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Functional Specification

Control and Protection Cabinets and Marshalling Kiosks

Revision	Date	Description	Originator	Reviewer	Checker	Approver
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1 SCOPE

This Functional Specification is applicable for use in offshore wind transmission links delivered by the Customer as Contestable Works, to be owned and operated by EirGrid. The specification relates to the Onshore Compensation Compound (OCC) and Offshore Substation Platform (OSP).

The specification deals with indoor control and protection cabinets and outdoor marshalling kiosks. These are used to house a combination of 19" modular chassis, protection relays, switches, auxiliary relays, terminals, wiring and trunking.

This specification should be read in association with the project specific contestable works pack and project documentation and all other relevant functional specifications as issued by EirGrid.

For the purpose of this specification the term Customer shall refer to Offshore Wind Power Developers, Independent Power Producers responsible for the design and build of assets to be handed over to EirGrid.

2 STANDARDS

Except where otherwise stated in the functional specification, materials shall be designed, manufactured, tested and installed according to relevant IEC/EN standards. Where applicable the Irish adaptation of the standard (IS EN version), including any national normative aspects, shall apply. Where no IEC Standard has been issued to cover a particular subject then an EN, International or British Standard shall be applied. The latest edition and amendments shall apply in all cases.

The cabinets and kiosks shall comply with this Specification and with the latest editions of the following standards:

IEC 60529 Classification of degrees of protection provided by enclosures.

IEC 60227 Polyvinyl Chloride insulated cables of rated voltages up to and including 450/750 V.

IEC 61439 Low-voltage switchgear and control gear assemblies.

IEC 60917 Modular order for the development of mechanical structures for electronic equipment practices.

In addition, there shall be compliance with the provisions of all relevant directives of the European Union. In order to confirm compliance, the equipment shall carry the CE Mark in accordance with Directive 93/465/EEC.

In case of conflict between this specification and any of the listed standards, this specification shall take precedence.

3 SERVICE CONDITIONS

There are no additional requirements above what is stated in the outdoor and indoor environmental service conditions in the latest revision of the EirGrid functional specification OFS-SSS-400, Onshore Compensation Compound General Requirements.

4 GENERAL CABINET & KIOSK REQUIREMENTS

4.1 CONSTRUCTION

All the indoor control and protection cabinets and outdoor marshalling kiosks shall be steel enclosed. They shall have a robust frame construction. They shall be rigid, and free from flaws, twists and bends.

All panel / door / cover edges shall be reinforced against distortion.

The lifetime of the cabinets/ kiosks shall be at least 40 years. All materials used in the cabinets/ kiosks shall be expected to be in good condition during that lifetime.

The equipment and materials inside the cabinets/ kiosks shall be arranged in such a way that with the doors, or removable front cover, opened there shall be unimpeded access to the interior of the cabinets / kiosks, i.e. no horizontal or vertical bars blocking access.

The doors shall be able to be opened to 180 °. The doors shall be metal hinged and provided with individual handles. Concealed hinges are preferred.

A padlock provision shall be available for each door access. Padlock provisions shall be suitable for fitting a padlock which shall have the diameter of max. 7 mm.

4.2 DEGREE OF PROTECTION

The degree of protection of the cabinets/ kiosks shall be in accordance with IEC 60529.

With doors closed, the degree of protection shall be at least:

- IP21 for standard indoor cabinets
- IP51 for indoor cabinets with dust sensitive and delicate equipment
- IP54 for outdoor marshalling kiosks.

For all cabinets/ kiosks, the degree of protection shall be at least IP2x when doors are open.

4.3 EARTHING AND BONDING

Earthing shall be as per the latest revision of the EirGrid drawing OFD-SSS-513.

A cabinet/ kiosk shall be equipped with one to three earth bars depending on its design. The earth bars shall be made from high conductivity hard drawn copper with minimum cross-sectional area of 20 mm x 5 mm.

The earth bars shall have threaded holes for bonding the cabinet / kiosk enclosure, all device metal cases, and the screens of all control and protection cables which will be terminated in the cabinet/ kiosk.

Suitable bolts shall be provided for these bonding connections. The threaded holes shall be M5. The centre to centre distance between two adjacent holes shall not be less than 30 mm.

The earth bars shall be bonded together by copper straps whose minimum cross-section shall be 50 mm² for outdoor kiosks, and 25 mm² for indoor cabinets.

The panels, top and bottom plates, and metal parts of doors of a cabinet / kiosk shall be bonded together by copper straps of minimum 6 mm², and then bonded to an earth bar by a copper conductor of minimum 6 mm².

All earth straps and earth conductors in the cabinets shall have green and yellow outer PVC insulation.

For each indoor cabinet, one of the earth bars shall be bonded to the control room earth grid by a copper conductor of at least 2 x 25 mm² cross-sections.

For each marshalling kiosk, one of the earth bars shall be bonded to the kiosk base frame by a copper conductor of at least 2 x 95 mm² cross-section.

4.4 INTERNAL WIRING

All wiring shall be methodically arranged and shall follow an orderly and tidy pattern, grouped in a logical manner according to circuits involved, and shall be adequately supported and protected from mechanical danger. Wiring shall be arranged so that access to terminals or other apparatus is not impeded.

- All wires from a trunking to an electrical device or to a terminal block of a protection relay shall be grouped and tied together.
- Internal wires (connections between internal equipment) and external connections (connections to external equipment) shall be installed separately in dedicated trunkings
- Internal wires shall be connected to the equipment side of a terminal block/ column/ row unless otherwise specified
- All connections shall be tight and correctly ferruled. Connections to devices must not be under strain. Varistors are required across the coils of auxiliary relays where no surge suppression exists. These varistors shall be wired in parallel with the coil of the relay in question and shall be kept outside the trunking.
- The internal wires shall be multi-strand flexible copper conductor. Each end of an internal wire shall be fitted with a crimp connector whose style and size shall be suitable for the expected rating and the connection to the target terminal. Wherever the terminals accept ring crimp connectors, this connector type shall be used. Wiring runs shall be so arranged as to minimise pick-up of interference or spurious transients.
- There shall be complete wire runs between terminal points, i.e. wires shall be jointed or terminated at terminal points only. Not more than two wires shall be connected to any one side of a screw terminal.
- An allowance shall be made in the length of each wire (50 mm max) at the point of connection to the terminal in order to permit the cutting off and remaking of the wire termination at least once without causing the need to disturb the main run of the wire. Wire loops on devices and terminal blocks shall be sized (cross section area) correctly and no more than 100 mm max in length. Wire loops, where appropriate, shall be kept outside trunking i.e. on test switches.

The internal wiring shall conform to IEC 60227

- The conductor size and colour shall be as per Table 1 below. The wire size and colour shall be as in Table 1 below unless otherwise specified by EirGrid.

Table 1 Wires of Different Circuit Types

Circuit Type	Minimum Wire Size	PVC Insulation Colour
Current transformer (CT)	2.5 mm ²	Black
Earthing	4 mm ² (6 mm ² for bonding current neutrals)	Green / Yellow
Others	1.5 mm ² or as specified	Not black, green or yellow

4.5 TERMINAL BLOCKS AND MCBs

4.5.1 GENERAL REQUIREMENTS

The terminals shall be screw type terminals. They shall have universal housing feet which allow the terminal blocks to be easily snapped onto the DIN rail profiles NS 35.

All terminal blocks shall be mounted on the DIN rail NS 35 x 7.5 mm in accordance with EN 60715.

One side of each terminal block shall be used for connecting to internal equipment. This side is called the equipment side. The other side, called the cable connection side, shall be for connections to external cables.

Internal wiring shall be on the equipment side of the terminal block unless looping has been specifically shown on the schematic drawings to be on the cable connection side of the terminal block. One example of this is that looping is required on the cable connection side of CT terminal block. Terminals including 20% of spare terminals shall be provided as specified in the detailed designs provided for wiring.

Each block of terminals shall be identified with an indelible identification label.

All terminals of each terminal block shall be numbered individually and continuously on both sides, from top to bottom, or from left to right, in ascending order.

Markers shall be used to make identification labels for terminal blocks, and number labels for terminals. They shall be stuck or held firmly on terminal blocks. They shall have white background with markings in black ink.

Bridging between adjacent terminals shall be done by using suitable fixed bridges or insertion bridges or bracket switch bars.

A partition plate or separating plate shall be used to separate two neighbouring bridges of a terminal block electrically and visually.

Suitable end covers shall be used to cover the conductors inside terminals when needed.

At each end of a terminal block, an end clamp shall be fitted to maintain a secure grip for the terminal block on the DIN rail and to provide the place for fitting on the terminal block label.

The terminals and their accessories shall be from the same manufacturer. The accessories shall be the items recommended by the manufacturer for fitting with the selected terminals.

Note: The spring charge motor supply for the circuit breaker should be wired through an isolatable terminal not an MCB.

Current and voltage transformer terminal types are specified in the following sections:

4.5.2 CURRENT TRANSFORMER (CT) TERMINALS

There are two types of CT terminals used for the different applications. It is mandatory that these CT terminals are used in locations as specified in table 2:

Table 2 CT Terminals

Terminals	Type	Application	Location
Type A	Phoenix type UGSK/S + GS and Phoenix type UK 6N.	Where shorting only is required.	Marshalling Kiosks
Type B	Phoenix type URTK/SP and Phoenix type UK 6N.	Where shorting and isolating is required.	Interface Kiosks and in the Protection cabinets

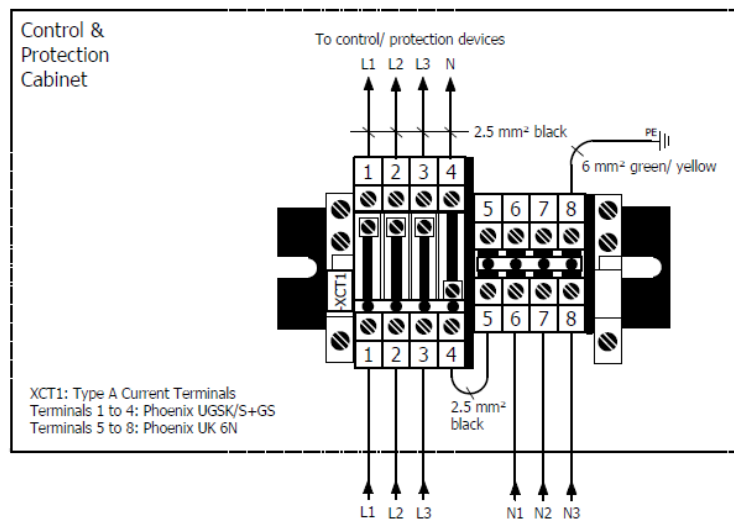


Figure 1 Type A CT Terminals

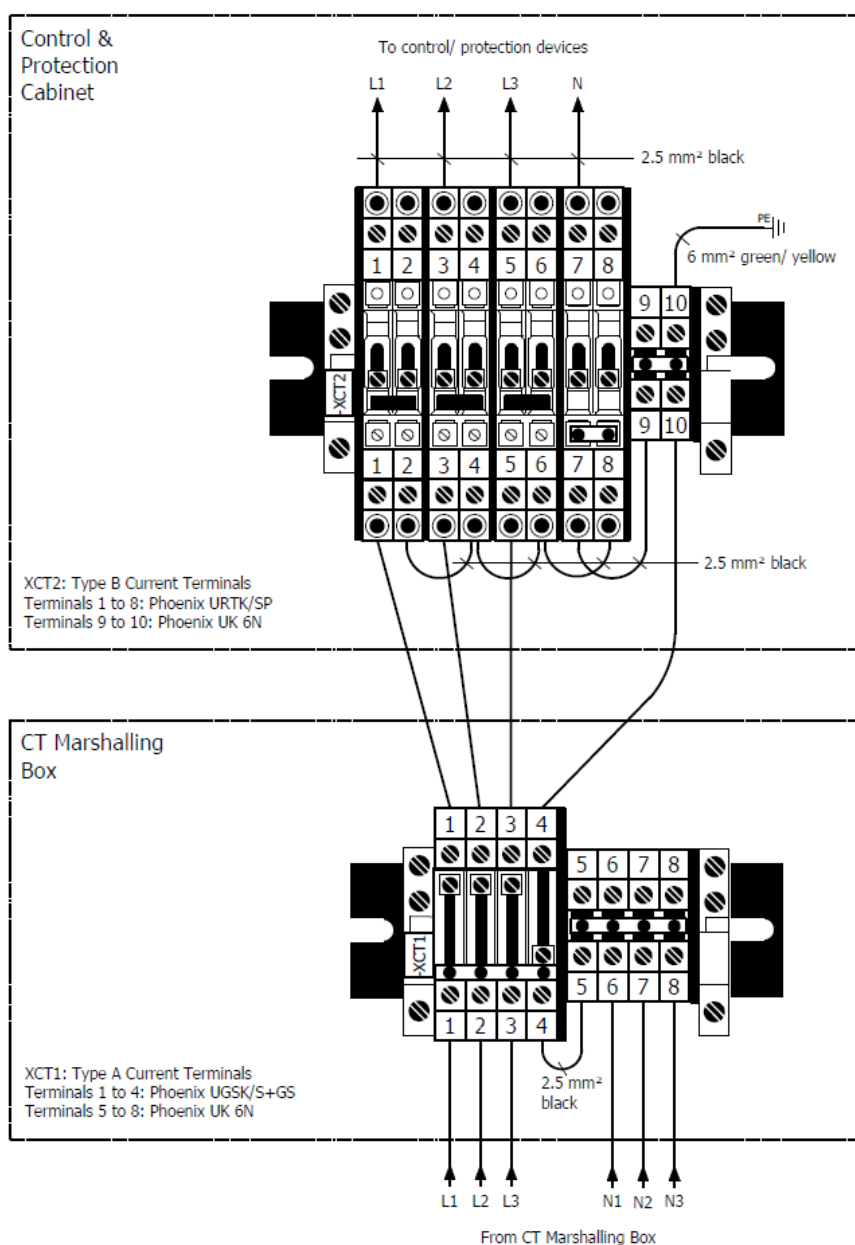


Figure 2 Type A & B current terminals for a transmission bay (indicative)

CT terminals should be labelled XCTx – where x is the HV CT secondary core number. For the CT terminals URTK/ SP, the CT secondary shorting links must be on the CT secondary side of the terminals and not on the ‘load’ side.

When the CT terminals are installed vertically, the terminal shorting bar / switching jumper (slider) shall be at the bottom, to ensure that in the event of a loose connection, the effect of gravity would result in the CT being shorted to earth.

4.5.3 VOLTAGE TRANSFORMER (VT) TERMINALS

Phoenix type URTK/S and UK 6N are specified for voltage terminals and use of these terminals is mandatory.

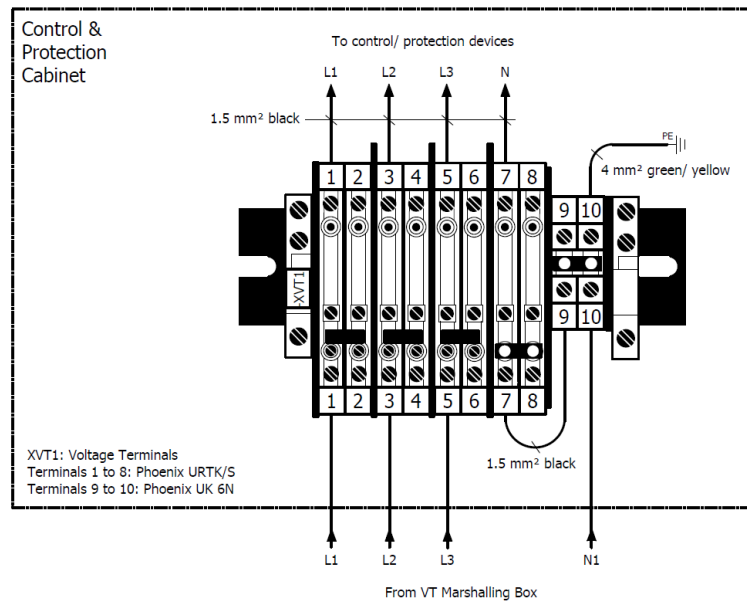


Figure 3 Voltage Terminals

VT terminals should be labelled XVTx – where x is the HV VT secondary core number.

Please see annex A for details of all terminals types, their function and representation symbols. Fuse Terminal Blocks for VT Circuits

Fused terminal blocks required are Phoenix type UK10 DREHSI (6.3 x 32) fitted with 6.3 x 32 mm, 2 A fuse Radionics type 420-167.

4.5.4 MINIATURE CIRCUIT BREAKERS FOR VT CIRCUITS

A dedicated 3-ph MCB (less than or equal to 3A, "B" curve or as required by specific protection/control device to which the VT is connected) shall be applied to the 3 phase voltage circuits at the VT marshalling point, a normally-open auxiliary contact shall be provided which shall operate simultaneously with the main poles of the MCB. Cables shall be terminated into standard terminals, then wired to the MCB.

4.6 TRUNKING

Wiring in the cabinets/ kiosk shall be accommodated in trunking. There shall be separate trunking for internal wires and external cable connections. Each trunking shall have the capacity to accommodate all the wiring plus 40 % spare space.

Trunking shall be open slot type, fitted with covers. Trunking and their covers shall be made of PVC.

The dimensions (width x depth) of a trunking shall not be less than 40 mm x 40 mm. For marshalling kiosks, a trunking shall not be bigger than 150 mm x 100 mm. For other cabinets, a trunking shall not be bigger than 120 mm x 100 mm.

The minimum clearance between a trunking and a terminal block, or an equipment item, shall be 25 mm.

The minimum clearance between the bottom plate and the lowest trunking shall be 120 mm.

4.7 ALARMS

Alarms from the marshalling kiosk shall be provided as required.

A standard VT MCB trip and mechanism box fault shall be provided. Individual alarms for each MCB is required.

5 INDOOR CABINETS

5.1 STANDARD CABINETS

The construction of the indoor cabinets shall meet the general requirements for cabinets stated in Section 4.1 construction and following requirements:

The cabinet frames shall be made of sheet steel with the minimum thickness of 1.5 mm.

The cabinet frames can be either fully welded frames or bolted frames, provided they are strong enough to house all the installed equipment without damage to the equipment or the cabinet during transport, installation and service.

All steel parts of the cabinets (except the zinc-plated/ galvanised/ stainless steel parts) shall be painted on both sides with the colour RAL 7035. All floor mounted cabinets (apart from floor mounted mimic control panel) shall be suitable for bolting together to form a row of cabinets. Each standard floor mounted cabinet shall be equipped with one side panel on its right side, i.e. there shall be a side panel in between two adjacent cabinets in a row.

All the side and rear panels and the roof of a cabinet shall be made of sheet steel. The minimum thickness shall be 1.5 mm for each panel and roof.

All the doors shall be made of sheet steel with a minimum thickness of 2 mm. The bottom plate shall be made of at least 1.5 mm thick stainless or galvanised sheet steel to prevent corrosion.

For floor mounted protection cabinets, 19-inch rack and adapter rails shall be mounted to the front frame of the cabinet to form the supporting frame for protection relays. The 19-inch rack shall be at least 40U (1778 mm) in height. Mounting plates made of 3 mm zinc-plated or galvanised sheet steel shall be fitted on the 19-inch rack.

For floor mounted protection cabinets, front doors are not required to cover the front mounting panel(s), but the side panels together with the rear door(s), front (mounting) panel(s), front door (400 mm front door for 1000 mm width cabinet), bottom and roof plates of a cabinet in a cabinet row shall form a metal enclosure which meets the specified degree of protection requirements for standard indoor cabinets.

For cabinets which have rear door(s), there shall be no obstruction to access the interior of the cabinet with the rear door(s) opened, e.g. a 19-inch rack at the back of the cabinet shall not be acceptable.

All cabinets shall have two side frames on which mounting of equipment, such as terminal blocks, wire trunkings and small equipment, shall be possible.

For all floor-mounted type cabinets, sufficient fixing points shall be provided on the bottom frame of each cabinet for bolting the cabinet firmly to the floor. The wall-mounted cabinets shall have fixing points on the back frame for bolting the cabinet to the room wall.

Door opening shall be possible without the use of any tool.

All cabinets shall have louvered air vents provided on the rear door/panel. The air vents shall be built in such a way that the cabinet shall meet its specified IP protection requirements. Dust filters shall be fitted onto the air vents.

Heater(s) shall be arranged inside the cabinet if needed to prevent moisture condensation inside it.

The cabinets shall have cable entry from the bottom. The bottom plate shall consist of a number of individual plates (2 to 4 plates for each cabinet). These plates will be fitted with cable glands by the Customer during the installation phase on site.

To facilitate future installation of additional field cables, these plates shall be easily removed even when the cabinet is fully assembled and in operation.

Cabinets shall be provided with lifting eye bolts on their top, or with an appropriate means to allow them to be lifted by crane. If a means other than lifting eyebolts is provided or if a different cabinet type is used, the supplier shall be requested to provide details on the appropriate means of lifting the cabinet".

If the base plates are not load bearing, then appropriate labelling shall be applied indicating clearly that individuals shall not stand on these items.

5.2 CABINETS FOR DUST-SENSITIVE OR DELICATE EQUIPMENT

In addition to the requirements set out for the standard cabinets, the following requirements shall be applied for the cabinets which house dust-sensitive or delicate equipment:

The degree of protection of these cabinets shall be at least IP41 (See Section 4.2 Degree of Protection) with their door(s) closed.

The cabinets shall have two side panels.

The front mounting panel(s) of the cabinets shall be covered by front door(s). Glazed front doors shall be provided, to permit viewing of the equipment installed on the front mounting panel, with the doors closed.

If glass is used on the doors, it shall be toughened glass.

If acrylic is used on the doors, the doors shall meet the following requirements:

- The doors shall be properly designed to allow for thermal expansion and contraction of the acrylic sheet.
- The doors shall be designed to prevent fire spreading from one door to the adjacent ones.
- The acrylic sheets used on the doors shall maintain their transparent property during the cabinet lifetime. They shall have the abrasion and chemical resistant properties as good as toughened glass. Certificates shall be submitted by the Tenderer to prove these properties for the acrylic sheets used.

5.3 SWING-FRAME CABINETS

Instead of fitting on the fixed front frame, the 19" rack of these cabinets shall be fitted on a swing front frame which shall be able to open to at least 135°.

These cabinets shall have a rear panel instead of rear door(s). Air vents with dust filters shall be installed on the upper and lower parts of the rear panel.

The rear frame of the cabinets shall be suitable for installing trunkings, terminal blocks, MCBs, auxiliary relays, etc.

The single size swing frame cabinets shall be wider and deeper than the standard single size cabinets (see Section 5.4 Dimensions). Layouts of these cabinets will be sent to the Supplier when ordering them.

5.4 DIMENSIONS

The dimensions of the cabinets shall be adequate to accommodate all wiring, equipment, terminal blocks, etc. and shall have provision for at least 20% spare for the future use.

Typical dimensions are as follows:

Each cabinet shall be nominally 2000 mm ± 5 mm in height, excluding plinth.

Each cabinet is to be fitted with a plinth which height is approximately 100 mm.

For all floor mounted cabinets (apart from floor mounted mimic control panel):

- The depth including rear doors shall be 600 ± 5 mm for standard cabinets or 800 ± 5 mm for swing-frame cabinets.
- The width including side walls shall be:
 - 600 ± 5 mm for single-size standard cabinets
 - $1,000 \pm 5$ mm for 1000 mm width standard cabinets
 - $1,200 \pm 5$ mm for double-size standard cabinets or
 - 800 ± 5 mm for swing-frame cabinets.

All cabinets used for common systems, such as signal interposing, shall allow enough space for the future development of the station as required.

Floor mounted cabinets shall be bolted to the floor of control rooms. The distance of the fixing point from front to back for floor mounted cabinets shall be 475 mm for 600 mm deep cabinets and 675 mm for 800 mm deep cabinets.

5.5 ADAPTER RAILS

Where adapter rails are required, they shall be used for the purpose of supporting 19" modular chassis. They shall be mounted to the front of the cabinets with provision for being recessed to the front of the cabinet and shall extend to a minimum of 40U in height, where one height module, $1U = 44.45 \text{ mm} = 1.75 \text{ inches}$.

5.6 DOORS

With the doors opened there shall be unimpeded access to the interior, i.e. no horizontal or vertical bars blocking access.

Doors shall be hinged and provided with individual handles. Concealed hinges are to be provided. No door is to exceed 800 mm width. The doors are to open to 180° , except where swing framed doors are used. Swing framed are to open to a minimum angle of 135° .

Each cabinet (with rear access) shall be provided with full length doors at the rear (except in the case of swing-frame cabinets which have rear panels). A document pocket shall be attached to the rear door; this shall be of adequate size for storage of cabinet drawings.

Louvered air vents shall be provided on each rear door / panel.

Each cabinet shall be capable of dissipating heat generated by enclosed equipment. The heat dissipation performance must be designed in accordance with the enclosed equipment manufacturer rating requirements.

5.7 CONFIGURATION OF CABINETS

Configurations of cabinets and arrangement of doors and panels will be specified on individual drawings.

The design layout of each cabinet should take account of safe systems of work and inform intuitive operation of devices on the cabinet.

Protection relays and their associated testing devices should be grouped.

Access to each device should not be impinged by other devices, wiring, terminals or trunking.

The layout of each cabinet shall be reviewed with EirGrid prior to construction.

All switches, MCB's or pushbuttons, on the door or within the cabinet, must be positioned at a height no greater than 1800 mm from floor level to allow safe access and operation.

6 OUTDOOR MARSHALLING KIOSK

These enclosures are required for outdoor use to marshal the signals from the bay electrical equipment. The panels shall be IP rated to IP54 or greater. The cabinets shall be robust and manufactured from stainless steel or hot dipped galvanised steel sheet. Marshalling kiosks shall have a minimum thickness of 3 mm. The frame and panels including all nuts and bolts shall be hot dipped galvanised to comply with the latest revision of EirGrid Spec OFS-SSS-420.

The kiosk frame shall be welded frame. The quality of the welded joints shall meet the Level B - Stringent Quality Level as specified by the standard EN 25817.

All cable entry to the Marshalling Kiosk is to be from the bottom. Two cable clipping rails shall be provided to secure the incoming cables in place at the bottom of the kiosk.

Doors shall be fitted with retainers to allow them to be held in the open position. Door retainers shall be strong enough to hold the door open in strong wind conditions, up to 50 m/s.

Earth bars shall be provided as required in Section 4.3 Earthing and Bonding.

A weatherproof socket outlet is to be provided for 230V AC. This is to be located on the exterior of the kiosk and should meet all requirements as per IEC60309.

A 3-phase 32A socket outlet shall be provided at the bay marshalling kiosk. The socket outlets shall comply with EN 60309 part 1 and part 2. The socket outlet should be installed so that it is not subjected to undue mechanical stress or to damage in normal service and that a plug can easily be inserted and withdrawn without damage to the flexible cable or cord. The socket outlet should be suitably rated to facilitate the connection of a SF₆ gas cart for filling purposes.

For the interface kiosk two sockets shall be installed, one each side of the kiosk.

There shall be two internal LED lamps with a wire protection grille fitted to prevent breakage of the tube, controlled by door operated switches.

Each kiosk shall be provided with an anti-condensation heater and ventilation to prevent condensation inside it. The wiring associated with these cabinets is listed in the project specific wiring diagrams.

The kiosks shall be fitted with padlockable doors at front and rear.

Sufficient fixing points shall be provided on the bottom frame of the marshalling Kiosk for bolting the kiosk firmly to the concrete base in the switchyard. All fittings required shall be provided.

6.1 DIMENSIONS

The dimensions of the kiosks shall be adequate to accommodate all wiring, equipment, terminal blocks, etc. and shall have provision for at least 20% spare for the future use.

Typical dimensions are shown below as follows:

The kiosk height, excluding roof and base frame shall be 1790 ± 10 mm.

The kiosk depth, excluding doors shall be 450 ± 5 mm.

The kiosk width, including side panels shall be 1000 ± 5 mm

The fixing points for fixing the base frame to the foundation shall be as follows;

- Distance between left & right fixing points shall be 580 mm
- Distance between front & back fixing points shall be 490 mm

7 LABELS AND NAMEPLATES

7.1 LABELS

Equipment labels shall be made adhesive label material. The lettering shall be roman upper-case type.

Labels shall be fixed firmly on each accessible front/ back door and front/ back panel of an indoor cabinet. The label size is to be 130 mm x 50 mm. The label material is to be an acrylic-based laminate or paper in acrylic holder. The background shall be white, and the lettering shall be black. The letter height is to be 9 mm.. All labels shall be clearly visible and shall not be obscured.

The contents of all labels of a cabinet/ kiosk will be provided in the layout drawings of that cabinet/ kiosk.

7.2 NAMEPLATES

Each cabinet/ kiosk shall have an indelible nameplate which shall be fixed on its front door or front panel.

Nameplates shall be made of durable material suitable for indoor or outdoor service locations of the Cabinet/ Kiosk. The texts on a nameplate shall have a good contrast to the nameplate background.

The dimensions (W x H) of each nameplate shall be approximately 100 mm x 50 mm.

The nameplate shall provide the following information:

Name of the Manufacturer

- Date of manufacture
- Weight (kg)
- Nominal DC voltage
- Maximum 50 Hz withstand voltage (kV/ 1 min)
- Reference documents (schematic drawing No., layout drawing No.)
- CE marking

8 INSULATION LEVELS

The insulation between conducting parts to earth and between circuits shall withstand the following AC 50 Hz voltages for one minute.

Table 3 Insulation Levels

Equipment, circuits	Dielectric Withstand Test Voltages (AC 50 Hz) for 1 minute
The equipment and associated wiring and terminals operating at the voltage not higher than 60 V.	1 kV
The equipment and associated wiring and terminals operating at the voltage higher than 60 V.	2 kV

The dielectric strength between conductors and earth of each circuit and between circuits shall be tested by applying AC 50 Hz voltages of the magnitudes specified in the Table 3 above.

9 FACTORY TESTING

Inspection and routine tests as follow shall be performed in the factory on each completed control and protection cabinet and marshalling kiosk. All pieces of equipment, relays etc., which are not rated for 1 kV or above, should be disconnected before performing any voltage tests.

If a cabinet fails testing, retesting shall be required.

Any deviation to the submitted layout should be agreed with EirGrid before the cabinet is delivered to site.

9.1 GENERAL INSPECTION

This shall involve checks under the following headings:

- 1 Dimensions, surface treatment, appearance and construction of the cabinets and kiosks.
- 2 Layout of equipment and markings.
- 3 Type and rating of each item of equipment.
- 4 Wiring and terminals – colour coding, identification, sleeves, neatness of arrangement, terminations, etc.
- 5 Earthing.
- 6 Markings, nameplates and labels.

9.2 WIRING CHECK

Connections shall be checked for compliance with drawings.

9.3 MEASUREMENT OF INSULATION RESISTANCE

The insulation resistance between conductor and earth of each circuit and between circuits shall be measured before and after the dielectric test by means of a 500 V Megger.

9.4 ADDITIONAL TESTS

Tests shall be carried out as appropriate in accordance with the relevant drawings.

- 1 Secondary injection tests
- 2 Functional testing of switches, auxiliary relays, protection relay binary inputs (220 V DC, 48 V DC supplies required)
- 3 Verification of phasing

Powering of protection relays Factory testing may be witnessed by EirGrid. The manufacturer shall be liable for repairs should a protection relay be damaged due to installation errors.

10 DOCUMENTATION TO BE INCLUDED WITH INITIAL SUBMISSION

All documents shall be in English.

The following information shall be supplied:

- 1 Technical details and description of all equipment offered, including installation instructions.
- 2 List of deviations.
- 3 Any other data necessary to describe the offer.
- 4 Reference list for equipment identical to that offered and evidence of reliability and successful operational experience.
- 5 Physical drawings of the cabinets, including dimensions, installation details and cable entry arrangements.
- 6 Electrical drawings, including details of connections, wiring and terminal arrangements. Two copies of marked up As-built drawings will be required. One set to remain with the cabinet, the other set to be issued prior to shipment of cabinet.
- 7 Installation, commissioning, operation and maintenance instructions, including technical manuals for proprietary equipment installed in the cabinet.
- 8 Factory test results (format to be agreed)

In addition, a complete electronic set of drawings on disc shall be supplied in the following formats:

MicroStation	*.dgn (if available)
AutoCAD	*.dwg
Adobe Reader	*.pdf

11 ANNEX A - STANDARD CONTACT BLOCK TYPES

11.1 DISCONNECT TERMINAL BLOCK PHOENIX CONTACT URTK/SP

- Disconnect terminal block used for all CT secondary connections except marshalling kiosks.
- Connection method: screw connection
- Picture shown in Figure 4 and CAD symbol in Figure 5

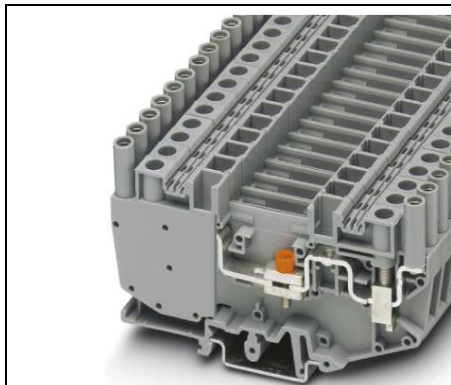


Figure 4 Phoenix Contact URTK/SP

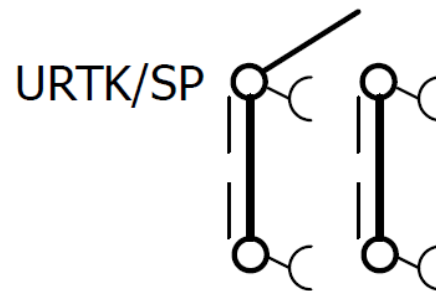


Figure 5 URTK/SP CAD Symbol

11.2 TEST DISCONNECT TERMINAL BLOCK PHOENIX CONTACT URTK/S

- Test disconnect terminal block used in VT connections
- Connection method: screw connection with test socket screws
- Picture shown in Figure 6 and CAD symbol in Figure 7

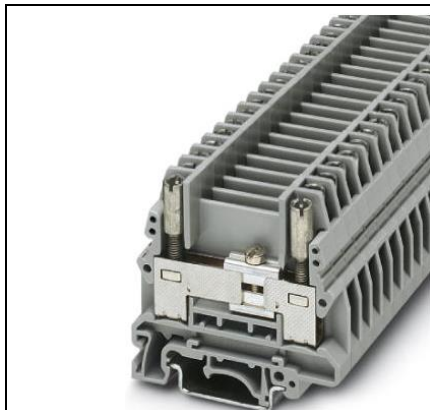


Figure 6 Phoenix Contact URTK/SP

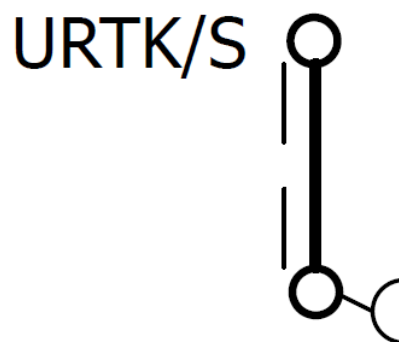


Figure 7 URTK/SP CAD Symbol

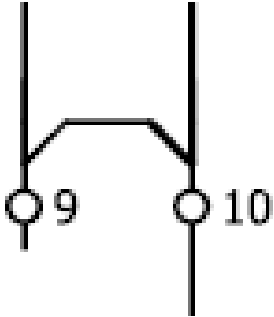
11.3 SLIDE-TYPE TERMINAL BLOCK PHOENIX CONTACT UGSK/S+GS

- Slide-type terminal block used in marshalling kiosks for CT connections
- Connection method: screw connection
- Picture shown in Figure 8 and CAD symbol in Figure 9

	
Figure 8 Phoenix Contact UGSK/S+GS	Figure 9 UGSK/S+GS CAD Symbol

11.4 FEED-THROUGH TERMINAL BLOCK PHOENIX CONTACT UK5N/UK6N

- Feed-through terminal block used for:
 - Star point connections for CTs and VT.
 - General purpose.
- Connection method: screw connection
- Picture shown in Figure 10 and CAD symbol in Figure 11

	
Figure 10 Phoenix Contact UK5N/UK6N	Figure 11 UK5N/UK6N CAD Symbol

11.5 KNIFE DISCONNECT TERMINAL BLOCK PHOENIX CONTACT UK5-MTK-P/P

- Knife disconnect terminal block used for:
 - Power supply distribution boards.
 - Busbar differential protection panel
- Connection method: screw connection with test socket screws
- Picture shown in Figure 12 and CAD symbol in Figure 13

	UK 5-MTK-P/P 
Figure 12 Phoenix Contact UK5-MTK-P/P	Figure 13 UK5-MTK-P/P CAD Symbol

11.6 FUSE MODULAR TERMINAL BLOCK PHOENIX CONTACT UK10-DREHSI

- Slide-type terminal block used in VT connections
- Connection method: screw connection
- Picture shown in Figure 14 and CAD symbol in Figure 15

	
Figure 14 Phoenix Contact UK10-DREHSI	Figure 15 UK10-DREHSI CAD Symbol