



SPECIFICATION OF ELECTRICAL SERVICES

FOR

TEAGASC

AT

OAK PARK, CARLOW

TENDER

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1. ELECTRICAL PRELIMINARIES

1.1. LABOUR

Only fully qualified and competent tradesmen, together with their necessary labourers or helpers will be employed by the Contractor on the works. The Contractor will provide full and adequate supervision and site administration during the progress of the works and will keep a competent and authorised Agent or General Foreman, approved by Teagasc, constantly on the works. Such authorised Agent or General Foreman will give his whole time to the supervision of the works and must be able to receive and act upon (on behalf of the Contractor) all instructions, directions or orders issued by Teagasc.

1.2. POWER SUPPLY

Electricity supply will be 220/380/50 cycles, three phase, and all electrical plant and equipment whether of a permanent or temporary nature, supplied by the Contractor for use on the works, will be suitable for the supply.

1.3. QUALITY

The Contractor will fully comply with the documentation provided by Teagasc and its appointed M+E Consultants and all current Irish or British Standards and Regulations, and Good Working Practices.

1.4. INSURANCES

The Contractor will keep in place all necessary insurances as required by the Contract Documents.

1.5. SAFETY, HEALTH & WELFARE AT WORKS:

The Mechanical Contractor shall include all requirements associated with the Safety, Health and Welfare at Work Act 2005 and Safety, Health and Welfare at work (Construction) Regulations, 2006 (SI 504) as detailed in the main contract documents.

1.6. BUILDING REGULATIONS:

This Mechanical Contractor shall be deemed to be familiar with, and have a full understanding of the latest Building Regulations and with the contents of all technical guidance documents to the Regulations. He shall ensure that all works are undertaken and completed in accordance with the Current Building Regulations.

1.7. INSTRUCTION

The Contractor will instruct Teagasc staff in the operation and maintenance of the various components forming the installation. The Contractor will prepare maintenance and operational manuals as set out later in this Specification.

1.8. INSPECTION

The Contractor will, before covering up any work, give Teagasc reasonable opportunity to inspect the works already executed. The Contractor will give all such notices and provide such facilities as may be required to Statutory Undertakings, entitled to carry out inspection, or examination of the

works or part of the works. The Contractor will not interfere with, or disconnect or remove any existing services without prior arrangement and without prior agreement.

1.9. OPENING DAY ATTENDANCE

The Contractor will have a qualified electrician in attendance on the opening day for the duration of Unit trading.

1.10. SECURITY

The Contractor will comply with all security requirements as detailed in the Contract documents.

1.11. WARRANTIES

The Contractor will include cost for 1 year warranties on all equipment.

1.12. COLLATERAL AGREEMENT:

Collateral Warranties are required for all Sub Contractors used by the Contractor. These are to be furnished to Teagasc signed by the Contractor and Subcontractor in a format approved by Teagasc at Practical Completion.

1.13. PLACING & ACCESS

The Contractor will allow for all design, supply, unloading, distribution, hoisting, placing and fixing of all materials, plant and equipment. All delivery charges, scaffolding and means of access required for the Works will be included.

1.14. LABELLING

All equipment, be it mechanical, heating or electrical equipment, or even equipment provided by Teagasc Direct Trade Contractors, will be durably labelled using engraved labels and the appropriate label holder, e.g. isolator switches, pod door controllers (office), pumps, heating circuits, boilers, sub-distribution boards etc.

The Contractor will include for providing heat sealed schematic layouts framed and located within each of the plant rooms.

1.15. TESTING

All testing and commissioning, balancing and handing over in working order will also be included. Testing Requirements are detailed in Electro Technical Council of Ireland, Fourth Edition ET101:2008.

1.16. MEETINGS

The Contractor is to include for all necessary meetings, reviews, coordination and integration necessary for completion of the project.

1.17. COORDINATION

The Contractor will lead coordination of the building services installation. The Contractor will lead and coordinate the production of all building services drawings including services provided by Teagasc Direct Trade Contractors (this includes BMS, Fire Alarm, Intruder Alarm and CCTV).

The Contractor needs to coordinate the final routes of all distribution systems (including those installed by Teagasc Direct Trade Contractors) and will ensure there is no conflict of routes or services or conflicts in the drawings. The Contractor will ensure that no pipework enters electrical rooms or runs above in the vicinity of control panels or electrical panels
The works contractor will lead coordination of the building services installation.

This Electrical Contractor will include for full production of fully co-ordinated, builders work and ongoing drawings for all services.

1.18. PROGRAM

The Contractor will submit a detailed time program to the Contract Administrator fourteen calendar days prior to the Commencement Date. The Contractor will also submit a revised Works Program on a weekly basis and/or whenever the previous Works Program is inconsistent with actual progress or with the Contractor's obligations.

1.19. DESIGN AND HANDOVER DOCUMENTATION**1.19.1. Working Drawings:**

This Electrical Contractor shall provide Dimensioned Working Drawings as follows, before work is put in hand;

(a) Details of builder's work requirements for all electrical work.

(b) Details of installation arrangements for all electrical work.

These drawings should be fully co-ordinated with all other trades.

The Works Contractor will act as lead co-ordinator for all other Contractors. Builders work and installation drawings will be provided by the mechanical Contractor.

The Electrical Contractor shall provide all necessary assistances to the Works Contractor to carry out these works.

It is the responsibility of the contractor to ensure a full set of latest construction issue layouts are kept on site. Any additional alterations/amendments etc. must be highlighted and marked for record.

1.19.2. As Installed Drawings

The Contractor must submit at practical completion stage, a full set of as-installed drawings, showing the final layouts of all service systems, and details, as actually installed. Drawings will be in AutoCAD disk format and in hard copy and will be submitted to Teagasc for approval. The Drawings will include the Fire Alarm, Intruder Alarm and CCTV systems. The Contractor is responsible for updating

the drawings to include these systems. The Contractor will carry out any amendments requested by Teagasc. At a minimum the drawings listed below must be provided:

1. Lighting Layout Drawing
2. Power Layout Drawing
3. Data Services layout
4. Fire Alarms Services Layout
5. Power Distribution Schematic
6. Security Services Layout
7. Reflected Ceiling Plan

On final approval by Teagasc, the Contractor will prepare and submit to Teagasc, a full set of drawings, for all service systems, showing the final as-installed layouts in AutoCAD disk format and in hard copy - three sets.

1.19.3. As Installed Documentation

The Contractor is to provide all the documentation listed below as part of his handover package at Practical Completion. All of the documents must be approved by Teagasc. The Contractor will carry out any amendments requested by Teagasc.

On final approval by Teagasc, the Contractor will prepare and submit to Teagasc, a full Handover Package, for all mechanical services in soft copy format and in hard copy - three sets.

1. M&E Engineers Opinion on Compliance with Building Regulations (The M&E Engineer must hold professional Indemnity Insurance)
2. Design Calculations and Specifications
3. Installed Product List
4. Supplier List
5. Subcontractor List
6. Operations and Maintenance Manual for the works comprising: -
 - a. Description of all systems
 - b. Operation and control systems
 - c. Maintenance instructions
 - d. Manufacturers catalogues

1.20. VERIFICATION

The Contractor is to allow for the complete verification of all systems by Teagasc. The Contractor will ensure that Senior Representatives from each of his Sub-Contractors are available to assist in the verification of the systems. It is anticipated that this work will take two full working days.

The Contractor will ensure that all systems are fully commissioned and witnessed by the Site Foreman prior to presentation to Teagasc for verification. The Contractor will make full allowance for the verification of all systems in the development of their on-site program of works. The building will not be handed over until the verification is complete to the full satisfaction of Teagasc. Verification will include the demonstration of all air and water flow rates. All control functions and all operation.

2. ELECTRICAL SERVICES INSTALLATIONS

The electrical services installation comprises the following services -

2.1. ELECTRICAL CENTRES & MAIN DISTRIBUTION INSTALLATION

2.1.1. Description of Services

This section of the specification deals with the services listed below:

1. LV Switchgear
2. LV sub-main cables
3. Cable Tray – LV
4. Cable Trunking – LV Services
5. Fire Stopping of Containment
6. Temporary Generator Hire
7. Cable containment from MDB to SDB

2.1.2. Generator Hire

The Contractor will include for supply, installation & commissioning of a temporary 300kva continuously rated generator to test and commission equipment in the malting room and national centre for brewing and distilling.

Generator to be hired for a two-week period. Contractor to make provision for fuel for this duration. Contractor to allow for delivery to site all necessary temporary cabling and attendance as necessary.

2.1.3. New LV Switchgear

The Contractor will include for the supply and installation of new LV switchgear as detailed on the schematic drawings and as described below.

The main switch board will be extendible on at least one end. The main switch board will have suitable front access and be suitable for top or bottom entry. It will be supplied in a fully furnished and pre wired condition.

Only Main Distribution boards from approved suppliers are to be installed.

All switchgear will be custom built low voltage switchgear assemblies manufactured by Switchgear Supplier to the engineer's approval. The switchgear will be designed, constructed and tested in strict accordance with EIC 439 and the ETCI Code of Practice for low voltage switchgear assemblies.

The main switch board will be a multi compartment switchboard of 1.5mm sheet steel construction and will be compartmented to Form 4B with each compartment clearly labelled. Partition fillets will be sheet steel manufacture. They will be of cubicle design with separate compartment doors for each outgoing device. Single cabinet type systems will not be acceptable.

All other sub boards will be compartmented to form 4A.

All circuit breakers will be of the same manufacture - Merlin Gerin or ABB.

Extension of Main distribution board (MDB) is required to accommodate new supply to SDB1. Refer to drawings.

The switchgear manufacturer will select the circuit breakers to ensure full discrimination is achieved, throughout the entire installation. The Contractor will submit computer calculations to indicate the prospective fault levels throughout the installation along with verification that full discrimination is achievable. The Contractor will notify Teagasc in writing prior to commencement of construction if any design modifications are required to facilitate the above

Each compartment of switchgear board assembly will be clearly identified by means of deep engraved plastic labels.

Deep engraved plastic labels will be provided for the following items – internal sections within the DB enclosures, MCB's, RCBO's and contactors.

The assemblies will have a bake-on powder spray finish in the manufacturers standard colour and will have an ingress protection rating of at least IP54.

Each MCCB compartment will be door interlocked so that the switch must be "off" before the door can be opened. Switches will be single or triple pole double break as indicated with a separate neutral link in each compartment.

All control wiring will be connected via DIN rail terminals and will be complete with a terminal designation chart fixed to the inside of the terminal cover.

General power circuits will be protected by means of 20A x 30 mA SP&N type C RCBO.

Lighting circuits will be protected by means of 10 A SP type C MCB.

Miscellaneous small power circuits will be protected by means of 20 A SP type C MCB.

All circuits will be pre-wired to asymmetrical rail terminal with phase and neutral terminals mounted side by side.

Sub main boards will be fitted with an energy meter to provide digital indication of phase and line voltages, phase currents and power.

Sub main boards will be provided with circuit reference charts mounted on the inside of the access door. This chart will relate to identification numbers to be provided on each outgoing circuit. Circuit reference charts will be protected against physical damage by means of a plastic pocket.

All distribution panels shall be provided with circuit identification. These circuit charts must be laminated and neatly fitted to the inside of each panel door. The contractor must ensure circuits are easily identifiable. Circuit identification bone tags are required below each circuit breaker.

The main distribution board shall be fitted with a BMS compatible energy meter to provide indication of phase and line voltages, phase currents and power and to record and Unit electrical energy usage. This shall have facility for remote connectivity for monitoring purposes.

Testing, inspection and certification will be carried out in accordance with the requirements of I.E.C. 439 and E.T.C.I. publication 201 "Code of Practice for the Design, Selection and Erection of Low Voltage Switchgear Assemblies".

Both a specialist from the switchgear supplier and the Contactor will be present for all standard verification prior to practical completion.

The Contractor will include for the supply and installation of all energy meters of the electrical installation as detailed on the tender drawings.

2.1.4. LV Main Distribution Cables

The Contractor will include for the supply and installation of all sub-main cables for the electrical and mechanical plant. Main distribution cabling shall be installed as noted on electrical schematic. Cabling from the ESB incomer shall be distributed to the main distribution panel and all indicated Sub distribution panels.

Sub-main cables will be stranded copper conductor XLPE insulated, steel wire armour with LSZH over sheath.

Cables will be fixed to the sub-mains and LV cable tray system using heavy duty nylon cable ties.

Each cable will be labelled using the cable reference numbers. The means of identification will be either an engraved plastic or brass label securely fixed to the cable with cable ties or a stamped brass or aluminium label securely tied to the cable with galvanised iron or tinned copper binding wire.

Self-adhesive embossed plastic labels will not be accepted as permanent means of identification.

The means of identification will give the cable size, number of cores, and function together with the cable circuit reference number.

Cable identification labels will be installed within 300 mm of every termination and along the entire cable route at approximately every 25 m or change of direction, etc.

Cores of all control cables will be identifiable either by means of the cable core numbering system or by means of proprietary identification ferrules.

Jointing and termination of cables will be carried out in accordance with the manufacturer's detailed instructions. Jointing of cables will only be carried out with prior approval from Teagasc.

Cables will be terminated with approved brass glands complete with LSZH shrouds and brass earth tags.

2.1.5. LV Sub Mains Distribution Cabling

The contractor shall include for the supply and installation of all sub distribution cabling to supply all electrical and mechanical plant.

Sub distribution cabling will be NJMJ insulated with LSZH sheath, solid copper conductor carried on cable tray or in galvanised steel conduit and saddle clipped to building structure.

2.1.6. Cable Tray (Sub-Mains and LV)

The Contractor will include for the supply and installation of all cable tray to comply with layouts as detailed on the specification drawings and as described below.

The Contractor will include for supply and installation or rerouting of the cable tray system for conveyance of modular LV final sub-circuit wiring systems to sockets etc. The Contractor will also include for all LV cable tray required for conveyance of sub mains.

Cable trays will be galvanised sheet steel to BS 1449. They will be medium gauge for final sub-circuit wiring and heavy gauge for conveyance of sub-mains.

The cable tray sizes indicated will be the minimum size acceptable. The Contractor will, prior to installation, satisfy himself as to their adequacy and will advise Teagasc if any of the tray sizes need to be increased. The Contractor will include for all vertical runs from ground level to the ceiling void.

The Contractor will include for all necessary supports and brackets. Trays will be fixed to the roof using a Unistrut trapeze bracket arrangement.

Supports will be in accordance with manufacturer's recommendations and in any event will not be greater than 1200mm apart.

2.1.7. Cable Trunking (LV Services)

The Contractor will include for the supply and installation of cable trunking systems for conveyance of LV circuits including lighting, GS sockets, fixed equipment and miscellaneous small power circuits as detailed on the tender drawings and as described below.

The Contractor will include for supply and installation of the entire cable trunking system for conveyance of LV services.

Cable trunking will be galvanised sheet steel to BS 4678.

The cable tray sizes indicated will be the minimum size acceptable. The Contractor will, prior to installation, satisfy himself as to their adequacy and will advise the engineers if any of the trunking sizes need to be increased.

The Contractor will include for all necessary supports and hangers.

Trunking will be suspended from the roof using a trapeze bracket arrangement.

Supports will be in accordance with manufacturer's recommendations and in any event will not be greater than 1200mm apart.

2.1.8. Underground LV SUB-Main -Trench/Duct installation

1. All underground LV sub-main cabling shall be installed in heavy-duty red electrical ducting suitable for underground installation. Unless noted otherwise, provide 125 mm minimum internal diameter ducting. Final duct size and quantity shall be verified against the selected cable size and cable manufacturer's installation requirements.
2. Provide minimum cover measured from finished ground level to the top of the electrical duct as follows:
 - o 600 mm minimum in grassed and landscaped areas.
 - o 750 mm minimum beneath tarmac, concrete, paved or trafficked areas.
3. Ducts shall be installed on and surrounded by a minimum 75 mm selected sand or approved thermal backfill, free from stones, sharp material or other debris liable to damage the duct or cable.
4. The thermal properties of the duct surround and backfill shall be appropriate to the final cable sizing and current-carrying-capacity calculations. Where required by the electrical design, proprietary thermal backfill shall be used.
5. Provide continuous red electrical warning tape – "CAUTION ELECTRIC CABLE BELOW" along the full route, installed approximately 300 mm below finished ground level.
6. Provide proprietary electrical cable protection marker slabs / strips continuously above the duct installation.
7. Unless otherwise indicated, provide:
 - o One dedicated duct for the LV sub-main cable(s); and
 - o Two spare duct extending over the full underground route.
8. All ducts shall be provided with suitable continuous draw ropes. Spare ducts shall be capped and sealed at both ends against ingress of water, silt, debris and vermin.
9. Maintain a minimum 300 mm clear separation from other normal underground services, including water, drainage, telecommunications and electrical services, wherever practicable.
10. Maintain a minimum 600 mm clear separation from high-pressure gas mains, strategic water mains, large-diameter pipelines or other high-risk services, unless otherwise agreed with the Engineer and relevant service owner.
11. Electrical ducts shall cross existing services at approximately 90° wherever practicable. Extended parallel installations directly above or below other services shall be avoided.
12. Where the specified separation cannot be achieved at a local crossing, provide appropriate additional mechanical protection, concrete slab or proprietary service barrier as agreed with the Engineer prior to installation.
13. Prior to excavation, the Contractor shall establish the location of all existing underground services by review of available service records, electronic service detection and trial holes where required. Hand excavation shall be undertaken adjacent to known or suspected live services.
14. Duct routes shall be installed as straight as reasonably practicable. Changes in direction shall utilise long-radius bends suitable for the final cable and shall comply with the cable manufacturer's minimum bending radius.
15. Provide suitable draw pits / cable pulling chambers at significant changes in direction and at intermediate locations as required to facilitate cable installation.
16. Final draw-pit locations and spacing shall be determined having regard to the selected cable manufacturer's requirements, including:
 - Maximum cable pulling tension;
 - Minimum bending radius;
 - Side-wall pressure;
 - Cable drum lengths; and
 - Practical cable pulling arrangements.

17. Backfill shall be placed and compacted in suitable layers. Finished surfaces shall be reinstated to match the surrounding existing grass, landscaping, tarmac, concrete or paving construction.

18. Prior to final backfilling, the completed duct installation shall be inspected and recorded. The Contractor shall provide photographic records and surveyed as-built information, including duct routes, depths, draw pits, changes in direction and service crossings.

19. The underground cable installation shall comply with the current edition of I.S. 10101, the project electrical specification, final electrical design calculations and cable manufacturer's recommendations.

IMPORTANT – FINAL CABLE COORDINATION

The duct sizes, number of ducts, bend radii, draw-pit locations and cable pulling arrangements shown are typical only. Prior to commencement of the underground works, the Contractor shall confirm compatibility with the final LV sub-main cable selection.

The Contractor shall verify the proposed installation against the cable manufacturer's maximum pulling tension, minimum bending radius, duct fill requirements and installation methodology. For the approximate 250 m cable route, intermediate pulling arrangements shall be determined from the final cable size and installation calculation. The cable shall not be pulled over the complete route solely on the basis of the typical trench detail without confirmation of the cable pulling requirements.

TYPICAL DETAIL DESIGN BASIS

- Grass / landscaped area: 600 mm minimum cover to top of duct.
- Tarmac / concrete / trafficked area: 750 mm minimum cover to top of duct.
- Duct surround: 75 mm minimum selected sand / suitable thermal backfill.
- Normal separation from other services: 300 mm minimum clear.
- High-risk / major pipeline separation: 600 mm minimum clear, subject to service-owner requirements.
- Warning tape: approximately 300 mm below finished ground level.
- Typical duct: 125 mm ID heavy-duty red electrical duct.
- Provide minimum one spare duct unless noted otherwise.
- Drawing detail: N.T.S.

2.1.9. Fire Stopping

Where cableway systems pass through fire compartment walls and floors the fire barrier must be maintained by installing suitable fire seals around cables, trunkings, conduits etc.

The Contractor will include for all fire sealing of all electrical services. The fire seals will provide a fire resistance not less than that provided by the building fabric.

The Contractor will be responsible for ensuring that such activities do not cause any damage to the services installed.

Where trunking systems pass through fire compartment walls and floors the Contractor will install an intumescent pad fire seal inside the trunking.

Fire seals for use inside trunking systems will be purposely designed and will not reduce the current carrying capacity of the cables within.

Major openings for the passage of cable trays and trunkings will be sealed using intumescent fire and smoke seal pillows or intumescent high density rock fibre slab.

PVC trunking systems will be fitted with an intumescent wrap which will be capable of crushing the trunking in the event of fire.

2.1.10. Description of Services

The Power Services comprises the following services -

1. Power Services for System Control Panels
2. General Services Socket Outlets
3. Mechanical services

2.1.11. General Services Socket Outlets

The contractor shall install NYMJ cabling mounted on adequately sized cable tray. Wiring to the sockets shall be carried out with (4.0mm²) NYMJ Cable and lighting circuits shall be wired with (2.5mm²) NYMJ Cable. Maximum number of sockets per circuit shall be exceed 6No. outlets

Sub distribution cables will be NYMJ insulated with LSZH sheath, meeting minimum requirements of Class Dca-s2,d2,a2 in accordance with I.S. EN 50575 , stranded copper conductor, carried on cable tray or in galvanized steel conduit and clipped to the building structure.

Cabling shall be protected within steel conduit where vertical drops are exposed or concealed behind stud.

2.1.12. Power Services at Equipment Centres

The Contractor will include for the supply and installation of all power services at equipment centres as detailed on the tender drawings and as described below.

The contractor shall install NYMJ cabling mounted on adequately sized cable tray. Wiring to the sockets shall be carried out with (4.0mm²) NYMJ Cable and lighting circuits shall be wired with (2.5mm²) NYMJ Cable.

Sub distribution cables will be NYMJ insulated with LSZH sheath, meeting minimum requirements of Class Dca-s2,d2,a2 in accordance with I.S. EN 50575 , stranded copper conductor, carried on cable tray or in galvanized steel conduit and clipped to the building structure.

Cabling shall be protected within steel conduit where vertical drops are exposed or concealed behind stud.

Deep engraved plastic labels will be provided for the local isolators as required.

2.2. BONDING AND EARTHING

The Contractor will include for the supply and installation of Bonding and Earthing throughout.

The bonding and earthing system will comprise the following;

1. - Main earth electrodes
2. - Earth conductor
3. - Main earthing terminal
4. - Neutralising link
5. - Protective conductors
6. - Main bonding conductors
7. - Local bonding conductors

Main earth electrodes will be installed adjacent to each new unmetered LV switch room to give an earth resistance of 10 ohms or less. There will be a minimum of 4 No. at this location.

The main earth conductors to each earth electrode will be 95mmsq stranded copper conductor cable. The cable will be PVC covered within the building and will be buried bare underground.

Main earthing terminal will be provided within each main LV switchboard.

This neutralising link will form a solid copper link between the main neutral and earth bars in both sides of the main LV switchboard.

Protective conductors will be run with each sub-main and final circuit.

Main bonding conductors will be installed between the earthing bar in main switchboards and each of the following;

1. Gas - 25mmsq
2. Water - 25mmsq
3. Ventilation Ductwork - 25mmsq
4. Distribution Boards - 25mmsq

Appendix 1

List of Tender Drawings

Electrical Drawing Register	DWG. No.	SCALE/SIZE
Electrical Services Layout – Site Plan	1811-E100	1:250@A0
Electrical Services Layout – Ground Floor Plan	1811-E200	1:125@A1
Power Distribution Schematic	1811-E300	NTS@A1