensions of switchboard passageways where there were bare conductors exposed or arranged to be exposed when live so that they may be touched. That regulation and the relevant definitions used are reproduced in Appendix 1. The dimensions specified were arrived at after much consideration of the circumstances in a Public Inquiry when those Regulations were being drafted. However, those dimensions can still provide guidance for an appropriate level of safety in many circumstances and where the voltages do not significantly exceed 3000 V. This does not condone the use of equipment having normally bare and exposed conductors if a safe alternative can reasonably be adopted.

UKPN standard tunnel dimensions below: -

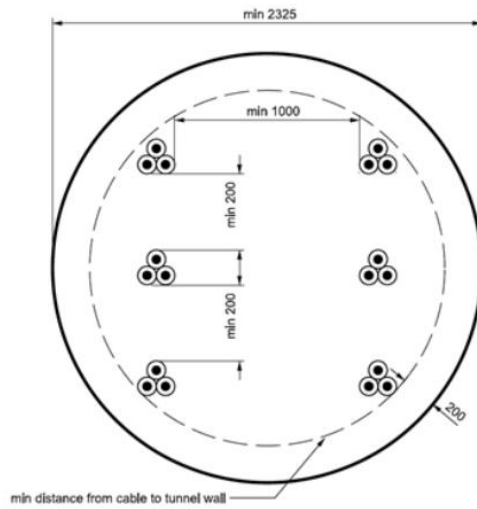


Figure 7-1 – Typical Tunnel Layout, Dimensions and Cable Layout for cables in trefoil

7.1.1 Cables

- Alternative option – 2 Nr. Trenches for the 1000kva transformer supply and 750Kva Generator supply cabling to C&I New In-Patient Facility

