Company standard
Construction Standards for MV Substation Buildings

(Not Generator Connection)

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Contents

Foreword

This document supersedes ESB Specification 13320 for ESB MV Substation Buildings Version 7.

Table 1: Superseded Documents

Document No.	Title	Full / Partial
ESB Specification 13320	ESB MV Substation Buildings Version 7	

Introduction

This specification covers the technical construction details of an MV substation.

On most sites there are conditions that need to be reviewed with ESB Networks at the design stage. Early contact with ESB Networks is essential to avoid expensive errors in substation design and construction.

If your query is about the provision of supply involving an MV substation, but you have not yet applied for supply, contact the ESB Networks Customer Care Centre on 1850 372 757. Please have the location of the proposed development. The Customer Care Centre will refer your query to the local area office. A member of the design team will contact you.

If you have received a quotation letter, it will contain the designer's name and contact details. Please contact them for any advice in relation to the electricity supply.

If you have paid the connection fee, have returned the signed Acceptance of Terms form and the SWA1 form and you wish to proceed with the construction of the substation then you can either:

a) Contact the designer who will provide you with the contact details of the installation teams.
b) Contact the ESB Networks Customer Care Centre on 1850 372 757 quoting the job number (5000…….). Your query will be referred to the local area office and a member of the installation team will contact you.

Please see the activity chart in Annex A. It shows how early contact with the ESB is essential to ensure a substation can be integrated into the building design.

ESB will endeavour to meet agreed work schedules. Good cooperation between the ESB and customers is important to achieve this. To avoid unnecessary delays, the substation building should be completed in accordance with this specification.

Errors in location and substation construction can delay a project and may result in costly and complicated reworking of the substation and its surrounding structures. Please refer to Annex B for a list of the common errors.

Network alterations to accommodate a new substation can take from eight weeks to over six months to complete. The variation in time reflects the voltage level and nature of the alteration required.

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Scope

This document is for customers who are required to build an indoor MV/LV substation. The substation can be for a large LV (230/400V) connection or a medium voltage (MV, 10kV or 20kV) connection. The requirements detailed in this document form part of ESB's contract with the customer.

i 

This specification is not for use where generation plants such as windfarms, solar farms, landfill gas, biogas or hydro plants are being connected to the medium voltage (MV) system.

Mandatory references

ii

Document Number	Document
A3D.205071-16A	Architectural Drawings for Medium Voltage (MV) Substation Buildings (DOC-150916-CH) Drawings
	Approved Material Suppliers for LV, MV, 38kV & 110kV Associated Works Approved Suppliers
DOC-030303-AEN	National Code of Practice for the Customer Interface http://www.presb.ie/esbnetworks/ncp

These documents are available on the ESB Networks website in the new connections area under ESB Publications.

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1. Types of Indoor MV Substation Building

There are three types of MV substation buildings:

- Freestanding MV substation:

Fig. 1: Freestanding MV substation.

- Freestanding MV substation adjoining a customer's switchroom.

Fig. 2: Freestanding MV substation adjoining a customer's switchroom.

- MV substation incorporated into a large building development.

Fig. 3: MV substation incorporated into a large building development.

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Where required the customer shall provide an adjoining switchroom which accommodates the customer's main circuit-breaker and revenue meter. The customer is responsible for switchroom design in accordance with the Code of Practice for the Customer Interface. See http://www.presb.ie/esbnetworks/ncp

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2. Design and Planning

2.1 Substation Dimensions

The substation **internal** dimensions are:

Single MV Substation (Standard Substation)

Width:	4,000 mm
Length (front to back):	3,500 mm
Height:	2,600 mm

Double MV Substation

Width:	8,000 mm
Length (front to back):	3,500 mm
Height:	2,600 mm

Dual Radial Feed MV Substation

Width:	4,000 mm
Length (front to back):	4,500 mm
Height:	2,600 mm

Wall thickness

Internal wall between MV substation and other areas of a building:	215 mm
External wall:	415 mm

For large customer electrical loads, it may not be possible to house all electrical equipment within the standard substation. A larger substation shall be required in such cases and details will be provided by ESB Networks.

2.2 Site transfer and legal requirements

If a new or relocated substation is to be established as part of any development, it is a requirement of ESB that the Customer will agree to transfer substation sites, including rights of way to ESB, and grant a wayleave for cables, free of charge to ESB, prior to the completion of the works requested. This requirement forms part of all Connection Agreements / Terms where substations or cable wayleaves are a feature.

As the legal process to achieve transfer / registration may take some time to complete and in order to facilitate the Customer, ESB Networks will normally agree to begin programming of the installation of MV/LV plant on the basis that the Customer arranges return of the SWA1 document that is issued with the letter of quotation. The SWA1 form should be completed by the land owner's solicitor and returned to ESB.

NOTE

Return of this document forms an important part of the 'terms accepted' requirements.
No works will be scheduled without a completed SWA1 form.

2.3 Unimpeded Access

MV substations are not only a point of supply but also provide a means of network isolation in the event of faults or emergencies. Therefore 24-hour unimpeded access for ESB Networks staff is essential.

The substation shall be located at ground level. Access to the substation should be from a public road, as vehicular access to the substation is required at any time of the day or night. This requires that the access route to be at least

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3 m wide and 4 m high. The maximum allowable slope of the access road or driveway to the substation is 1:10. To facilitate the installation or replacement of heavy electrical equipment, the immediate area around the substation shall be level.

If the only available site is behind locked gates or a barrier, agreement on the access arrangements shall be made at the design stage with ESB Networks. A Key safe shall be installed. The keys or swipe cards required for gaining access to the substation shall be stored in the Key safe adjacent to the gate. It shall be possible to open the locked gates or barriers even if electric power is not available. Access will be needed throughout the full lifetime of the substation, so any new owner or management company shall be made aware of this requirement, and new access arrangements can be made with ESB (new keys, cards etc.)

Fig. 4: Key safe available from local ESB depot.

Substation and “right of way” layout shall be designed to avoid the need for ESB staff entering onto the hazardous sites, or sites that require ongoing site induction. It is important to discuss this with ESB at design stage.

Where site conditions along the right of way remain unchanged, site induction of ESB staff shall be carried out only once for an individual.

If a site is judged to be so hazardous as to require site induction before every visit to the substation, ESB reserves the right to either, not install the equipment, or disconnect supply to that substation.

Also, see the ‘National Code of Practice for the Customer Interface’ (http://www.presb.ie/esbnetworks/ncp) regarding access to customer switchrooms for meter reading.

2.4 Position of substation relative to customer’s switchrooms

If an adjacent customer switchroom is required (LV or MV), it shall be sited adjacent to the MV substation room. It shall comply with the ‘Code of Practice for the Customer Interface’. The customer’s main circuit breaker should be located so that the feeder cables can run directly from the ESB substation duct, through the boundary wall at the base of the duct, and directly up into the main circuit breaker terminals. This requires careful consideration of the switchroom position, layout of the customers’ switchroom ducting, customer panel design and orientation of the customer panel.

Occasionally, customer switchrooms are located directly above or below the ESB substation. In this situation careful consideration shall be given at the design stage to routing the feed cables from the substation to the switchroom. Fireproofing the substation ceiling and sealing the cable ducts against transformer oil leakage is vital in the event of a fire. Any proposed design shall be approved by ESB Networks at the design stage. It shall comply with the ‘National Code of Practice for the Customer Interface’.

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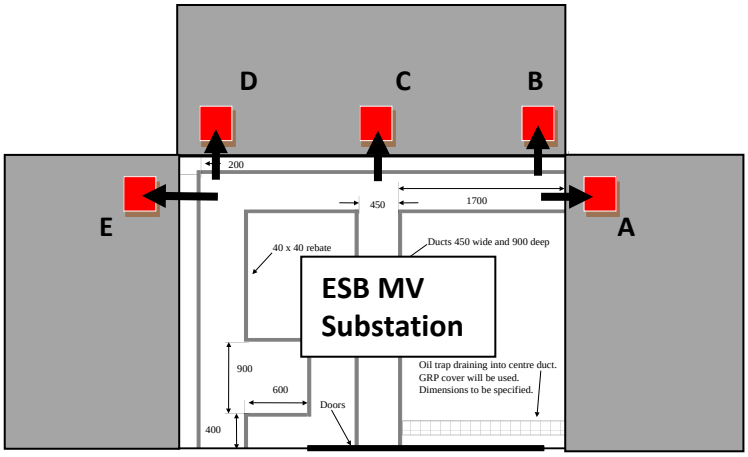
Typical layouts are given in Fig. 5 and are for information only and are not to scale.



Customers Switchroom possible positions:

Customers Main Circuit Breaker possible positions A…E:

Possible direction of feeding cables to customer:

Fig. 5: Typical alternatives for the location of customers' switchrooms in relation to the ESB MV substation.

2.5 Location of substation within building complex

The customer shall incorporate the substation(s) into the overall building or building complex design. The customer shall have due regard for the access, location of the electrical load and customer's switchroom(s). If LV connection is being provided, substations shall be located reasonably close to the customer load. This will minimise the possibility of the customer experiencing low voltage problems.

Where a substation/switchroom combination is primarily used to supply one building within a building complex, for example a large office block or apartment block, the substation/switchroom combination shall be incorporated into that building (Fig 3 above) or be standalone (Fig 2 above). It is not permitted to incorporate the substation/switchroom combination into an adjacent building.

The main electricity supply cables (owned by ESBN) enter the substation through duct opes. There are normally two at the front of the building in line with each internal duct. However, the location of duct opes depend on cable routing for each substation. It should be agreed with ESB Networks prior to the construction of the substation.

2.6 Fire Rating

A fire in the substation shall not put people at an unacceptable risk. These risks include the spread of fire, smoke, and interference with means of escape from fire and smoke. Substations shall be located so that doors open onto low-fire risk outside areas.

A risk assessment shall be carried out by the customer's design team. This is to ensure that the precautions put in place will facilitate the safe evacuation of all buildings that may be affected by a substation fire. A substation's structure - including floor, walls and ceiling - is designed to contain a fire which starts inside the substation.

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The substation shall be constructed with the internal leaf of block on flat, poured concrete floor and roof slab. All ducts, both above and below ground level, shall be sealed by the builder (or developer responsible for the building project) to provide a four-hour fire rating.

Approved substation doors with louvres do not require a certified fire rating as they open onto low-fire risk, outside areas.

All substations incorporated into larger buildings shall have a smoke detector fitted to the door. The detector shall be connected to the fire alarm system in the main building.

A customer may, at their discretion, fit a smoke detector to the door of a free standing MV substation on their property.

Substation doors shall not be less than 3 m from main entrance, exit or any fire escapes.

Substation doors shall not be less than 3 m from air conditioning intakes.

Small single room air vents serving a single apartment are permitted within 3 m of the substation door frame provided that they are automatically shut off in the event of a fire alarm from the substation.

All windows within 3 m of the substation door frame shall have 30-minute fire rated glass fitted and be non-openable type.

Substation doors shall not be less than 5 m from exposed oil pipes, exposed gas pipes, fuel tanks or similar risks.

2.7 Doors

Hot-dip galvanised steel doors have been designed to include vertical louvres for ventilation. It shall be possible to open doors through 180 degrees unless otherwise agreed at the design stage with ESB Networks.

Doors are only available from the approved suppliers in one standard size for a single MV substation. The door ope must be 2485 mm by 2485 mm with a tolerance of 0 to + 20 mm.

If a door is mounted flush with the façade of a multi-storey building, a drip rail shall be fitted along the top of the door frame.

2.8 Earthing

Earthing of an MV substation is important. It reduces the possibility of stray voltages around the substation. It helps to protect operating staff and members of the public from electric shock. There are three main elements that have to be installed during the substation construction:

- Earthed steel reinforcing mesh in the substation floor. Refer to section 4.5.
- Copper earth wires laid as required adjacent to the substation by ESB Networks. Refer to section 4.7.
- A copper earth mat under the footpath at the substation door. Refer to section 4.8.

2.9 Flood Risk

MV electricity substations are vulnerable to the effects of flooding. Forced outages of MV stations will also have a negative impact on the ability of the surrounding business or homes to cope with flood conditions. Under flood conditions safe access can be limited by flood waters so large sections of the distribution network may have to be isolated to render the flooded substation safe, thus widening the impact of the flood to unflooded areas.

Construction of an MV substation should only be permitted in areas at risk of flooding when there is no alternative.

MV substations shall not be constructed in areas with a flood Zone A rating.

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MV substations may be constructed in areas with a flood Zone B rating if there is no alternative. Measures shall be taken to reduce the impact of the flooding on the MV substation and associated distribution equipment. Such measures include raising the floor of the MV substation to 300 mm above the predicted flood level along with the provision of steps and landing area outside the substation door.

Demountable defence gates and sump pumps are not an acceptable flood defence measure for new MV substation buildings.

2.10 Drainage

Ground level drainage shall be provided above and below ground level to ensure the substation and ducts will not flood.

Non-metallic rainwater downpipes shall discharge into gullies that are piped away to suitable and adequately sized soakaways.

2.11 No Impediments

There shall not be any beams or columns inside the substation. Pipes or services shall not be routed through the substation. No steel stanchions, fire-sprinkler pipework, electrical cable trays, thermal or acoustic insulation, rain water downpipes or any other equipment shall be inside the substation.

Fig 6: No steel stanchions or other equipment inside the substation.

2.12 Planning Permission

The customer shall obtain planning permission for all buildings - including the ESB substation - be it freestanding or incorporated into a larger building.

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3. Part Three: Pre-Construction

3.1 Quotation and Terms for Connection

Details on how to apply for an electricity connection can be found on ESB Networks' website (www.esb.ie/esbnetworks).

ESB Networks will provide a quotation letter or connection agreement which will specify if the customer has to provide a substation.

A connection agreement will specify the expected date of the completion of the substation building by the customer. It will also schedule the provision for the connection. This completion is referred to in the connection agreement as 'the terminal substation completion date'.

Where a substation is required, the customer shall undertake to transfer the substation site and provide a legal easement for electricity cables as part of the acceptance of the connection offer. The connection works cannot be authorised until the following details are in place:

- Legal issues have been finalised.
- Payment has been received.
- Customer has officially accepted any other requirements specified in the quotation letter or connection agreement.

3.2 Safety During Construction

Safety – Statutory Obligations
The customer is responsible for managing safety for the building project in accordance with the following and all other relevant safety legislation:

1. The Safety, Health and Welfare at Work Act 2005.
2. The Safety, Health and Welfare at Work (General Application) Regulations 2007 and amendments.
3. Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. 291-2013)

ESB Underground Electricity Cables / Overhead Electricity lines

Underground electricity cables or overhead electricity lines constitute one of the more common hazards encountered when working near buildings or on building sites. Always assume electric cables are present. If ESB cables, cable slabs or warning tape are uncovered, digging shall stop until the site has been inspected by ESB Networks.

The customer shall ensure that when digging is taking place, the location of all underground cables in the vicinity is known. Maps giving the location of cables are available from ESB Networks.

You can email your request including your site map to mailto:dig@esb.ie

Call 1850 928 960 or +353 01 8582060.

You can make a postal request to:
Central Site
ESB Networks,
St Margaret's Road,
Finglas,
Dublin 11,
D11X3W7,
Ireland.

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A Cable Avoidance Tool used by a skilled operator can give a precise location of cables when used in conjunction with maps.

Refer to the ESB Networks website for further information on digging and excavation work Safety

and the Code of Practice for Networks Avoiding Danger from Overhead Electricity Lines Code of Practice PDF

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4. Construction Details

4.1 Associated Documentation

This section should be read in conjunction with the relevant drawings as listed in table below:

Table 2: MV Substation drawings.

Item	Drawing No.	Rev.	Title	Source
1	A3D.205071-16A	A	MV Substation Building	ESB Publications Website *
2	A3D.205071-16A-DS	A	Double MV Substation Building	Local ESB Contact
3	A3D.205071-16A- DRF	A	Floor plan layout for a Dual Radial MV Substation Building	Local ESB Contact

* These drawings are available in PDF and DWG format and can be downloaded from the ESB's website (www.esb.ie/esbnetworks under ESB Publications, underground Networks Technical Documents). Link > Drawings

The ESB website also contains information on ESB's approved suppliers for doors, duct covers and earth mats.

A freestanding substation will have:

- Strip foundation at 1450 deep (subject to ground conditions).
- Cavity wall with 215 mm concrete block or solid concrete inner leaf, 100 mm cavity and 100 mm outer leaf.
- Concrete floor slab with 900 mm deep ducts.
- Floor steel mesh electrically isolated from any other steel in the building.
- Floor steel mesh welded together with two earthing and two test points.
- Cast in situ re-enforced concrete roof with approved weather proofing membrane.
- Steel door from an ESB approved supplier.
- Copper earth mat, from an ESB approved supplier, outside the door at 200 mm deep.

An incorporated substation will have:

- Foundation as required by the main building.
- Cavity external walls with 215 mm concrete block or solid concrete inner leaf, 100 mm cavity and 100 mm outer leaf.
- Internal walls 215 mm concrete block on flat or solid concrete.
- Concrete floor slab with 900 mm deep ducts.
- Floor steel mesh electrically isolated from any other steel in the building.
- Floor steel mesh welded together with two earthing and two test points.
- Cast in situ re-enforced concrete ceiling 215 mm thick. (No insulation, thermal or acoustic, is permitted within the substation)
- Steel door from an ESB approved supplier.
- Copper earth mat, from an ESB approved supplier, outside the door at 200 mm deep (from finished footpath level).

4.2 Excavations and Foundations

Excavation for wall foundations shall be to a minimum depth of 1450 mm. This depth is required for ducts, which are 900 mm deep in the substation floor. It may be necessary to excavate deeper if required to reach a sufficiently firm stratum.

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4.3 Substation Wall

Prior approval is required if the building is to be of solid cast concrete or precast concrete.

All external substation walls shall be of cavity wall construction.

The cavity wall shall be:

- Inner leaf 215 mm thick constructed from blocks conforming to EN 771-3, 7.5N/mm^2 laid flat, neatly pointed.
- Cavity 100 mm wide with no insulation.
- Cavity closed at door ope by returning the inner leaf tight to outer leaf separated by vertical DPC 300 mm wide. See Drawing A3D.205071-16A Sheet 7.
- External leaf block on edge with two coats of render or of brickwork / other masonry cladding.
- External walls should be finished to blend in with the surrounding buildings. The finish applied should require no maintenance.
- The external leaf can be substituted for cladding if all other buildings in the complex are of cladding design.
- Cladding shall be maintenance free and not diminish the ventilation or damp proofing properties of the substation.

Internal walls between the customer's property and the MV substation shall be 215 mm thick from blocks conforming to EN 771-3, 7.5N/mm^2, laid flat, neatly pointed.

4.4 Floor

A poured concrete floor shall be installed. The floor will incorporate a duct lay-out, oil trap and reinforcing steel as shown in Drawing A3D.205071-16A.

4.5 Reinforcing Steel

For electrical safety, reinforcing steel mesh shall be incorporated into the substation floor. This is to ensure equipotential bonding between the floor slab and the electrical equipment. It shall be electrically isolated from all other steel in the building or building complex. See Drawing A3D.205071-16A for details.

The steel mesh sections shall be welded together and welded to the two 16 mm reinforcing bar bridge pieces crossing the cable ducts at the front middle and rear right of the substation. See drawing A3D.205071-16A Sheet 2. These bridge pieces will be used to connect the steel mesh to the earth grid of the substation.

Two test and inspection points shall be provided as shown on A3D.205071-16A Sheet 2.

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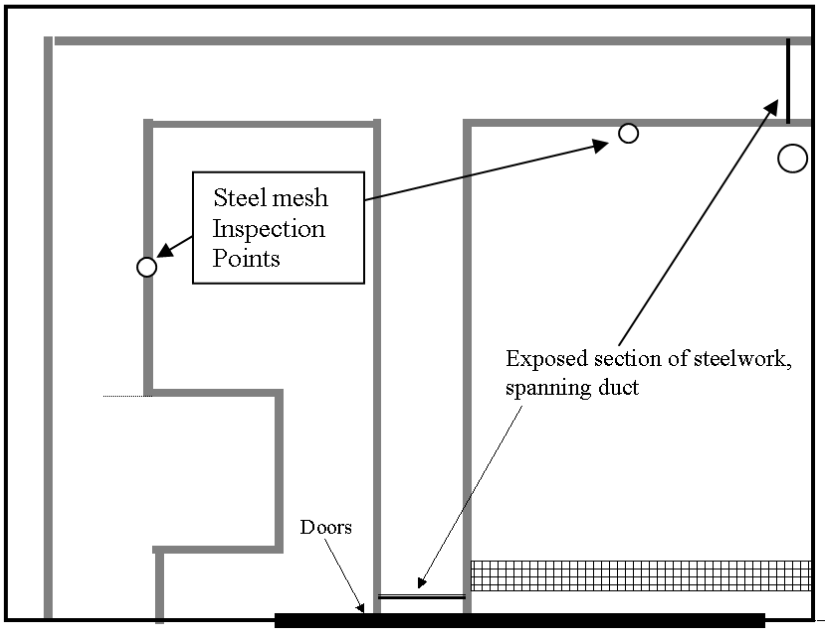

Fig. 7: Reinforcing steel inspection and earthing points.

4.6 Ducts

The duct profile is shown in Drawing A3D.205071-16A. Walls and the base of duct shall be constructed from poured concrete. The following are the critical dimensions:

1. Height of rebate shall be 40 mm (+5, -0).
2. Total width of duct plus rebate on either side shall be 530 mm (+5,-0).

These dimensions are tightly specified because prefabricated duct covers are available from approved suppliers. These duct covers are factory cut to minimise amount of work on site.

4.7 Copper Earthwire Installation

Copper earthwires are laid as required adjacent to the substation by ESBN staff. They are laid below ground level and adjacent to the substation to provide a 'substation main earth'. The design and layout of this 'substation main earth' are site specific and vary from one location to another depending on network configuration. Earthwires are laid by ESB Networks in conjunction with the main cable ducting.

Close cooperation is required between the developer and the ESB Networks contact person at this phase.

Final groundworks, paving and landscaping should not be carried out until all the electrical cables and earthwires are installed.

4.8 Copper Earth Mat Installation

An approved copper earth mat shall be installed under the front door step. The tail of the mat shall run into the middle cable duct for connection to the main MV earth system. The mat shall be installed 200 mm below the finished footpath level. The wall must be core drilled at the correct level, or have a 50mm duct installed at the construction stage to allow the earth mat copper tail to enter the central duct.

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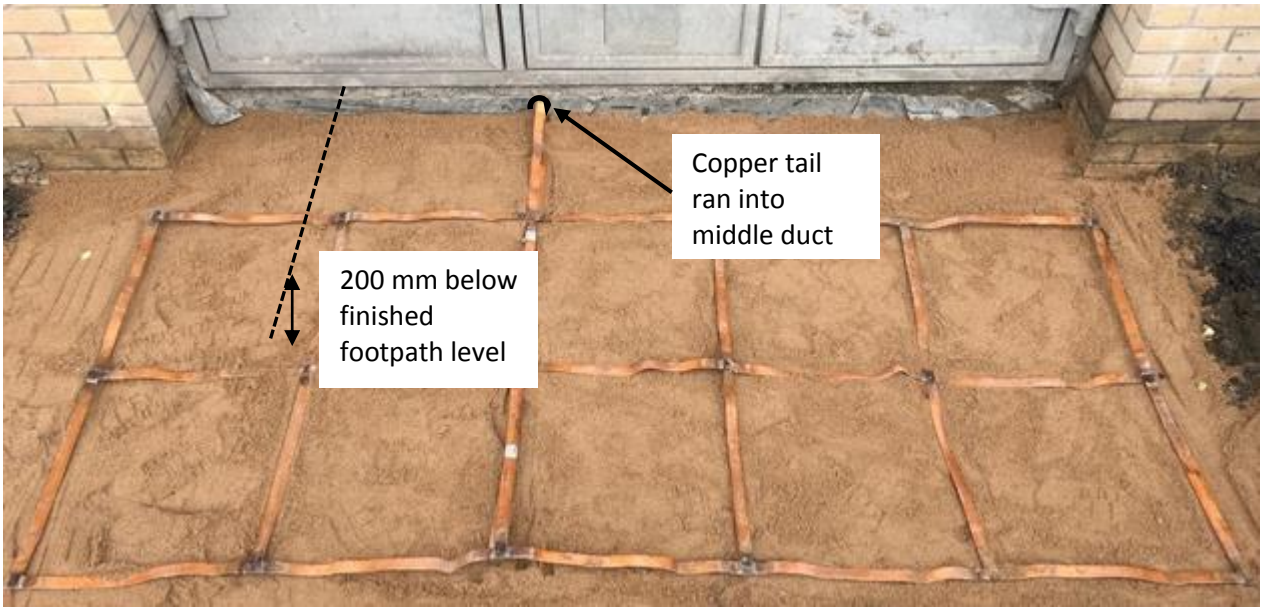

Fig. 8: Earth mat installation under door step

The best time to install the earth mat is when the final groundworks and footpath works are being carried out. Installing the step and the footpath too early could impede the cable installation. The substation will not be energised if the earth mat is not installed to standard, confirmed by ESB supervision or by photograph. Careful co-operation with ESB Networks staff is critical if the works are to proceed smoothly.

4.9 Duct Opes

Duct opes are where cables enter the substation. They are 450 mm wide by 330 mm high and lead into the base of the duct 900 mm below floor level through the solid rising walls. There are normally two at the front of the building in line with each internal ducts. However, the location of duct opes depends on cable routing for each substation and should be agreed with the ESB prior to construction. A lintel shall be installed at the head of the duct ope to support the blockwork. See drawing A3D.205071-16A.

The duct ope between the ESB substation and the customer switchroom shall also be constructed in the same manner. However, an ope size of 450 mm by 215 mm will suffice. The location of the ope to the customer's switchgear will depend on the layout and location of the customer's switchroom. See Fig. 9 and Fig. 5 for the location of suitable duct opes 'A' through to 'E' depending on the location of the customer's main circuit breaker.

It is important that the duct ope to the customer's switchroom is kept to a minimum size of 450 mm by 215 mm. This allows for easier fireproofing.

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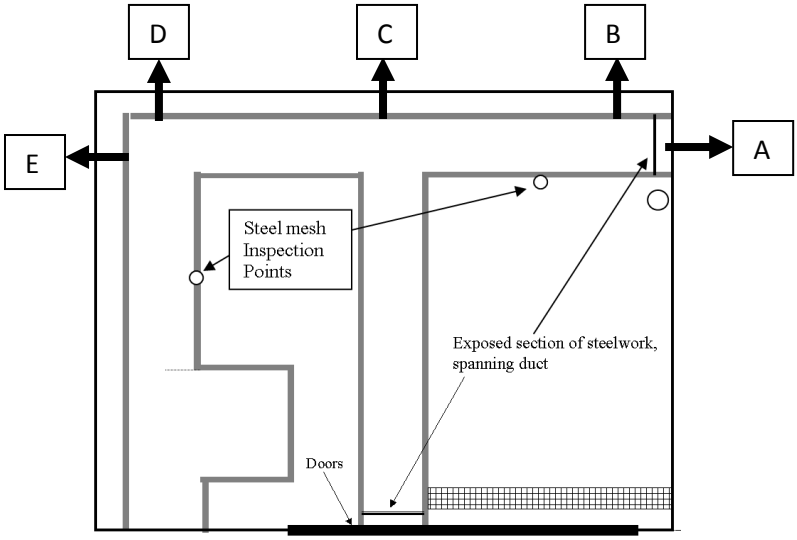

Fig. 9: Cable opes 'A' to 'E' to customer depends on location of the customer's main circuit breaker.

4.9.1 C - Oil Trap

A drain to the front of the main floor slab is required to contain any transformer oil in the event of an oil leak. It is designed to convey the oil into the main centre duct. See drawing A3D.205071-16A. Drawings

4.9.2 D - Duct Covers

GRP (Glass Reinforced Polyester) duct covers are available from an approved supplier. Duct covers will be delivered cut to size and to be installed as shown in Drawing A3D.205071-16A Sheet 17. The duct covers fit into the 40 mm x 40 mm rebates on either side of the ducts.

4.10 Doors, Detail and fitting

4.10.1 A - Approved Door Suppliers

Substation doors shall be sourced from ESB Networks' approved suppliers. A list of these suppliers is available on ESB's Approved Suppliers

4.10.2 B - Door Ope

A door set is 2465 mm wide and 2465 mm high. Dimensions of the door ope shall be 2485 mm wide (+20 mm, -0) and 2485 mm high (+20, -0) high.

The base of the door frame is 66 mm below the substation floor.

Fig. 10 shows the door threshold in relation to the substation floor and the door step.

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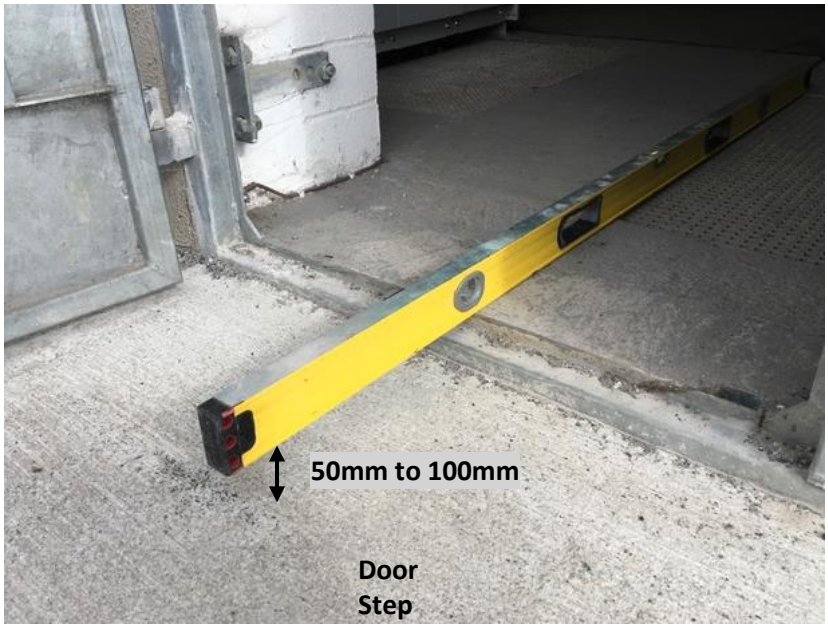

Fig. 10: Substation door threshold.

4.10.3 C - Smoke Detector

All substations incorporated into larger buildings shall have a smoke detector fitted to the door. The detector shall be connected to the fire alarm system in the main building.

The requirement for the smoke detector housing should be notified to the door supplier at the ordering stage.

The smoke detector shall be accessible for testing without the need for ESB Networks' presence.

ESB Networks keep substation earths separate from customer earths for safety reasons. The following precautions shall be followed if a smoke detector is installed:

- Housing of smoke detector must be non-metallic.
- Cabling to smoke detector within the substation shall be installed in plastic conduit.
- Cabling shall have an insulated sheathing.
- The smoke detector wiring shall have no earth conductor.
- Before any electrical work is carried out on the smoke detector in the substation or the associated cabling, the wiring shall be disconnected at the remote end.

Fig. 11: Smoke detector fitted inside the hatch on substation door.

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4.10.4 D - Cladding

Cladding can be attached to the substation doors providing:

- It does not restrict door opening through 180º. Cladding, including supporting framework, can be up to 40 mm thick.
- It does not impede access to cover plate for locking mechanism or hatch included at base of centre door.
- Galvanised door surface is not broken when securing the supporting framework. Brackets should be designed onto the door in conjunction with the approved door supplier.
- It is still possible for air to circulate through the vertical ventilation louvres.
- The door has to be designed to accommodate the cladding by the approved door supplier.
- Cladding shall be completed before the substation is energised.

The maintenance and upkeep of the cladding shall be the sole responsibility of the main building owner.
Liability for any claims arising from the cladding shall be the sole responsibility of the main building owner.

4.11 Roof

For standalone buildings, or substation buildings adjoining customer switchrooms, an overhung roof is the preferred option. This design is less prone to leaks and requires little maintenance. The roof shall be cast in situ with reinforced concrete. Precast slabs or permanent formwork are not permitted.

The roof shall be at least 175 mm thick, well vibrated 35 Newton reinforced concrete slab with a sand / cement screed, minimum 25 mm thick laid to fall of 50 mm from the centre, with a waterproof covering of 20 mm asphalt or other approved roof covering laid in two layers.

In the case of an 'Incorporated MV Station' the roof/ceiling structure shall be 215 mm thick well vibrated 35 reinforced concrete. Precast slabs or permanent formwork are not permitted. No insulation, thermal or acoustic, is permitted within the substation.

On all substation roofs, reinforcing mesh shall be at least two layers of A393, 75 mm apart, with a minimum of 55 mm concrete cover from the inside ceiling.

See Drawing A3D.205071-16A Sheet 15 and 16.

4.12 Finishing Details

4.12.1 House Supply

The terms and conditions for connection at MV require the customer to provide, free of charge, a single-phase LV supply. This is for the heating and lighting of the ESB substation. ESB Networks keep substation earths separate from customer earths for safety reasons. The customer shall provide a 6 mm square stranded copper phase and neutral wire into the ESB substation in a 25mm plastic conduit.

Where supply is at LV this house supply is not required.

4.12.2 Internal Painting

The finished walls and ceilings shall be coated with a Polybond sealer prior to painting them with two coats of an white emulsion. It is not acceptable to have any other colour finish or to leave the walls unpainted.

The floor of the substation should be painted with a single-pack moisture curing polyurethane coating for sealing and dust proofing the floor. The colour of the floor paint shall be red or grey.

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It is essential that the floor has a non-slip finish. Apply the floor paint onto a clean, dry surface as follows:

1. Prime the floor surface. The primer consists of single-pack polyurethane paint mixed with the thinner in proportions specified by the paint manufacturer.
2. Apply the first top coat after the primer has dried.
3. Sprinkle fine grade aggregate evenly onto the first top coat whilst still wet.
4. Allow to cure. Then brush off excess aggregate.
5. Apply a second top coat to seal in the aggregate and allow to cure. Avoid pin holing by applying the second top coat at right angles to the first.
6. Follow paint manufacturer's instructions for application of the floor paint.
7. Apply paint with a brush or roller.

4.12.3 Door Reveal

The cavity at the door reveal shall be sealed by returning the inner leaf tight against the outer leaf to provide fire rating. 300 mm vertical DPC must be installed in the position shown.

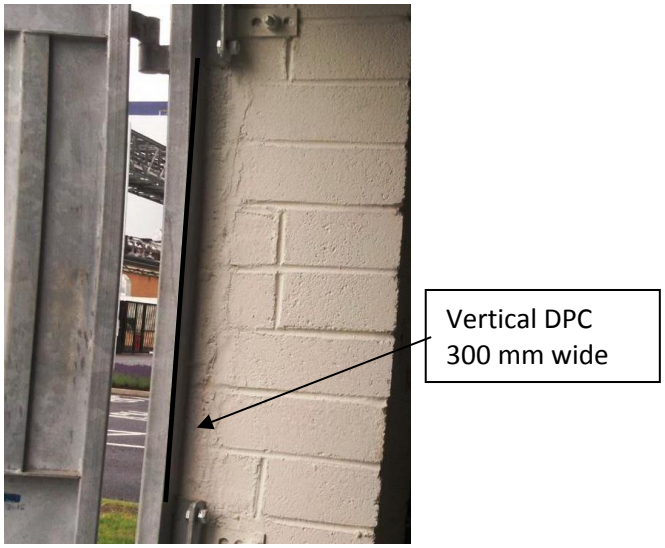

Fig. 12: Inner leaf returned at door ope to close cavity.

4.12.4 External Walls

External walls should be finished to blend in with the surrounding buildings. Finish applied should require no maintenance.

4.12.5 Approach

ESB Networks require vehicular access to the substation. Where necessary, a driveway, 3 m wide, will be laid consisting of a 100 mm layer of concrete on a 150 mm bed of crushed stone.

If the substation is located in a parking area, it may be necessary to install demountable bollards or paint yellow hatching on the ground to ensure ESB can gain access to the substation.

4.12.6 Rainwater Pipe

For free-standing substations a non-metallic rainwater pipe has to be provided. Drainage pipes shall **not** pass inside the substation.

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4.13 Final Inspection of Substation Building

A formal final inspection of the completed substation building will be made by ESB Networks before acceptance of the building and before commencing work on the installation of the electricity connection.

This inspection requires the substation to be completed in accordance with ESB Networks' specification. The inspection will take place after the customer has provided a Certificate of Completion covering the workmanship and materials used in the construction of the substation building.

The certificate shall be completed and signed by the Chartered Engineer and / or Architect with responsibility for the site. A copy of the certificate is included in Annex C.

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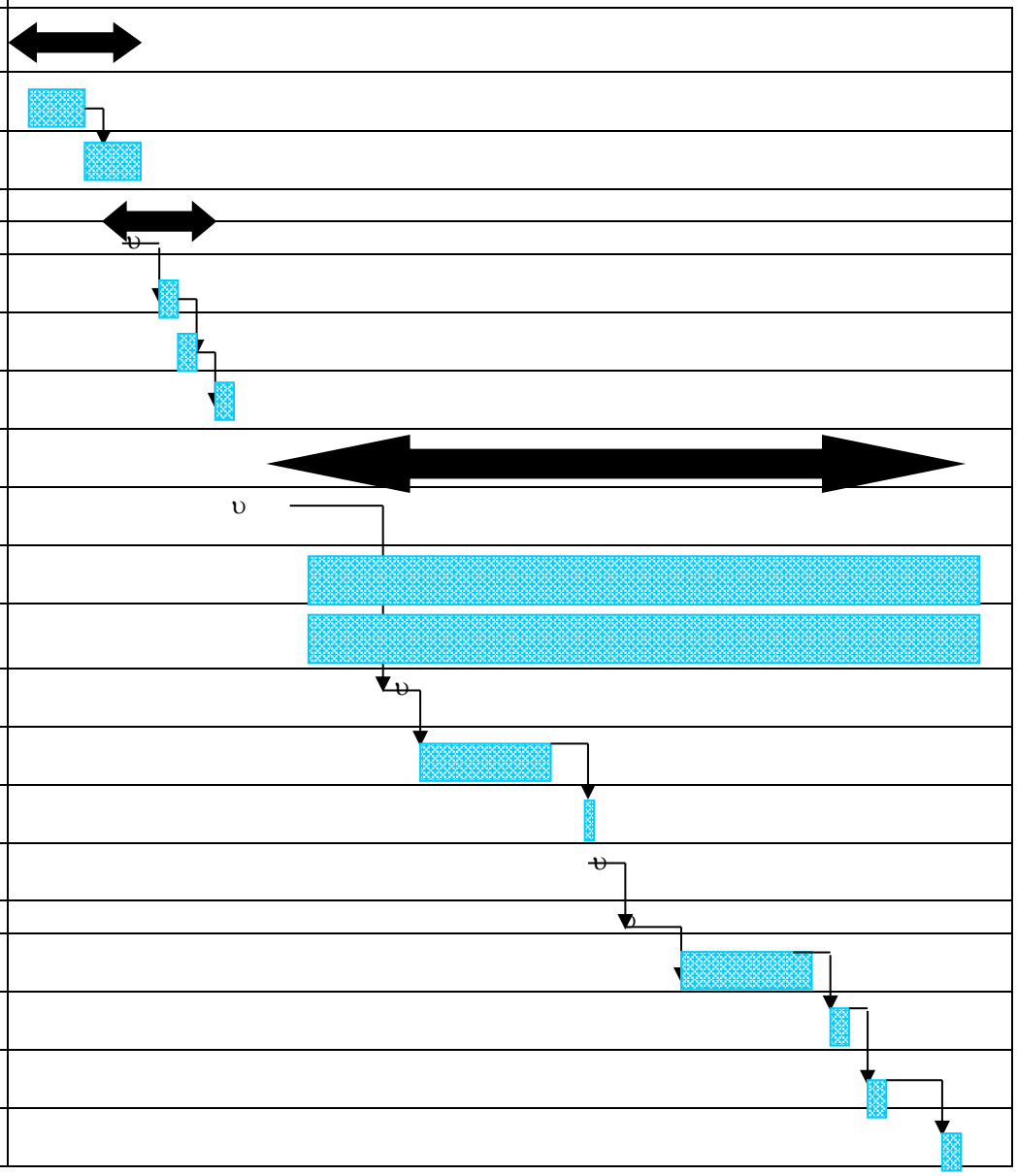
Annex A. (Mandatory)Typical Project Gant Chart

	Task
1	**1. Design and Planning**
2	Customer contacts ESB Networks during building design to agree location of ESB substation.
3	Customer obtains planning permission for building development, including planning permission for ESB substation.
4	**2. Terms of Connection**
5	Customer provides ESB Networks with site layout plan.
6	ESB Networks designs electrical network and provides written quotation.
7	Customer pays connection costs and returns a signed Acceptance of Terms form.
8	ESB Networks schedules work to provide electricity connection as agreed with the customer.
9	**3. Building and Equipping substation**
10	Customer consults ESB Networks about location of underground cables and, if necessary, overhead lines.
11	Customer manages site safety.
12	ESB Networks is available for consultations and the installation of substation main earths and steel floor mesh (see 3.6).
13	Customer provides Commencement Notice to Local Authority before construction begins.
14	Customer commences build of ESB substation in accordance with ESB Networks' specification.
15	Customer advises ESB when floor steel is available for inspection before the floor is poured
16	Customer provides ESB Networks with Certificate of Completion signed by Chartered Engineer or Architect.
17	ESB Networks verifies that substation is built to specification.
18	ESB Networks installs cables and electrical equipment and bonds substation main earths, earth mat and floor steel.
19	Customer incorporates copper earth mat in concrete footpath outside the substation in front of its doors.
20	Customer reinstates ground around substation.
21	Customer fireproofs duct ope between ESB substation and customer switchroom.



MV Substation Tasks – from design to completion.

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Annex B. (Mandatory) Common errors in design and construction of MV Substations

The following are a list of common errors that can delay an electricity connection. They can result in a costly and complicated reworking of a substation and its surrounding structures. Also, please refer to the certification checklist in Annex C.

Table 3: Common errors in design and construction of MV Substations.

Number	Error
1	Incorrect substation type selected, find out at the design stage if it is: • Single substation, double substation, dual radial feed, or another type of substation. • Will the substation be incorporated or freestanding?
2	Specification DOC-280518-DFK (this specification) type substation is built where a generation plant substation is required. Generation plants include windfarms, solar farms, landfill gas, biogas or hydro plants which are being connected to the medium voltage (MV) system.
3	Substation not at ground or street level. The substation must be at ground level unless there is specific agreement between ESB Networks and the customer. See section 3.01.
4	Inadequate vehicular access to the substation. The substation must have 3 m wide and 4 m high vehicular access.
5	Limited access to substation where it is constructed behind locked gates or fences. Full unrestricted vehicular access to the substation is required at any time of the day or night without the need for site safety or security inductions. See section 2.3.
6	External walls of substation are not a cavity type design. See drawing A3D.205071-16A Sheet 5 and sheet 16.
7	Cavity left open or poorly fire sealed around the door. See drawing A3D.205071-16A Sheet 7.
8	Steel mesh not present in the floor slab. See Drawing A3D.205071-16A.
9	Steel in the floor slab not brought out for earthing at two points and two test points. See Drawing A3D.205071-16A Sheet 2.
10	Steel in the floor slab interconnected with other steel in a larger building. It should be electrically isolated.
11	Earth mat in front of door not installed correctly or not of an approved type. See Drawing A3D.205071-16A Sheet 5.
12	Structural steel stanchions within the substation room, or exposed in the walls.
13	Precast or permanent formwork ceiling or roof used instead on poured concrete.
14	Insulation (thermal or acoustic) present inside the substation beneath the substation roof/ceiling
15	Floor slab orientation incorrect. Do not mirror image the floor plan. Keep to the floor plan layout as specified unless specifically requested to change it by ESB Networks.
16	Customer's main switch not adjacent to the dividing wall between the ESB MV substation and the customer's switchroom. See section 3.02.
17	Cable opening to customer's switchroom too large. It should be 450 mm x 215 mm at a maximum.
18	Customer's switchroom and access to equipment not conforming to the National Rules for Electrical Installations.
19	Groundworks completed without the installation of the required earth wires. See section 2.06.
20	Exits, fire escapes or air conditioning intakes within 3 m of substation door.
21	No smoke detector fitted to substation door incorporated into larger building.
22	Windows within a 3 m of the substation door frame do not have 30 minute fire rated glass or can be opened

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Annex C. (Mandatory) Certificate of Completion for MV Substation

This certificate of completion shall be completed to ESB Networks' satisfaction and signed before work begins on providing an electrical connection.

Working conditions on site shall comply with the Safety, Health and Welfare at Work Act and its regulations. Scaffolding shall not be over the work area as any excavation nearby for the installation of ducts/cables could undermine it. Furthermore, there may be a danger in working underneath. Similarly, there shall be a clear unobstructed access route in order to safely reach the workplace.

It is critical that these requirements are complied with in order to give you connection on time. If ESB can't carry out the work because of obstructions on site, then delays are inevitable.

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Substation Location: _____

1. External Conditions

Item	Clause		Yes	No
1.1	2.12	Has the substation building received full planning permission from the local authority?		
1.2	2.3	Is there an unobstructed access route 3 m wide x 4 m high?		
1.3	2.3	Is access external to the main building where substation is incorporated?		
1.4	4.8	Has an earth mat been installed in the ground immediately in front of the substation door(s)?		
1.5	2.10	Is ground level drainage satisfactory?		
1.6	General and 2.3	Has the ground been reinstated to allow safe access for installation of equipment?		
1.7	4.3	Are all external walls of cavity construction? Or approved solid cast concrete?		
1.8	4.11	Is the roof cast in situ concrete?		
1.9	4.12.6	Are all downpipes external to building?		

2. Doors

Item	5. use		Yes	No
2.1	2.7 & 4.10	Are ESB standard steel galvanised doors installed?		
2.2	2.7	Do the doors open through 180^0? (Unless otherwise agreed.)		
2.3	2.7 & Drawing	Are doors adequately secured, and opening and closing freely?		
2.4	2.7	Is there a drip rail at the top of the door if the door is installed flush to a multi storey building?		
2.5	Information from door name-plate: Manufacturer: _____ Serial Number: _____ Year of Manufacture: _____			

3. Internal Condition

Item	Clause		Yes	No
3.1	2.1	Are the internal dimensions as required?		
3.2	General	Has all excess material been removed?		
3.3	Drawing	Is duct layout in accordance with ESB drawing A3D.205071-16A?		
3.4	2.8 &4.5	Is reinforcing steel in substation floor isolated from all other structural steelwork?		
3.5	4.9	Has the floor been neatly finished with a smooth level surface?		
3.6	Drawing	Is the substation floor 100 mm to 150 mm above the finished ground level?		
3.7	4.5 and Drawing	Are the bars of reinforcing steel spanning the duct at the points indicated in the drawing A3D.205071-16A?		
3.8	4.5 and Drawing	Is all the reinforcing steel welded together including the duct bridging bars?		
3.9	4.5 and Drawing	Are steel mesh testing points provided at the side of the ducts as indicated in the drawing A3D.205071-16A?		

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3.10	4.6 and Drawing	Are the cable ducts 900 mm deep x 450 mm wide?		
3.11	Drawing Sheet 17	Are GRP cable duct covers properly installed, flush with the concrete floor, so that they don't constitute a tripping hazard? Are they securely supported at all points?		
3.12	4.12.2	Are the walls and ceilings neatly finished and painted white?		
3.13	4.12.2	Has the floor been painted as specified with red or grey single-pack polyurethane paint to give a non-slip finish?		
3.14	4.12.3	Is vertical DPC installed at the door reveal?		

4. Fire Safety

Item	Clause		Yes	No
4.1	2.6	Has a fire risk assessment been carried out ?		
4.2	2.6	Is the substation door more than 3 m from main entrances and exits, fire escapes and air conditioning intakes?		
4.3	2.6	Are the substation doors more than 5 m away from exposed oil pipes, exposed gas pipes, fuel tanks or other similar risks?		
4.4	2.6	Is there a smoke detector fitted if the substation is incorporated into a larger building?		
4.5	2.6	Are windows within a 3 m radius of the substation door frame non openable and fitted with 30 minute fire rated glass?		
4.6	2.6	Are all room vents within a 3 m radius for the substation door frame fitted with alarm activated automatic shut offs?		
4.7	2.11	Is the substation free of all pipes, ducts or services - not required by ESB's specification?		
4.8	Drawing	Are all internal walls leaves block on flat or solid concrete and ceiling poured concrete?		
4.9	4.12.3 & Drawing	Has the cavity at the door reveal been sealed by returning the inner leaf tight to the outer leaf?		
4.10	Drawing Sheet 16	Is the cavity closed at the door lintel?		

5. Working Conditions

Item	Clause		Yes	No
5.1	2.3	Is a safe working environment assured for ESB staff on site by compliance with The Safety, Health and Welfare at Work Act 2005?		

CERTIFICATION

I certify that it is my professional opinion that the substation located at: _____ has been constructed in accordance with:

- ESB Networks Company Standard –Standards for MV Substation Buildings DOC-280518-DFK

- Additional conditions given in ESB's Terms of Connection letter dated ___/___/___ (if applicable)

Signed : _____ Date : _____
Company : _____
Qualifications : _____
Position in Company : _____

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Derogations

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Contributors

The following individuals supported the development of this document.

Name	Role/Location	OneSource Role
		Document Developer
		Working Group Memember
		Interest Group Reviewer

Table 4: Contributors to the Document Development

Terms, Definitions & Symbols Used

For the purposes of this document, the following terms and definitions apply.

Table 4: Terms & Definitions

Term	Definition
Shall	Designates a Company Requirement, hence conformance is mandatory.
Should	Designates a Company Recommendation where conformance is not mandatory, but is recognised as best practice.
May	Designates a Permissive Statement - an option that is neither mandatory nor specifically recommended.

Symbols & Abbreviations

CAUTION: Used to give the end user information on what can happen, why and the consequences of ignoring the caution.

Used to give the end user specific, important information to help complete the task or procedure correctly.

This is a stop or critical point in the procedure. It contains a rule that shall be followed by the end user.

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Risk Assessment (Informative)

The Risk Assessment section is a optional document element, and may be deleted in its entirety if it is not needed. It is informative in nature as it provides the end-users with information about the risks which were considered as part of the development of the document, and the rationale behind the requirements (born from the control measures). The Document Developer may add multiple Risk Assessments as needed to this section of the document.

				Risk Before Control Measures					Risk After Control Measures		
Ref	**Hazard**	**Risk (Potential Harm)**	**Persons at Risk**	**Likelihood (L)**	**Severity (S)**	**Risk Rating = L x S**	**Control Measures**	**Respon sible**	**Likelihood (L)**	**Severity (S)**	**Risk Rating = L x S**

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