

2018

Lighting & Power Specification  
Cooney's Lane, Grange, Co. Cork.

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# [LIGHTING & POWER SPECIFICATION]

**SPECIFICATION**

**SECTION 1**

**OUTDOOR LIGHTING**

**GENERAL REQUIREMENTS**

1. **DELIVERY OF PLANT AND MATERIAL, ACCESS TO SITE AND STORAGE ON SITE.**

Delivery to the area of the Works shall be by public thoroughfare and shall be subject to access arrangements agreed by the Client.

No storage areas will be made available on the site for component parts and the Contractor will be required to provide at his own expense a suitable safe compound area near the site for materials stored and for site accommodation.

The Contractor shall state in his Tender his arrangements for storage of equipment and materials.

The handling and storage of all components and other equipment and material in any local storage area or on site shall be entirely at the risk of the Contractor and without responsibility to the Client.

2. **SITE ELECTRICITY**

The Contractor shall provide at his own expense all power necessary to execute and complete the Works.

All electrical installations provided by the Contractor supplied from any source shall comply with the appropriate statutory requirements and with the latest edition of the National Rules for Electrical Installations, issued by the Electro-Technical Council of Ireland.

3. **SITE WORKING CONDITIONS**

The Contractor shall, at all times, carry out the Works so as to cause as little obstruction and inconvenience to Third Parties as is reasonably practicable.

Throughout the period of construction of the Works, the Contractor shall maintain the whole area of his operations in a clean, tidy and safe condition by

arranging his materials in an orderly manner. All rubbish, waste material, debris, etc., shall be systematically cleared off the working areas as directed by the Engineer, and if not removed directly off the site, shall be deposited at general collecting points agreed by the Engineer pending its removal to a place of deposit to be found by the Contractor and approved by the Engineer.

4. SUB-CONTRACTORS

As soon as practicable after entering into the Contract, the Contractor shall, having obtained the Engineer's approval in accordance with the General Conditions of Contract, enter into the sub-contracts he considers necessary for the satisfactory completion of the Contract Works.

5. INSTALLATION AND CHECKING OF WORK

The Contractor shall submit to the Engineer for approval and discussion his proposals and plans for the method and procedure to be adopted for the installation of the Works and the particulars of temporary works involved.

The Contractor shall check and be responsible for the correctness of electrical connections.

The carrying out of all work included in this Contract shall be supervised throughout by a sufficient number of qualified representatives of the contractor who have had thorough experience in comparable installations.

The work shall be carried out with as little interference as possible to other work being done on the Site.

6. DESIGN, INTERCHANGEABILITY AND MATERIALS

The general design of the equipment and materials shall be to the approval of the Engineer and only equipment designed and proved to be able to withstand the most arduous conditions that can arise for this class of installation will be acceptable.

The workmanship throughout shall be of the highest class, materials shall be new and of the best quality, and all shall be to the satisfaction of the Client.

No welding, filling, or plugging of defective parts will be permitted without the sanction, in writing, of the Engineer. The greatest accuracy shall be observed in manufacture to ensure that all parts will fit together on erection at site and

corresponding parts throughout shall be made to gauge and shall be interchangeable.

In particular, all lighting column doors and supply pillar doors of each type shall be fully interchangeable with all others of the same type.

Every reasonable precaution and provision shall be incorporated in the design of the equipment for the safety and security of the system and of those concerned with its operation and maintenance, and particular care shall be taken in the design of the columns to ensure safety in their operation and maintenance, and also that they shall not constitute a danger to persons or traffic by failure of any single component.

7. TESTS ON SITE

After installation, such tests, including those specified in detail, as may be considered necessary by the Engineer shall be carried out by the Contractor upon arrangement with the Engineer.

8. COMPLIANCE WITH ELECTRICAL STANDARDS

The complete electrical installation shall comply with the latest edition of the National Rules for Electrical Installations, as published by the Electro-Technical Council of Ireland. All testing, as specified in ETCI document E101: 2008 Part 6 and as detailed in Appendix 1, shall be carried out by the Contractor.

9. STANDARDS, SPECIFICATIONS, AND CODES OF PRACTICE

All materials and practices used in the construction of the Contract Works shall be made and supplied in accordance with all relevant Irish, British, or European Standards or Codes of Practice current at the date of Tendering, unless otherwise specified or approved by the Engineer.

10. GALVANISING

Galvanising shall be applied by the hot-dip process in accordance with BS 1461. The zinc coating shall be smooth, clean, of uniform thickness and free from defects.

The preparation for galvanising and the galvanising itself shall not adversely affect the mechanical properties of the coated materials.

All welding, drilling, punching, stamping, cutting and bending of parts shall be completed and all burrs removed before the galvanising process is carried out. Any erection, assembly, or identification marks shall be clearly legible after galvanising.

Where the use of galvanised bolts is approved these shall be completely galvanised by the hot-dip process including their threads, but the threads of nuts are to be left uncoated. Alternatively, hot-dip spun galvanised nuts and bolts may be used.

Stringent precautions shall be taken to protect galvanised parts from damage to the zinc coating during fabrication, transit, storage and erection. No repair of the galvanised finish by 'cold galvanising', filing or grinding or otherwise will be permitted, and where galvanising is found to be damaged or imperfect the items shall be replaced or regalvanised at no cost to the County Council.

All steel used in the construction of the columns shall be of a type which is compatible with the production of a bright galvanised finish.

#### 11. WELDERS AND WELDING

Structural steelwork and other components shall be welded by an electric arc process or other such process as may be specifically approved by the engineer for the structure or component concerned.

The welding procedures shall be such as to minimise distortion of the completed structure.

Unless the written permission of the Engineer is given, only shop welding shall be permitted.

The preparation, procedure, testing and inspection shall conform to the requirements and recommendation of the relevant Irish, British or European Standards as may be applicable, or shall be to the approval of the Engineer.

Intermittent welding shall not be carried out and all welded joints shall be completely sealed by welding to prevent penetration of moisture, provided that there are no unventilated voids created which could trap air or moisture.

Unless specifically approved otherwise, no welder shall be employed to perform welds of a type for which he has not been qualified to the satisfaction of the Engineer.

Details of proposed welding procedures and sample welds shall be submitted for approval before welding commences, if requested by the Engineer.

12. ELECTRICAL SUPPLY SYSTEM

Unless otherwise indicated all apparatus and wiring shall be suitable for use with a 1 phase 230 volts 50 Hertz earthed neutral supply system.

13. EARTHING

All electrical installations provided by the Contractor supplied from any source shall comply with all appropriate statutory requirements and with the latest edition of the National Rules for Electrical Installations, issued by the Electro-Technical Council of Ireland.

All equipment shall be fitted with earth stud, nuts and washers for bonding purposes.

14. DRAWINGS

A list of the drawings forming part of the Contract are included with the Specification. Any change from drawings is at the discretion of the Engineer.

The Tender shall be accompanied by the drawings specified in the schedule and any other drawings necessary to describe fully the equipment offered, but the final details shall be such as will conform to the reasonable requirements for the Engineer and receive his approval. Scales shall be indicated on drawings where applicable.

The Contractor shall submit for approval three copies of any drawings requested by the Engineer as soon as possible before the commencement date, and in any case in sufficient time to admit of modifications being made, if such are deemed necessary by the Engineer, without delaying the initial deliveries or the completion of the Contract. The drawings submitted shall be modified as may be required by the Engineer and re-submitted for final approval.

If the Contractor shall require early approval of any drawing to avoid delay in the completion of the Contract Works, he shall advise the Engineer to such effect when submitting the drawing.

Approval of drawings shall not relieve the Contractor of his obligation to supply plant in accordance with the Specification.

15. CONTRACT RESPONSIBILITIES

In addition to normal contract responsibilities, the Contractor shall undertake the following additional responsibilities:

(a) Maintenance

This Contract shall include for maintenance, under guarantee, during the maintenance period to cover the replacement, including supply and fitting of any faulty structural, mechanical, electrical or luminaire accessories, lamps, parts or components, supply pillars, and cables except as may be due to fair wear and tear. In the event of the rate of fault or failure, except fair wear and tear, of a particular item, accessory, lamp, part or component exceeding 10% during the maintenance period, the Engineer may require the Contractor to replace, including supply and fitting, all similar items throughout the installation at no cost to the Purchaser.

(b) Photometric Tests

The Engineer may carry out photometric tests after completion of the installation to prove that the levels of luminance and illuminance guaranteed in the tender have been achieved. Following such tests the Contractor may be required to take remedial action to rectify any deficiencies. Any material necessary to facilitate the test will be provided by the contractor.

(c) Cabling

The Contract includes all glanding, terminating and connecting of cables to columns, supply pillars and other terminating points.

It shall be noted that the Contract includes for the whole of the work involved and shall include inter alia: -

1. Detailed layout of all cable routes including marking out on the ground for approval by the Engineer and / or production of drawings to show exact location and disposition of cables, ducts, pipes, thrust bores and trenches.
2. Pumping, as necessary, of existing and new cable routes.
3. Off-loading, handling, storage and protection of all cable and other material, and equipment.
4. Lifting and replacing covers at cable duct positions and elsewhere and making safe at all times any openings exposed.
5. Detail design, including production of drawings for approval of all pillars, and installation at Site including foundation work as specified.
6. Provision of all power supplies, lighting, test equipment and other tools and equipment.
7. All testing of the installation.
8. Final inspection at end of maintenance period.

(d) Maintenance Period

The maintenance period shall commence at whichever is the earlier of (a) The use of the public lighting installation in service on the road, or (b) A date not later than twelve months after the completion of hand over of the public lighting installation.

16. CERTIFICATION OF STRUCTURAL DESIGN

The structural design of columns is subject to certification and Tenderers shall include with their Tender sufficient information to indicate that the design has been carried out in accordance with the requirements of this Specification.

Tenderers shall also confirm that full design information would be made available in the event of an order being placed with them and that, if required by the Engineer, they will provide independent design certification.



17. DESCRIPTION OF INSTALLATION

An electrical installation comprising:  
Public lighting

- 17 No. 8m high tapered hexagonal galvanised rolled steel lighting columns fitted with a post top mounted 57W 8.4KLM Neutral White Philips Miniluma Luminaire A BGP621 DM10 Lamp Lanterns & SELC photocell set to switch on 35 lux and off at 18 lux as per SEAI Profile 2A.
- 82 No. 6m high tapered hexagonal galvanised rolled steel lighting columns fitted with a post top mounted 26W 4.0KLM Neutral White Philips Microluma Luminaire B BGP615 DM10 Lamp Lanterns & SELC photocell set to switch on 35 lux and off at 18 lux as per SEAI Profile 2A.
- 25 No. 6m high, hinged, tapered hexagonal galvanised rolled steel lighting columns fitted with a post top mounted 9W 1.4KLM Neutral White Philips Microluma Luminaire C BGP615 DM10 Lamp Lanterns & SELC photocell set to switch on 35 lux and off at 18 lux as per SEAI Profile 2A.
- 11 No. 6m high, hinged, tapered hexagonal galvanised rolled steel lighting columns fitted with a post top mounted 9W 1.4KLM Neutral White Philips Microluma Luminaire D BGP615 DN10 Lamp Lanterns & SELC photocell set to switch on 35 lux and off at 18 lux as per SEAI Profile 2A.
- 28 No. 7W Philips Coreline Bollards switched in pillar with SELC photocell set to switch on 35 lux and off at 18 lux as per SEAI Profile 2A.
- 15 No. Minipillars

All cabling to the lighting columns will be ducted underground.

The electrical supply points have been identified and shall be agreed in advance between the Engineer and the ESB, as indicated on the drawings. The Contractor is obliged to liaise with the ESB with regard to upgrading the UMSR and may have to provide facilities in the public lighting supply pillar for ESB electrical equipment.

18. END OF MAINTENANCE PERIOD INSPECTION

The Contractor shall arrange for replacement of faulty components, including lamps, during the maintenance period. Only under exceptional circumstances resulting in failure of more than 10% of any components shall immediate action be taken. Otherwise the rectification work shall involve visits no more frequently than every three months.

19 ROADWORKS DISCIPLINE

All work shall be carried out in accordance with the terms of current version of Department of Transport Documents "Traffic Signs Manual Chapter 8" of April 2007 and "Guidance for the Control and Management of Traffic at Road Works" of Oct. 2007 plus any specific requirements of Clare County Council in respect of excavation and reinstatement of pavements.

The Contractor shall be responsible for the discipline of his employees and that of his sub-contractors while working on or near roads which are open to traffic.

No work shall be carried out on, or in the vicinity of, roads which are open to traffic without authority having been obtained, and all persons shall wear appropriate safety clothing and gear at all times.

Personnel shall not be permitted to encroach on the carriageway areas unless suitably protected by coning and signage.

SECTION B

TECHNICAL PARTICULARS

20. LIGHTING DESIGN PARAMETERS

The lighting installation offered shall be based on the installation of columns at the positions indicated on the drawings accompanying this Specification, with lantern mounting heights as indicated. The precise positioning of columns on site shall be agreed on site with the Engineer or his representative.

The lighting installation shall meet the minimum road surface illuminance requirements set out in Schedule 2, assuming a road surface luminance coefficient of 0.07.

21. LIGHTING COLUMNS

1. Road Lighting Columns

(a) General

Lighting columns 6m galvanised rolled steel columns mounted on the public thoroughfare at the back of the footpaths.

Tenderers shall provide detailed drawings of all columns offered, showing dimensions, wall thicknesses and grade of steel used. Structural calculations shall be provided.

(b) Column Construction

Columns shall be rooted type of one piece galvanised steel construction and shall comply with IS EN40 Series.

A minimum sheet steel thickness of 3mm. shall be used for all columns. Due allowance shall be made in the column design, where appropriate, for the degradation of the steel due to welding, annealing, galvanising, or other manufacturing processes.

Columns shall be designed using a RWF of  $587\text{N/m}^2$ , as defined in BS EN 40. Certification of structural adequacy for the column/ lantern combination shall be provided by the tenderer for each column/ lantern combination offered.

(c) Column Openings and Fittings.

Columns shall have fitted compartment doors at a height of 1.5 metres above ground level to centre of door opening in accordance with the drawing accompanying this document. The door opening shall be of laser cut flush access type with all around weather strip. A flat steel door of minimum 3mm steel plate, secured by two triangular head screws shall be fitted. All doors shall be standard size and fully interchangeable. They shall not require any site adjustment or modification to fit properly each column. The locking triangular head screws shall have a narrow neck under their heads to take a metallic retaining washer, which shall be crimped in place. The screw threads shall be lightly greased to prevent them seizing or binding.

A wooden baseboard measuring 500mm x 100mm x 10mm thick, and treated with wood preservative shall be securely fitted facing the door

opening. The clearance between the baseboard and the inside face of the door when secured shall be not less than 100mm.

(d) Corrosion Protection

Columns shall be protected against corrosion inside and outside by hot dip galvanising after manufacturing to BS EN 1461:2009. The galvanised surface shall be free of all contamination, degreased, and etch-primed prior to application of bitumen extending for 250mm above ground level on inside and outside of column surfaces.

(e) Column Erection

Marking out of column positions on site shall be carried out by the Engineer or his representative. Care shall be taken when erecting columns to avoid obstructing entrances and other services, and that columns are safely positioned outside of falling distance from overhead power lines and trees. In general, columns shall be erected in a previously installed socket (see design drawings for details). The method of excavation shall be agreed with the Engineer. Excavation and erection of columns shall be co-ordinated so that no holes are left open overnight. Columns shall be erected in a safe and workmanlike fashion, using a crane or suitable hoist, and holes shall be pumped free of any water before being filled with concrete.

The concrete used for securing the column shall be in accordance with the Department of the Environment Specification for Road Works, Clause 1502, Concrete for Ancillary Purposes (Class E). Concrete shall be vibrated as necessary to achieve satisfactory compaction.

All columns shall be oriented so that the access door faces away from oncoming traffic.

22. LANTERNS, LAMPS AND CONTROL GEAR.

(a) General

A sample lantern of each type may be submitted to the Engineer for examination if requested.

Each lantern shall be complete with lamp and all necessary lamp control gear and fitted with a minimum 20Amp rated HRC BS 88 fuse. Fuse rating shall be stated. The supply to each lantern shall be at 230 volts A.C. single phase.

Each lantern shall be individually switched by a high quality photo electronic switch unit.

(b) Lanterns

Lanterns shall be LED type, certified to BS EN 60598 -1 :2015 with a wattage coding patch.

All lanterns shall be weatherproof and designed to inhibit ingress of dirt. The lantern optic shall be sealed to IP65 minimum, and shall be either a sealed optical unit, or be enclosed by a transparent visor of toughened glass or polycarbonate material bedded on a high grade gasket. The lanterns shall be of the styles and approximate dimensions shown in the drawings, and shall open with a simple catch arrangement designed to facilitate removal and replacement without the use of tools. The system of retention shall not be prone to operational failure due to weather and dirt. The visors and covers shall be positively retained when open, and be incapable of falling off due to wind movement on their hinging arrangements.

Details of the degrees of protection achieved for the lantern and control gear enclosures shall be stated in the Tender. The lantern body shall be made of cast aluminium, and all toggles, fixing screws, hinges, clips, cover securing catches, and other small components shall be of approved non-corrodible material.

Lanterns shall incorporate positive and substantial means of fixing to the column designed to allow adjustment and to ensure that, once set in the required position, they shall remain there.

Setting markings included on the body for adjustment of the optical system, or orientation of the lantern, shall be made in a clear and indelible manner. If adjustments of the optical system and lantern orientation are necessary during installation, these shall not be prone to alteration during re-lamping and cleaning or maintenance operations.

Internal lantern connections shall be neatly and securely wired with heat resisting cable suitably protected against the high temperatures adjacent to the lampholder and components. This wiring shall be so arranged as to

avoid any abrasion occurring in service, particularly at the rear of the lampholder. The design shall also be such that replacement of this wiring can be effected in service without the necessity for major dismantling of components.

Lanterns shall be complete with terminal block, earthing terminal, lampholder, and cable clamp to the approval of the Engineer. All lantern control gear components and lampholder brackets shall be bonded to the earth point. Fuses shall be provided with fixed holders.

The lantern optical system shall consist of a one-piece high grade aluminium or metallised plastic reflecting surface, capable of providing the light distribution specified.

The heat generated inside the lanterns shall not cause deterioration of any component and the operation of the discharge lamps shall not be impaired in any way by the heat generated by the lantern/lamp control gear assembly.

Lanterns shall comply with IEC 62722-2-1: 2014.

LEDs shall be 20W & 35W CLO type or approved equivalent, with a guaranteed life of not less than 100,000 operating hours.

Lamps shall be capable of withstanding the movement and vibration of the enclosing lantern, and shall not be prone to unscrewing under such conditions.

(d) LED Modules

Modules shall comply with IEC 62717.

During the maintenance period a record shall be kept by the Contractor of lamp and lamp control gear failures requiring replacement, and this will include the date of replacement and the approximate burning hours at the time of replacement. This record shall be submitted to the Town Council on completion of maintenance.

Where failure of any component exceeds 10% of the total for any reason, the Engineer, at his option, may require replacement by alternative components of all the type of component or lamp affected.

23. COLUMN INTERNAL ELECTRICAL EQUIPMENT

(a) Column Fuse Unit

Each lighting column shall be fitted out, as shown in the drawings with a Lucy MCO40SLF Fuse Unit or equivalent with a 6 Amp B.S. 88-2 fuse.

(b) Column Internal Cable

Wiring from the column baseboard to the lantern shall be 2.5 sq. mm. heavy duty PVC PVC 3 core flex with stranded copper conductors, which shall be properly glanded at the baseboard unit and clamped in the lantern.

(c) Main Cable Terminations

Termination blocks used to terminate the underground cables if required in the mini-pillars shall be BICC 63 Amp type, or Lucy 63 Amp type, or equivalent, and shall be fully insulated and solidly mounted on the column baseboard. The metal connector block, when cabled, shall be positively retained in the link enclosure when its cover is removed.

24. SUPPLY PILLARS AND CIRCUIT SWITCHING

(a) Pillar Construction

The pillars shall be of sheet steel construction, the overall dimensions to be approximately:

SP: 440mm.x 250mm.x150mm (HxWxD)

as in Carson Industries Fortress BLP-1, or similar, manufactured in 3mm. thick steel including the door and bottom plate, as detailed on the drawing accompanying this document. Extension plates or feet shall be fitted at the bottom to enable firm cementing into the ground. Ground level shall be clearly marked.

The pillars shall each be fitted with a single flat plate hinged door with two captive triangular head locking screws, as used for the lighting column doors. Locking screws shall have their threads lightly greased for ease of operation. The pillars shall be protected against corrosion inside and outside by hot dip galvanising after manufacturing to BS 1461:2009. The portion below ground and for a distance 50mm og shall also be

treated with a bitumen coating 150 microns thick, as specified for the lighting column roots. All brass and metal components shall be electro-plated.

A blockboard baseplate approximately 20mm. thick shall be fitted in each pillar. An earth terminal shall be provided on the pillar body inside the door frame.

NOTE: All supply pillars shall have outside on their front a prominent permanently fixed sign with a symbol indicating the presence of high voltage within, and the legend:

**“PUBLIC LIGHTING HIGH VOLTAGE DANGER”**

Main cables entering the supply pillars may terminate in termination blocks as specified for lighting columns, or the phase conductors may terminate directly in their appropriate fuse units. In either case, neutral and earth shall each terminate in a termination block.

The layout of the electrical equipment in the supply pillars shall be as detailed in the drawings accompanying this document.

For each ESB supply point the Contractor shall liaise with the ESB to establish what space, if any, is required in the main public lighting supply pillar for ESB installed equipment, such as cutouts, isolators, meters etc.

(b) Pillar Fuses, Bases and Carriers

Each pillar shall be equipped with ESB Single Phase Fused Cut –out and Isolator together with separate Neutral and Earth Terminal link blocks and a minimum of three single phase fuse units, i.e. incoming supply and outgoing circuits fused to BS 88-2 with a minimum 20Amp rating. A spare fuse shall be supplied suitably accommodated in a clip, rack or box fixed inside the pillar.

Fuses shall be rated as required to comply with ET101:2008. All fuses and circuits shall be identified with indelible engraved labels fixed to the baseboard, and a laminated circuit block diagram fixed to the back of the pillar door.

(c) Circuit Switching



Each lantern shall be dusk-to-dawn switched by an individual miniature photo-electronic unit. The photo-electronic cell shall be solid state unit incorporating a photo-transistor as the light sensor, and comply with I.S. 428: 1991 (e.g. SELC ACRO 8480 by Solar Enterprises, or equivalent).

- (d) At each main supply point the incoming supply to each system shall be protected by a fused switch-disconnector (Switchfuse) to VDE 0660 Part 107 or equivalent (BS EN 60947–Part 3), appropriately rated.

## 25. EARTH ELECTRODE

A bare copper or hot dip galvanised iron rod 12mm in diameter and 1,200mm long shall be sunk at each supply pillar. A 16 sq. mm copper conductor shall be connected from the earth rod to the main earth terminal block and between the pillar and earth terminal block. Earth rods shall be installed either within the pillar or with suitable inspection traps to facilitate the inspection of the earth wire connection to the rod. The clamp connecting the cable to the rod shall be protected after installation with “Denso” tape.

## 26. EARTHING SYSTEM

The earthing system shall consist of a bare copper or hot dip galvanised iron earth rod 16mm in diameter and 1200mm long installed at each supply pillar. The electrode shall be connected to the main earth link block in each pillar by a 16 sq.mm. PVC insulated stranded earth wire. The earth stud on the metal pillar body shall also be connected to the earth link block by 16 sq.mm PVC insulated earth wire.

In the case of NYCY cable the protective concentric copper conductor of the underground cables shall form the main earth path to individual lighting columns. This conductor shall be terminated, as specified, in an earth link block at the base of each column. The earth stud on the column door frame shall be connected to the column earth link using 16 sq mm PVC insulated stranded copper earth wire, with a non-ferrous tinned lug at the door frame stud. The lantern, if not of the double-insulated type, and any other extraneous metal not forming part of the electrical circuit, shall be connected to the earth link with 2.5 sq mm stranded copper PVC insulated earth wire, which may be incorporated in the specified flexible cable feeding the lantern. Additional earth electrodes may be required by the Engineer to be installed, if satisfactory earth resistance values are not achieved.

27. UNDERGROUND CABLES

(a) General

Underground cables shall be two-core NYCY type to V.D.E. Specification 0271/5, 600 to 1,000-volt grade. Cables and equipment shall be installed strictly in line with the arrangements indicated on the drawings and schedules accompanying this Specification, and no deviation of any nature is permissible unless agreed with the Engineer.

Where other services are uncovered they shall be suitably supported and protected. Where obstructions are encountered which necessitate diversion or alteration to other services the Contractor shall immediately inform the Engineer. Where French or rubble drains are crossed they shall be carefully lifted, suitable ducts installed for the cables and the drains re-instated to the Engineer's satisfaction.

When the excavations have been accurately executed, notice shall be given by the Contractor to the Engineer. Laying of cables, ducts and pipes shall not be started until the Contractor has obtained the Engineer's sanction to proceed with the work, failing which the Contractor may be required subsequently to open or restore the trench at his own cost.

The Tenderer shall confirm his ability to carry out the work in accordance with the planned layout of cables, and to this end he is required to visit the Site during the tendering period and satisfy himself that the arrangements and details of ducts, and all other cable routes, are such that he would be able to install cables and equipment in the required manner exactly as indicated or, alternatively, put forward proposals for different arrangements which he would propose.

(b) Installation of Underground Cables

Cables shall be drawn into ducts, only after the ducts have been cleared of debris and obstructions. Prior to drawing in cables, ducts shall be proven by pulling through them a solid cylindrical mandrill whose diameter is not less than 75% of the duct diameter.

Ducts shall be roped with 10mm diameter polypropylene rope and plugged.

The cable routes, cable particulars, location of the cable ducts and trenches are shown on the drawings issued with this Specification, and no deviation from these general routes shall be permissible except by agreement with the Engineer. The exact details of each route and run shall be to the approval of the Engineer on Site prior to installation. In all cases, cables shall be installed strictly in accordance with the manufacturer's recommendations and with due regard for the requirements of separation of power and communications cables, including multipair telephone and co-axial types, where interaction can take place between them.

Cable laying shall take place only when the ambient temperature is above 0° C and has been above this temperature for the previous 24 hours, or approved special precautions have been taken to maintain the cables above this temperature to avoid the risk of damage during handling.

Where rollers are used during the installation of cables, they shall have no sharp projecting metal parts liable to damage the cable. Care shall also be taken to avoid damage by the use of sharp or pointed spades, tools or other equipment in the installation of cables, or of damage by passing cables over sharp edges. Suitable bell mouths shall be provided for ducts and pipes, where necessary.

Cables shall be terminated in columns and in supply pillars only. No underground joints or tees shall be allowed.

Both looping cables shall exit the duct by way of a preformed "swept Tee", enter the column above the foundation block and be protected by uPVC 50mm diameter duct for a distance of 300mm into the column.

In the event of damage or theft occurring, the Contractor will be required to replace the cable without expense to the Town Council or delay to the programme.

Where cables are damaged for any reason, The Engineer shall be notified, and normally the entire cable shall be replaced. If, in exceptional circumstances, the Engineer shall agree to a repair of damage, his approval shall be obtained in writing to the repair and the method of repair. The position of the damage shall be accurately recorded before commencing the repair, and this shall be noted on the final record drawings.

Prior to ordering cables the Contractor shall verify by site measurements the lengths required, and notify the Engineer. The responsibility for provision of cable of the correct length shall, however, remain with the Contractor.

(c) Termination of Cables

Cables shall generally be terminated without exceeding minimum bend radii as specified in cable link blocks as specified in supply pillars and column bases. In the case of unplugged terminations a minimum of two termination screws shall bear on each conductor, in the link block. The concentric copper protective conductor of NYCY cable shall be neatly twisted and also terminated in a similar link block.

For single phase circuits using two-core cable, the blue conductor shall be neutral.

(d) Ducts

Ducting shall comply with BS 3506 Class B as a minimum. Single wall ducting shall be red coloured, 107mm. ext. diameter manufactured from u PVC material and with a minimum wall thickness of 5 mm. It shall be marked as Public Lighting ducting.

It shall be laid so that the upper surface is 600mm below ground level and with a warning tape at 300mm below ground level.

Clearances from other services shall be as per ESB Networks Electrical Services Guidebook.

28. SITE TESTS

The Contractor shall carry out tests on delivered cable prior to installation and whatever tests he considers necessary to prove the insulation and continuity of the installation as it proceeds.

The Contract shall include for testing of the installation in accordance with Appendix 1, and to the Engineer's approval. The Contractor shall advise the Engineer of the dates on which it is intended to carry out tests in order that he may witness them.

Tests shall be carried out on sections of the installation as these are completed, and normally these sections shall comprise not less than one circuit. Where, for

any reason, testing is carried out after the cables have been connected, the responsibility for the disconnection, testing and reconnection after testing shall be deemed to be included in the Contract.

All cable cores shall be tested by 'Megger' after installation to the Engineer's satisfaction. Where any cable core is found to have an insulation reading substantially less than the average obtained on other cables, the Engineer may, at his discretion, require the replacement of the cable, if the reason for the low reading cannot be discovered and rectified.

The results of all tests shall be recorded by the Contractor in a standard format agreed with the Engineer.

29. Contractor shall comply with WEEE Directive as required.

**SCHEDULE 1**

**LIGHTING PERFORMANCE REQUIREMENTS**

Carriageway Width	Varies
Verge, Cycleway and Footpath	Varies
Lantern Setback	Back of Footpaths
Nominal Mounting Height	6 & 8m.
Outreach Bracket	None
Lamp Type	LED
Lamp Watts	57W, 26W, 9W, 7W.
Average Road Surface Illuminance.	Residential.  Class M4, P3 and P4 of BS 5489-1:2013 with S/P ratio of 1.61. SEAI Profile 2A.

## **Appendix 1**

### **Electrical Testing Procedures.**

#### **Sequence of Tests**

##### With the Electrical Supply connected:

1. Visual Inspection of Installation.
2. Verification of Phase balancing of load.
3. Voltage Readings.
4. Fault Loop Impedance.
5. Verification of Operation of residual current devices. (RCDs).

##### With the Electricity Supply disconnected.

6. Polarity.
7. Continuity of main underground cables.
8. Resistance of protective conductor.
9. Insulation resistance of cables.

#### **References**

Guide to the National Rules for Electrical Installations as Applicable to Domestic and similar Installations. ET 207: 2003. Section 21. Verification and Testing.

National Rules for Electrical Installations ET 101:2008. Chapter 714.Outdoor Lighting Installations.

Code of Practice for Public Lighting Installations in Residential Areas ET211; 2003.

National Code of Practice for Customer Interface 4<sup>th</sup>. Edition 2008. Layout 3 Page 70.

#### **Contractor's Responsibility.**

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**1.**

The Contractor shall be responsible for carrying out all testing specified and for recording the results of such tests on the Test Sheets provided. A responsible member of the Contractor's staff who shall be electrically qualified at least to electrician level shall sign the completed Test Sheets.

**2.**

The Contractor shall provide circuit diagrams and any other relevant information showing any alterations from the original specified design.

**3.**

The Contractor shall provide at least two operatives to carry out the testing at least one of whom shall be a qualified electrician who shall be thoroughly familiar with the installation being tested, with the test equipment being used, and with the required testing procedures.

**4.**

The contractor shall provide all necessary test equipment and tools, which shall as a minimum include the following:

- (a) Insulation resistance meter.
- (b) Fault loop impedance meter.
- (c) Residual current device (RCD) tester (where applicable).
- (d) Digital multimeter with direct reading ohm scale.
- (e) One pair of two-way radios.

**Tests with the Electricity Supply Connected.**

**1. Visual Inspection of the Installation**

The purpose of this inspection is to verify that suitable materials and equipment have been used for the installation, and that these have been installed in a manner consistent with best current practice.

Test Instruments

None.

Inspection:

Check the following:

- (i) All lights functioning (either short circuit photocells or inspect after dark)



- (ii) All equipment securely anchored and aligned, including lanterns, brackets and columns.
- (iii) All doors to columns and supply pillars securely closed and capable of being readily opened.
- (iv) All electrical equipment within columns and supply pillars secured fixed, and arranged in a convenient and logical pattern
- (v) All cables neatly made-off and securely terminated.
- (vi) All covers, flashguards, protective sheaths properly fitted.
- (vii) Earth rods correctly installed and connected, with main connection to rod accessible for inspection, and protected by "Denso" tape or other suitable method.

## **2. Verification of Phase Balancing of Load**

The purpose of this test is to ensure that the entire public lighting installation load is equally balanced across the three phase supply, and that in the case of high mast installations, or installations with single point photocell controls, the control circuits are also evenly distributed over the three phases.

### **Test Instrument:**

None

### **Test Procedure:**

Switch on all lights in the installation. Withdraw individually and replace each of the main supply public lighting fuses, noting the lights that are extinguished for each fuse removed. Make written record of the lights on each phase.

## **3. Voltage Readings**

The purpose of these tests is to ensure that the voltages at each light comply with specification.

### **Test Instrument:**

A.C. voltmeter.

### **Test Procedure:**

- (a) Measure and record supply no-load voltage at main supply public pillar between each phase and neutral.
- (b) With all lanterns in installation lighting, measure and record full-load voltage between each phase and neutral at
  - (i) the main supply public lighting service pillar.

- (ii) Each sub service pillar.
- (iii) Each high mast base (where applicable).
- (iv) The column baseboard of the last light on each phase of circuit

#### 4. **Fault Loop Impedance Test**

The purpose of this test is to verify that the fault loop impedance of each final circuit, sub-main, and distributor is sufficiently low to ensure that protective devices will operate within the required disconnection times in the event of a phase-to-earth fault occurring.

##### Test Instrument:

Fault loop impedance tester.

##### Test Procedure:

It is very important to have already verified the continuity of the protective system before carrying out this test.

The fault loop impedance should be measured at the furthest point of each circuit for each phase, with all other circuits isolated. The measured value should be compared with that given in the National Rules for Electrical Installations for the particular type and current rating of the protective device.

#### 5. **Verification of Operation of Residual Current Devices**

The purpose of this test is to check the effectiveness of RCDs in the completed installation.

(NOTE: It is unusual to have RCDs fitted in public lighting installations, so this test may not be required unless an RCD protected socket outlet for portable appliances is provided, such as in high mast installations).

##### Test Instrument:

RCD tester.

##### Test Procedure:

Disconnect all loads protected by the RCD under test, connect the RCD tester between the outgoing phase from the RCD and the main earth terminal. Measure the time taken for the RCD on test to trip and verify that it complies with the requirements of the National Rules for Electrical installations.

When testing has been completed, operate the test button of the RCD and verify that the RCD trips.

### **Tests With The Electrical Supply Disconnected:**

#### **6. Polarity**

The purpose of these tests is to verify that:

- (i) all fuses, single pole switches, and protective devices are connected to the phase conductors only.
- (ii) The fuse contacts are properly polarised.

#### **Test Instrument:**

A low current d.c. ohmmeter, or the continuity range of an insulation resistance tester (Megger).

#### **Test Procedure:**

Isolate circuit under test from all other circuits. Bridge the protective conductor at the main supply public lighting service pillar to each of L1, L2, L3 in turn. For each phase, measure continuity at the relevant columns between the protective conductor and the feed contact of the fuseholder. (Note: Public lighting columns on three phase circuits are normally connected sequentially to each of the three phases).

#### **7. Continuity of Main Underground Cables.**

(Note: This test requires a helper)

The purpose of these tests is to verify that:

- (i) There is continuity in all conductors of the main underground cables.
- (ii) There are no erroneous interconnections or bridging.

#### **Test Instruments:**

A low current d.c. ohmmeter, or the continuity range of an insulation resistance tester (Megger).

#### **Test Procedure:**

Withdraw all column fuses to disconnect all lantern and photocell loads, and isolate all other circuits from the circuit under test. Close all photocell test switches to prevent high test voltages affecting photocells. At each service pillar measure sequentially L1 – N, L2 – L3, N – E, for three-phase, and L – N, N – E, for single-phase. For each measurement at first read open circuit for each pair; then have each pair bridged in turn at last column of each circuit and observe meter reading falling to continuity.

#### **8. Resistance of the Protective Conductor**

The purpose of this test is to verify that the resistance of the protective conductor is sufficiently low to allow the protective device to operate in the event of an earth fault.

Test Equipment:

A low current d.c. ohmmeter having a visible resolution of 0.01 ohms.

Test Procedure:

Isolate circuit under test from all other circuits. Bridge protective conductor and neutral at last column in circuit, having disconnected the protective conductor from the column metal. Measure resistance of protective conductor / neutral loop at main supply public lighting service pillar. Remove bridge between protective conductor and neutral and bridge neutral and one phase conductor. Measure resistance of neutral / phase loop at main supply public lighting service pillar. Divide this reading by 2 (assuming phase and neutral conductors are the same material and have the same cross sectional area) and subtract the result from the first reading. The final result is the resistance of the protective conductor.

**9 Insulation Resistance of Cables**

The purpose of these tests is to verify that:

- (i) There are no short circuits between current carrying conductors, or between live conductors and earth.
- (ii) There is no reduction in insulation resistance due to damage or dampness.

Test Instrument:

An insulation resistance tester (Megger)

Test Procedure:

Withdraw all column lantern fuses to isolate all lanterns and photocells in the circuit under test. Isolate circuit under test from all other circuits. Measure sequentially at the main supply public lighting service pillar L1 – L2, L2 – L3, L3 – L1, N – L1, N – L2, N – L3, E – L1, E – L2, E – L3 for three-phase. Measure L – N, L – E, N – E for single-phase.

All readings shall equal or exceed 0.5Megohms.