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Onshore Compensation Compound

Civil and Building Works

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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) where GIS (Gas Insulated Switchgear) or AIS (Air Insulated Switchgear) is installed.

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 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.

The specification lists the minimum requirements of EirGrid. The Customer shall submit in full, the Civil, Building and Structures design package in accordance with Section 1.1 of this Specification which shall also include all deviations from the EirGrid Specification requirements. Where deviations are proposed, the Customer shall initiate and clarify these deviations. EirGrid shall be given reasonable access as agreed with the Customer to OCC site during the construction phase of the Civil, Structural and Building works.

The scope of the Civil, Structure and Building works shall be as outlined in sections 1.1 and 1.2 below.

1.1 OCC (ONSHORE COMPENSATION COMPOUND) WORKS - EXTERNAL

Work shall include but is not limited to:

- Geotechnical soil investigation and topographic survey of OCC site
- Groundworks
- Terracing of the yard and retaining walls
- Surface water and foul drainage, treatment and disposal system including connections to main drains, if required.
- Storm water infrastructure including swales, settlement ponds, attenuation ponds / tanks
- Security fencing and gate works /CCTV- Perimeter intrusion
- Cable / service trenches and covers, manholes and cable ducts
- Equipment bunds and external equipment foundations
- OCC roads and access ways
- Landscaping and Hardstanding
- Crushed stone in fill to areas other than roads, access ways, landscaping, and Hardstanding areas within the OCC
- OCC access road from main road, including any bridges and structures required to cross waterways and ditches
- OCC external operational lighting
- Civil works associated with the OCC
- Lightning Protection Mast

- Radio/Communications Mast
- House Transformer Base
- Parking Facilities
- Road markings, Signage -directional, parking, buildings, externally
- Earth grid
- Outdoor sockets
- Any other works not specifically covered but required to provide safe and fit for purpose outdoor areas within the OCC.

1.2 OCC WORKS – BUILDINGS

Work shall include but is not limited to:

- Groundworks
- Foundations works
- Architectural and Superstructure works to include walls, masonry, flooring, roofing, cladding, finishing's, and painting
- Building electrical installation for Data, lighting, and power socket outlets
- Building fit-outs including platforms, ladders, suspended steel floor, etc
- Insulation and waterproofing
- Sealing and fire-stopping of openings
- Air conditioning, heating, plumbing and ventilation
- Fire detection, alarm, telephone, and data
- LV Distribution Systems (refer to specification OFS-SSS-403 -Auxiliary Power Supplies)
- Water supply and Services (Heating and Ventilation Systems)
- Cable containment Systems
- Drainage works

Any other works not specifically covered but required to provide a safe and fit for purpose OCC control building.

The Customer will be responsible for the detailed design of the OCC. The following drawings 'OFD-SSS-501 - STANDARD 220kV AIS STATION' and 'OFD-SSS-503 - STANDARD 220kV GIS ONSHORE COMPENSATION COMPOUND. LAYOUT DRAWING - PLAN VIEW', may be used as a reference for typical layouts and buildings.

Detailed requirements of these works are described in the latter sections of this specification.

All works shall be of a standard that meets the requirements of the Law and relevant authorities, including the local authority, planning, building control, government services and other relevant authorities.

2 ABBREVIATIONS

AIS	Air Insulated Switchgear
BCAR	Building Control Amended Regulations -Ireland
BBA	British Board of Agreement
BRE	British Research Establishment
BS EN	British Standard. European Standard
CBR	California bearing ratio
CE	Certification Marking to a product traded in European Economic Area (EEA)
CIRCA	Construction Industry Research and Information Association
CIRIA	Construction Industry Research and Information Association
CPR	Construction Products Regulation (EU) No 395/2011.
CPR	European Construction Products Regulations 305/2011
DoP	Declaration of Performance
DoEHLG	Department of the Environment, Heritage and Local Government
ENA	Energy Networks Association
EIAR	Environmental Impact Assessment Report
EPD	Environmental Product Declaration (EPD)
GDR	Geotechnical Design Reports
GIB	Gas Insulated Busduct
GIR	Ground Investigation Report
GIS	Gas Insulated Switchgear
GRP	Glass Reinforced Plastic
GWP	Global Warming potential
HDPE	High Density Polyethylene
hEN	European product standard
HSA	Health and Safety Authority (Ireland)
HV	High Voltage
I.S. EN	Irish Standard. European Standard
INAB	Irish National Accreditation Board
ITM	Irish Transverse Mercator Grid
MDPE	Medium density polyethylene
MDR	EirGrid Offshore 'Master Document Register'
OCC	Onshore Compensation Compound (EirGrid)
OPW	Office of Public Works
SUDS	Sustainable drainage systems:
SWL	Safe Working Load
TGD	Technical Guidance Document (Building Regulations – 2017 as amended) – Ireland
TII	Transport Infrastructure Ireland (Specification for Road Works)
UKAS	United Kingdom Accreditation Service
WAN	Wide Area Network

3 STATUTORY REQUIREMENTS, CODES STANDARDS AND COMPLIANCE

The Customer shall be required to assume full professional liabilities regarding fulfilment of any statutory requirements. Equipment offered shall be compliant with the provisions of the latest applicable versions of all relevant Irish legislation and directives of the European Union.

These include the following or latest versions/ amendments as appropriate:

SI No. 132	Safety signs regulations 1995 (implements EEC Directive 92/58)
SI No. 291	Safety, Health and Welfare at Work (Construction) Regulations
SI No. 299	Safety, Health and Welfare at Work (General Application) Regulations 2007
SI No. 445	Safety, Health and Welfare at Work (General Application) (Amendment) Reg. 2012
Reg (EC) No 1907/2006	Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
Reg (EC) No 1272/2008	Classification, Labelling and Packaging of Substances and Mixtures (CLP)
Reg (EU) No 517/2014	Fluorinated greenhouse gases and repealing regulation (EC) No 842/2006
Reg (EU) 2015/2068	Format of labels for products and equipment containing fluorinated greenhouse gases
Reg (EU) 2015/2065	Format for notification of the training and certification programmes of the Member States
Reg EU 2015/2066	Minimum requirements and the conditions for mutual recognition for the certification of natural persons carrying out installation, servicing, maintenance, repair or decommissioning of electrical switchgear containing fluorinated greenhouse gases or recovery of fluorinated greenhouse gases from stationary electrical switchgear
Directive 2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS)
Directive 2012/19/EU	Waste electrical and electronic equipment (WEEE)
Directive 2014/30/EU	Harmonisation of the laws of the Member States relating to electromagnetic compatibility
Directive' 2016/1148 (via	Network and Information Systems (NIS)- Statutory Instrument No. 360)
ECE/TRANS/275	Vol. I and II ("ADR 2019") European Agreement Concerning the International Carriage of Dangerous Goods by Road

All works shall be carried out in accordance with the requirements of this specification and the most recent and commonly used European, British or International Standard, where a

corresponding Irish Standard does not exist. A list of the proposed standards to be used shall be submitted as part of the design criteria submissions. All dimensions or quantities shall be expressed in SI units.

A grant of planning permission for the development, will be required in accordance with the Planning and Development Act 2000 (as amended) and its Secondary legislation the Planning and Development Regulations 2001 (S.I. No. 600 of 2001) whilst complying with the requirements of this Specification. An Environmental Impact assessment will also be required to be submitted with the planning application in accordance with the Planning and Development Regulations.

In addition, there shall be compliance with the provisions of all current relevant Directives of the European Communities and the Republic of Ireland relating to design, workmanship, materials, and equipment.

All works shall further comply with the requirements of the local authorities relating to planning permission, government services, National Monuments Service, and any other relevant local authority.

The works shall be designed and constructed to meet or exceed the requirements of the Building Regulations and current Technical Guidance Documents (TGD's) unless any specific waiver / exemption has been received for the relevant Local Authority.

Any deviations from the Technical Guidance Documents published by the Department of the Environment, Heritage and Local Government (DoEHLG) shall be agreed with EirGrid.

It is the responsibility of the Customer to oversee compliance with current building regulations and the requirements of the Building Control Amended Regulations (BCAR).

The Customer shall undertake the electrical design in accordance with the Requirements of IEC 61936-1.

In advance of any work taking place any proposed deviations from these standards and any later amending acts shall be agreed with EirGrid and their agents.

Unless the Customer can document that CE, marking is not required, equipment shall carry the CE Mark in accordance with Directive 768/2008/EC and the EU Construction Products Regulation (No. 305/2011 – CPR) and adequate documentation to demonstrate full compliance should be retained.

In order to prove compliance, the equipment shall carry the CE Mark in accordance with Direction 768/2008/EC and the EU Construction Products Regulation (No. 305/2011 – CPR) where required.

The Customer shall ensure the associated works in accordance with the specification are to be undertaken and committed to the Irish Sustainable Development Goals and to the Grid 25 Strategy targets of

- Meeting 33% of electricity consumption from renewable energy.
- Meeting 40% of consumption from renewables.

3.1 DESIGN STANDARDS

Designs shall be based on and conform with the latest revisions of the following European, British or Irish Standards with precedence being given to the requirements of any Irish Standard, all without exceeding settlement, deflection, and stress limits:

Loading / Actions	Design in accordance with IS EN 1991
Foundations	Design & Construction in accordance with IS EN 1997
Structural Concrete	Design and construction in accordance with IS EN 1992
Waterproofing	Design & Construction in accordance with BS 8102
Structural Steelwork	Design fabrication and erection in accordance with IS EN 1993
Composite Steel & Concrete	Design & construction in accordance with IS EN 1994
Blockwork/Brickwork	Design & Construction in accordance with IS EN 1996 & S.R. 325:2013
Structural Timber	Design & Construction in accordance with IS EN 1995
Earth Retaining Structures	Design & Construction in accordance with IS EN 1997

A list of all key standards referenced in this Specification is contained in Appendix F

The Customer shall be responsible for the detailed design, structural integrity and safety of the buildings, plant, and equipment within the OCC to meet the Civil, Structural, Architectural and Environmental requirements of this Specification. The Customer shall produce and submit to EirGrid for review, full design calculations for all buildings and structures on the Site including piling (if required by the design), ground improvements, foundations, building structures and enclosures, site structures and enclosures, etc. They shall also produce and submit detailed construction drawings for these items (refer to Section 4.9.2).

The review of the Customer's drawings or calculations by EirGrid shall not relieve the Customer of any of their obligations to meet the requirements of the Specification or the responsibility for the adequacy of design calculations / drawings.

3.2 HEALTH AND SAFETY

The Customer is solely responsible for Safety on Site. The project shall be managed in accordance with the Safety Health & Welfare at Work Act 2005 as amended and in compliance with the Safety Health and Welfare at Work (Construction) Regulations 2013.

The Customer shall undertake the duties of the Client which shall include the provision for the pre-construction setting up of the Site Compound including security, access/haul roads, offices, welfare units- toilets, parking and adequate storage areas .

The Customer is the Designer and is responsible for all Permanent and Temporary Works required and will be required to discharge their duties in accordance with the above Regulations, including the completion and submission of permanent and temporary works design certificates.

Key duty holders Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) shall be appointed by the Customer acting as the Client, refer to OFS-GEN-012, in accordance with the Construction Regulations.

The Customer and their appointed PSDP and PSCS shall be responsible for compliance, preparation of and liaison with relevant bodies in respect of all documentation associated with the above regulations including but not limited to:

- Design Risk Assessments
- Temporary and Permanent Works Certificates
- Notifications to the HSA (AF1 & AF2)
- Preliminary and Construction Stage Safety & Health Plans
- Safety File and as built drawings and Services (see Section 4.9)

3.3 HAZARDOUS MATERIALS / CONTAMINATED SOILS

The Customer shall comply with all current applicable Irish and European environmental legislation. Refer also to Health and Safety section of OFS-SSS-400.

This includes compliance in relation to:

- Declaration of materials
- Declaration of hazardous substances
- Safety data sheets and packing Waste
- Disposal of material found to be hazardous

EirGrid reserves the right to adapt (with agreement) these requirements in the event of a change of law in either Ireland or the European Union governing such matters.

The Customer shall aim to contribute to the Sustainable Development Goals and offer plant, equipment, materials and methods of work which would contribute to EirGrid's policy of becoming as sustainable as possible.

All hazardous materials / contaminated soils shall be removed from site to a licensed facility. The treatment of hazardous materials / contaminated soils shall comply with all statutory, relevant legal and other requirements.

3.4 CONSTRUCTION PRODUCTS

In compliance with the Construction Products Regulation (EU) No 305/2011 (CPR), as from 1st July 2013, all construction products covered by a harmonized European product standard (hEN) shall have Declaration of Performance (DoP) and a CE mark in order for them to be placed on an EU market. The Customer shall comply with the CPR. This requirement applies throughout this Specification where he is applicable.

4 REQUIREMENTS/DESIGN CRITERIA

4.1 GENERAL

The Customer is fully responsible for the design and supervision of the Civil and Building Works. Engineers shall be Chartered Civil / Structural Engineers and Architects shall be registered with the RIAI or similar professional institution.

The Civil and Building works designs shall adhere to the listed standards and shall consider all climatic and environmental conditions on site including exposed locations, humidity and

marine environments and shall include all loads (dynamic and static) which may also be present. The designs shall be submitted to EirGrid prior to the commencement of any works on site and shall demonstrate how they comply with the listed standards.

In carrying out the design obligations, including the selection of materials and plant to the extent that those are not specified, the Customer shall ensure that all designs are fit for the purpose for which they are intended

The submissions shall be in accordance with the project programme.

The Customer's design shall be in accordance with the design criteria submissions and shall include but not be limited to calculations, drawings and reports relevant to the Civil and Building Works.

The Customer's designs, where feasible and practical, shall incorporate renewable energy technologies in compliance with Technical Guidance Document Part L 'Conservation of Fuel and Energy – Buildings other than Dwellings' of the Building Regulations 2021 as well as other codes of best practice and standards as applicable.

4.2 OCC CONTROL BUILDING FUNCTIONAL REQUIREMENTS

4.2.1 GENERAL

The OCC control buildings are used to operate, control, and maintain OCC equipment and assets.

Customer designs shall provide/allow:

- Space for full development of the OCC.
- Removal of any item of equipment whilst minimising any disturbance to other equipment.
- Addition of new equipment up to the full design capacity of the OCC without disturbance to other equipment or additional works.
- Cable routing and cable pulling
- Adequate access for operations and maintenance. Roof access – where roof access is proposed and shall be identified and coordinated with a suitable external hardstanding area with anchor points and fragile area markings as required for operational safety.
- Building services shall be provided as required to meet relevant standards and regulations and to satisfy requirements as identified in this specification and EirGrid Specification OFS-SSS-418 for 'Electrical and Mechanical Services for Transmission System Control Buildings and Compound'.

4.2.2 AIS SUBSTATION CONTROL BUILDINGS

Substation control buildings for Air Insulated Switchgear (AIS) substations shall normally be designed as single storey standalone buildings.

AIS Substation control buildings shall contain the following rooms and facilities:¹

4.2.2.1 A RELAY ROOM/ CONTROL ROOM

This room contains low voltage protection, metering, and control equipment. This shall include raised access flooring to facilitate cable management.

4.2.2.2 BATTERY ROOM

As Per OFS-SSS-404 a VRLA battery is required therefore the battery rooms shall be a separate room designed so that they are not classified as a hazardous area.

The room shall comply with battery manufacturer recommendations, relevant standards and requirements given in OFS-SSS-404 Specification.

4.2.2.3 MESS ROOM

This room shall be used for basic food preparation and consumption and shall also double as a meeting room.

The following items will be purchased and installed by the station supervisor post construction:

- Countertop appliances
- Small countertop or under-counter fridge
- Tables and chairs.

The remaining facilities shall be provided by the Customer including:

Countertop for appliances and basic food preparation. Space shall be adequate for a countertop fridge (where preferred by the end user) and typical household countertop appliances such as kettle, toaster, microwave oven etc.

A sink with hot and cold taps. Cold water to be derived from mains where feasible and shall be in accordance with IW-CDS-5020-03 - Code of Practice for Water. Note - Alternative sustainable methods of water supply may be investigated through the Customers Design process.

- Infrastructure. Hot water to be provided via an on-demand electric water heater.
- Water heater.
- Room Heaters.
- Ventilation facilities as required.
- Small power and lighting facilities.
- Adequate small power and lighting provision shall be made based on the users' requirements.

A typical electrical installation might include the following; however, this shall be confirmed with the end user:

¹ The notes provided here are intended to provide an overview of the function of these rooms and should be referred to in addition to the standard layout drawings and more detailed requirements referenced or listed elsewhere in this specification.

3 off 2 gang 13 A switched socket outlets on countertop.

1 off 2 gang 13 A socket outlet under countertop for an electric water heater.

2 off 2 gang 13 A switched socket outlets in rest of room.

4.2.2.4 WORKSHOP AND STORAGE ROOM

Facilities for the storage room and workshop facilities e.g., storage units, work bench seating to be supplied including:

- Room Heaters.
- Adequate small power and lighting facilities based on the users' requirements.
- A typical electrical installation might include the following; however, this shall be confirmed with the end user:
 - Workbench sockets
 - Workbench task lighting

4.2.2.5 TOILET (SEE SECTION 6.8)

4.2.3 GIS SUBSTATION BUILDINGS

GIS Substation buildings shall contain all of the rooms and facilities provided for AIS substation control buildings, as described in section 4.2.2.

GIS Substation buildings must also provide additional rooms and facilities to cater for HV Gas Insulated Switchgear, HV circuits, HV GIS equipment and associated systems.

It is essential to coordinate the design and orientation of GIS buildings and equipment with the external routing of incoming and outgoing HV circuits.

The minimum pulling bending radius and installation bending radius of cable circuits must be observed.

External crossings of HV cabled circuits should be avoided.

The full proposed route of all HV circuits within the substation, i.e., from GIS switchgear to external equipment or site boundary, shall be submitted to EirGrid for approval prior to construction.

EirGrid functional specification OFS-SSS-413 specifies additional requirements for gas insulated switchgear installations.

4.2.4 ELECTRIC CAR CHARGING

Within the OCC as a minimum the provision for four number three phase 22kW rapid chargers for electric vehicles

The Customer shall consider the following in their design choice for electric car chargers selected

- Selecting the type(s) of EV charge point (considering compatibility, speed, and different types of charge point)
- Location and design of EV charge point facilities – ensuring parameters for the design of charge

- Implementation, operations, safety, and maintenance
- Emerging and future technology

4.2.5 TWO STOREY GIS BUILDING DESIGN

Where HV cables are used, a two-storey standalone building is required, with the switchgear installed on the upper storey.

Lower storey can be used for cables as well rooms for control, protection, LV AC and DC distribution panels, equipment. The panels, equipment shall be installed above the external level of the ground.

The structural design of the building shall consider the upper floor stability/rigidity, levelness, and accuracy of GIS embedded rails to support GIS Equipment Flange Alignment and prevent SF6 Leakage in operation (If GIS is to be installed above Cable Basement).

As general reference for a typical GIS two storey Design Refer to Drawing OFD-SSS-503 – 'STANDARD 220KV GIS ONSHORE COMPENSATION COMPOUND. LAYOUT DRAWING - PLAN VIEW'

4.2.5.1 HOIST SHAFT

A hoist shaft shall be provided to facilitate hoisting of GIS switchgear from the ground floor to the GIS switch room.

The design shall allow deliveries to be made by reversing a standard truck into the hoist area.

An external roller shutter door of minimum 4 m width, and full height up to the ceiling height of the first floor shall be provided.

A suitable external hardstanding area shall be provided for delivery vehicle movements.

4.2.5.2 GIS SWITCH ROOM

This shall be located on the upper storey, above the cable room.

A crane shall be provided for delivery of GIS switchgear from the hoist shaft and movement to the full extent of the switchgear installation, allowing for future bays. (See section 6.5.12 for further details).

A handrail meeting building regulations shall be provided at the top of the hoist shaft (e.g., 1100 mm Kee Klamp guardrail or similar approved).

A minimum clear area of 3 m length and equal width to the width of the GIS switchgear is required on both ends of the GIS switchgear for HV testing.

Earthing arrangements including floor rebar to be coordinated with the GIS supplier and the Customer. Refer also to the earthing section of this specification.

Overpressure vents, if required, shall be provided. This shall be confirmed with the switchgear supplier.

Access platforms shall be provided as required to access the switchgear.

- Two sets of stairs – one located at each end of the building⁴.
- High voltage cable room⁴.

This room shall be located on the ground floor, below the GIS switch room.

It shall provide space and facilities for the management of the HV cables from their point of entry to their point of transition to the GIS switch room on the upper storey.

Facilities and features to include:

- Floor slab to form a cable pit for the receipt of HV cables.
- Floor slab gradients and sump to be provided for drainage.
- Duct sleeves and collars cast into wall for entry of HV cables.
- Sealing of incoming cable ducts to prevent ingress of moisture and gases.
- Fire sealing of HV cable transitions to GIS switchgear room.
- Cable supports – suited to cable weight and bending radius. These shall be situated to ensure that HV cables are vertical at the point of termination to the switchgear and as they pass through ring CTs.⁵
- Pulling eyes or other facilities to pull and replace cables.
- Exclusion zones –The immediate area of cable entries to the cable pit shall be kept free from obstructions. Each cable duct exclusion zone shall extend 300 mm wider on both sides than the width of the cable entry, and 2 m perpendicular to the cable entry wall. Refer to standard drawings listed in Appendix G for further details.
- Fencing and ladders down to cable pit level at entrances and exits – one at each end.
- Modular relocatable non-metallic (e.g., GRP) cable bridges shall be provided within the cable pit for personnel to cross over cables within the pit.
- Where cable crossings cannot be avoided, they should take place inside the cable pit. Other arrangements can be considered only if accepted by EirGrid.
- An interactive 3D model shall be provided for the cable pit, HV cables, supports, cleats, current transformers, and cable bridges to demonstrate the design feasibility.

Note - On sites where the space is restricted and there are special requirements, three storey GIS buildings may be considered as an exception subject to planning approval and subject to agreement with EirGrid.

4.2.6 SINGLE STOREY GIS BUILDING DESIGN

The use of Gas Insulated Busduct (GIB) HV circuits as an alternative to HV cables is subject to approval by EirGrid. Where (GIB) is used for incoming and outgoing HV circuits to gas

⁴ Refer also to section 6.5.9 for further details relating to floor level and ducting.

⁵ This requires that the HV cable room be a minimum height of cable pit

insulated switchgear, the building can be single storey, eliminating the need for stairs, hoist shaft and a HV cable room.

Transitions from cabled circuits to GIB take place outside the building.

Delivery of GIS equipment shall be via roller shutter door directly into the GIS switch room. The same door sizing and hard standing requirements apply as described for the two-storey design in section 4.2.5 .

A crane shall be provided for delivery of GIS switchgear from the delivery location to the full extent of the switchgear installation, allowing for future bays. (See section 6.5.11 for further details).

4.3 ARCHITECTURE

The buildings shall be designed so that they are compliant with current Building Regulations, low maintenance and durable and can be operated safely. The architectural design and external finishes of the buildings may be required to integrate with the surrounding environment on the site and as agreed with the Local Authority and relevant Planning Approvals.

The overall design and selection of materials and finishes shall be compatible with the local receiving environment and shall be resistant to damage or deterioration due to such factors as water ingress, saltwater corrosion, wind damage etc. All materials and equipment shall be designed by the Customer, taking into account minimum design life and site conditions.

Exterior walls adjacent to hardstanding areas shall be resistant to damage by vehicular traffic, or otherwise protected by provision of approved bollards, barriers, or similar devices. Any rendered external walls shall be finished in a self-coloured render.

The buildings shall be of sufficient size to accommodate safely the scheduled electrical equipment including safe circulation, maintenance access and adequately sized access routes to accommodate replacement equipment.

A suggested layout of these spaces is shown on the drawings OFD-SSS-501 (standard 220kv AIS station layout) and OFD-SSS-503 (Standard 220kv GIS layout) . These shall be used as a guide only, the minimum criteria being the safe accommodation of the scheduled equipment and fittings.

4.4 LOADING

The loading on the structure shall comply with

IS EN 1991-1-1 – General Actions – Densities, self-weight. Imposed loads for buildings.

IS EN 1991-1-2 – General Actions – Actions on structures exposed to fire.

IS EN 1991-1-3 – General Actions – Snow Loads

IS EN 1991-1-4 – General Actions – Wind Loads

IS EN 1991-1-5 – General Actions – Thermal Actions

IS EN 1991-1-6 – General Actions – Actions during execution

IS EN 1991-1-7 – General Actions – Accidental Actions

The following are the minimum imposed loading requirements for building areas, unless otherwise specified by the switchgear supplier:

Table 1 Building Loadings

Material/ Area	Loading
Suspended steel floor over GIS cable pit (to include covers):	15 kN/m ²
GIS room floor (to include covers):	15 kN/m ²
Steelwork supports for GIS protection cabinets:	7.5 kN/m ²
General floor load in all other areas (to include covers)	10 kN/m ²

The design loads shall be no less than those specified by the GIS Equipment supplier. Note that in some cases equipment suppliers specify temporary characteristic loads of 20 kN/m² applicable during installation of the Switchgear. The Customer shall ensure that the point load calculations and layouts of the equipment from the supplier are adequate to achieve the surface/area loads.

General / Control room raised access floor shall be a class A floor to IS EN 12825 designed for the following loadings:

Table 2 Raised Access Floor Loadings

Material/ Area	Loading
Design Value	15 kN/m ²
Characteristic Value	5 kN/m ²

4.5 FIRE

The building(s) shall be designed in accordance with Part B, Fire Safety, of the Technical Guidance Document of the Ireland Building Regulations 1997 to 2017 (as amended) as a purpose 'Group 6 Building' (Industrial). Limitation on travel distances for the building should follow the guidance set out for places of 'Industrial High Risk' outlined in Table 1.2 of the TGD Part B. It is the responsibility of the Customer to provide a Fire Safety Certificate if required, to make the application and to forward the certificate to EirGrid before commencement of the Works. In the event of a Fire Safety Certificate not being sought, a letter of confirmation of this fact shall be forwarded to EirGrid stating the reasons why the development is exempt. Should a Fire Safety Cert not be required, a report on compliance should then be forwarded to EirGrid.

In addition to any requirements of TGD Part B, the minimum fire rating for the building shall be 1 hour, or higher if required by the Fire Safety Certificate.

All fire seals shall be certified as having a 1-hour rating, or higher if required by the Fire Safety Certificate, by an approved installer. They shall be tagged as such and listed in the Safety File.

4.5.1 FIRE DOORS

The Customer shall ensure that the following documentation in relation to Fire Door Certificates is integrated into their QA/QC systems for the works:

- Customers Certificates of Compliance that the buildings Fire doors have been constructed in accordance with TGD Part B-Fire Safety and the current Building Regulations including -.
- Customers Testing and Commissioning Certificates associated with the Fire doors electrical and mechanical works.

4.6 DISABILITY ACCESS CERTIFICATE

OCC buildings may require a Disability Access Certificate (DAC) from the Local Authority in accordance with the Building Control Regulations, SI 351 of 2009. However, given the proposed use of the developments, the Customer may request and be granted a dispensation from TGD - Part M, Access, and Use, of the Building Regulations from the relevant Local Authority. The Customer shall submit confirmation of the grant of a Part M dispensation to EirGrid before commencement of detail design.

4.7 SITE SELECTION

The Customer's attention is drawn to the importance of selecting the optimum location based on a variety of criteria including:

- Available area.
- Topography (sloping or flat site).
- Flood risk.
- Streams, Rivers, Watercourses
- Geological and geotechnical characteristics of the soil.
- Susceptibility of site to landslides.
- Vehicle access.
- Environmental conditions.
- Pollution / Landfill.
- Altitude.
- Overhead/Underground utilities and services
- Line corridors –
- Wayleaves.

Customers Design will ensure that the final site to any new transmission assets are sited in a planned manner in terms of the overall Transmission System.

4.8 SOIL INVESTIGATION

The Customer shall assess the ground conditions pertaining to the site by full site investigation in accordance with EC 7 (EN 1997-1 & 2), BS 5930-2015 and BS 1377 Series.

Initially the Customer will carry out a desk study report which will include for scoping the future on-site soil investigation works.

In agreement with landowners the Customer shall undertake further investigations in accordance with EC7 to develop an interpretative report undertaken by the Customers Chartered Engineer with a post-graduate degree in Geotechnical Engineering as a minimum qualification" -

This will require that -

1. A factual report is obtained from the ground and soils investigation. This information shall be integrated into the 'EiAR' as part of the planning application
2. The factual information will then be interpreted for the completed GIR and GDR in accordance with EC7 standards.

As required the Customer will undertake any additional site investigations needed to complete the design in advance of any construction.

The investigation shall include a ground penetrating radar survey where there is evidence of existing services. The investigation should include soakaway tests where mains drainage is not available.

Soil resistivity shall be tested and taken into consideration with respect to the earth grid design as per EirGrid functional specification OFS-SSS-407.

For sites where the likelihood of landslide exists, the geotechnical investigations shall establish all geotechnical parameters required to carry out relevant calculations to determine the likelihood of such conditions occurring and for designing mitigation measures to prevent their occurrence.

In areas where there is evidence of karstified rock, in addition to borehole and other investigations, a suitable geophysical survey shall be carried out to determine locations of possible voids in the underlying rock.

If contaminated material or material requiring special disposal measures is encountered during excavations, the Customer shall dispose of this material in a manner appropriate to the material in accordance with all relevant statutory and other requirements.

A copy of the final Geotechnical Investigation Report shall form part of the Customers Quality documentation.

4.9 DOCUMENTATION, PLANNING, DESIGN AND CONSTRUCTION AS BUILT SUBMISSIONS

The Customer shall be responsible for the detailed design, strength, and safety of the OCC to meet the structural, dynamic, and environmental requirements.

All documentation for submission to EirGrid for review as listed in this specification shall be submitted in duplicate, and all models with drawings shall be in electronic format. The relevant electronic format shall be clarified with EirGrid. All as-built drawings and operation manuals (refer to Section 4.9) shall be submitted in duplicate to EirGrid upon completion of

the Civil and Building works in accordance with the agreed project schedule. Both hard and soft copies in duplicate of all information required to be submitted.

4.9.1 PLANNING PERMISSION

The Customer shall submit a full set of planning submission documents to EirGrid for review.

This will include but not be limited to the following studies where appropriate:

- Site Assessments (for wastewater treatment systems)
- Soakaway tests
- Flood studies
- Traffic studies
- Appropriate Assessment Screening
- Noise Reports
- EIA, if appropriate

The Customer will be responsible for submitting a request for planning permission. The Customer shall oversee the compliance with any conditions imposed by the relevant authority.

Once planning permission is granted the Customer shall forward a hardcopy and digital copy of the approval to EirGrid.

4.9.2 DESIGN AND CONSTRUCTION SUBMISSIONS

The Customer shall submit the documentation listed below for EirGrid to review. All documentation submitted shall form part of Customer QC/QA documentation (refer to Section 4.13) and be subject to internal verification by the Customer prior to submission to EirGrid. Documents shall state the full names of the producer, verifier, and approver of the documents and drawing submitted. The following is list of key information to be provided: -

- Soils Investigation Report
- Flood Risk Assessment Report
- Appropriate Assessment Screening Report
- Statutory and Local Authority approved Licences and permits required as part of the planning approval conditions including but not limited to works on or adjacent to public roads, Watercourses (including for Freshwater/ Marine), Waste Disposal and public utilities/services
- Full planning submission documents
- Fire certificate submission
- A document titled 'Design Criteria for Civil, Structural and Building Works' summarising all design related parameters, to be issued prior to commencement of detailed design.
- Structural drawings and calculations
- Building Control approved drawings .

- A set of civil engineering approved drawings
- The design calculations for any piling deemed necessary, including settlement calculations and drawings for proposed piled foundations
- A Design Risk Assessment
- A Ground Risk Register
- A set of construction drawings, reinforcement drawings, steelwork fabrication drawings and cladding / roofing drawings at least 3 weeks prior to commencement of work on site.
- On handover a complete set of as built drawings and associated records for all buildings and structures including for as built services and associated electrical plant and equipment (refer to Section 4.9.3) .
- A Radon Report

Notice of completion of civil works shall be given to EirGrid in writing. Prior to completion all information stipulated in the Specification shall be supplied to EirGrid.

All documents necessary for upkeep and maintenance of the building and structures, including all required certificates confirming the suitability of materials used as covered by this Specification, shall be submitted by the Customer with the Safety File (Refer to Section 3.2).

The Design Risk Assessment should cover all activities including Construction, Operation and Maintenance of the Station over its lifetime.

The DRA should identify whether any space within the Station can be classified as a confined space (per HSA Code of Practice for Working in Confined Spaces) once the electrical equipment is installed and mitigate the associated risks.

4.9.3 AS BUILT / LAID RECORDS

As Built drawings shall be provided in duplicate for all structures. As built records shall be provided explicitly for handover to EirGrid as follows:

A topographic survey of before (showing all key features) and after works indicating as built relevant ITM coordinates in plan and sections for each building, structure and associated hardstanding, electrical plant/ equipment, internal /external access roads , parking ,services , electrical cabling footways and fence lines provided. The topographic survey shall also identify all other key features impacted by the works such as associated landscaping and coastal protected areas and watercourses/culverts.

A copy of the latest revision of the construction drawings marked up in red showing clear and legible as built dimensions. Structures shall be dimensionally referenced, in 2 orthogonal directions, to pre-existing structures within the station.

As Built drawings shall be submitted in duplicate as hard copies and electronic format to scale with a drawing register referenced and categorising separately for the Civils, Building , Structures and Electrical Works (in dwg and pdf format) and stamped or otherwise identified as 'as-built' and be fully verified and approved by the Customer within 3 months of practical completion of the project ,(Refer to Appendix E). The Customer shall be aware that it is essential that appropriately detailed and relevant drawings are provided to facilitate future maintenance and operation of the asset.

4.9.4 DESIGN CRITERIA DOCUMENT

As part of the Design process for the OCC the Customer shall produce documentation titled 'Design Criteria for Civil, Structural and Building Works', which shall detail all design related parameters used, including standards, codes of practice, loadings, texts, design procedures, computer programmes, etc and shall be included in the documents required for handover.

4.9.5 FLOOD RISK ASSESSMENT

The Customer shall also prepare a flood risk assessment report. The site selected shall be assessed for the 1000-year return event. The report shall be made available to EirGrid. No development shall be allowed for inside the 1 in 1000-year event floodplain of a river or watercourse and all planning applications should be accompanied by a Flood Risk Assessment (FRA) in accordance with statutory guidelines.

4.9.6 SPECIES AND HABITATS ASSESSMENT REPORT

Where necessary, the Customer shall also prepare an Appropriate Assessment under Article 6(3) of the Habitats Directive of the implications of a plan or project, either individually or in combination with other plans and projects, on a Natura 2000 site in view of the site's conservation objectives.

4.9.7 GEOTECHNICAL ASSESSMENT ,ENVIRONMENTAL AND SITE ASSESSMENT REPORT

A geotechnical risk assessment shall be completed and a geotechnical risk register and an Environmental Soils Classification Report and a Site Assessment Report shall be produced.

4.9.8 OTHER INVESTIGATIONS

The Customer shall also undertake all other necessary investigations required to complete the design and comply with approved planning condition requirements. These investigations shall include for all environmental, engineering, architectural and electrical surveys deemed necessary in order to minimise risk and improve design and safety through all phases of the OCC project.

4.10 DURABILITY

The Civil and Building works shall be designed for a minimum life of 40 years. All exposed steel shall have a minimum period to first maintenance of at least 20 years.

4.11 CONCRETE, REINFORCEMENT AND PRECAST CONCRETE MATERIALS

All materials used shall be new and of high quality and be suitable for the environment in which they are installed. Materials and colour schemes not specified in this specification shall be subject to the acceptance of EirGrid. (Note – Concrete for pavements refer to Section 5.10.2)

4.11.1 CONCRETE MATERIALS

This part of the Specification shall be read in conjunction with IS EN 206, IS EN 1992 and IS EN 13670.

The Customer's design, as part of their Quality systems, shall provide details and certificates as required in the various sections of the Specification including:

- Concrete Mix Report: The Customer shall at contract commencement submit to EirGrid a site-specific report titled 'Concrete Mixes' in accordance with requirements of this Specification.
- Inspection Sheets: Inspection and tolerance sheets shall be completed by the Customer for all concrete works.
- Environmental Product Declaration (EPD): The Customer shall provide either an EPD or a calculation of the cradle to gate embodied carbon content of their proposed concrete and measures shall be taken to monitor and use, where feasible, low carbon concrete throughout the Customers mass concrete and reinforced concrete structural designs and associated methods of work.

Certificates of compliance shall be provided for materials and products used in the Works. Products bearing the CE mark or third-party certification shall be checked against the delivery ticket and visually inspected.

4.11.1.1 CEMENT

Cementitious Material used in the Works shall be as defined in IS EN 197-1 and the Irish National Annex to IS EN 206.

The quantities of cement used shall be based on Table 1 of the 2011 revision of IS EN 197-1. Future revisions to the code will supersede the percentages currently listed in Table 1.

Cement shall be supplied from a single source to ensure uniformity of colour in the finished concrete.

Super-sulphated or high alumina cements shall not be used either in concrete or mortar.

CEM III cements shall not be used for elements with an XF exposure class.

Cements in combination with a type II addition in accordance with the Irish National Annex to IS EN 206 shall consist of the following:

- CEM I or CEM II cement to IS EN 197-1.
- A minimum of 30% type II additions shall be used in concrete with the following restrictions:
- Total percentage of fly ash is limited to 35% (the limit is based on the quantity of fly ash already in the cement as well as additional quantities).
- Maximum limits as set out in IS EN 206.
- Customers Design approval is required where the overall percentage of clinker (Ordinary Portland Cement) in the cement is less than 35%. Responsibility for detailed design and construction shall remain the responsibility of the Customer, refer to OFS-GEN-012.

4.11.1.2 AGGREGATES

Aggregates shall comply with IS EN 12620 and S.R. 16:2016 (i.e., Guidance on the Use of IS EN 12620) and shall consist of naturally occurring materials from a source approved by EirGrid and open to inspection.

The Customer will obtain evidence that the producer of conformity has ISO:9001 accreditation and is CE certified and compliant with the Irish National Annex of IS EN 206 to ensure the aggregates in the concrete do not lead to alkali-silica reaction.

4.11.1.3 WATER

Water shall be in accordance with IS EN 1008.

4.11.1.4 ADMIXTURES

The use of admixtures, where permitted, shall be in accordance with IS EN 206 and IS EN 934-2.

If the Customer intends to use two or more admixtures in combination, he shall consult the manufacturer(s) and verify that these proposals are acceptable.

4.11.1.5 PIGMENTS

Pigments shall be in accordance with IS EN 12878.

4.11.1.6 FORMWORK AND FALSEWORK

Certificates of compliance shall be provided for materials and products. Formwork and Falsework shall be in accordance with the requirements of BS 5975 and IS EN 13670 and shall be designed to withstand the most onerous combination of applied loads from whatever source including dynamic effects from vibrating and compacting the concrete. Concrete pressures shall be derived in accordance with the requirements of BS 5975, IS EN 12812 and IS EN 12813 and CIRIA Report No. 108: Concrete Pressure on Formwork.

Formwork spacers shall not impair the appearance or durability of the concrete structure.

Form release agents shall be to the approval of the Customer's Design. They shall be applied carefully and sparingly and shall not be allowed to come in contact with concrete surfaces or with items (including reinforcement) which are to become bonded to the concrete.

Striking of formwork shall be subject to the permission of the Customer and shall be in accordance with IS EN 13670 and subject to an absolute minimum 5 MPa concrete strength to resist damage to surfaces that may arise during the striking.

4.11.1.7 REINFORCEMENT

Steel reinforcement for concrete shall be in accordance with IS EN 1992 as amended by the provisions of this clause.

Concrete reinforcing steel shall comply with IS EN 10080 in conjunction with the following standards:

- BS 4449 Steel for the reinforcement of concrete,
- BS 4482 Steel wire reinforcement,
- BS 4483 Steel fabric

Stainless steel reinforcing bars shall be in accordance with BS 6744.

Steel reinforcement shall be scheduled, cut, and bent in accordance with BS 8666 and shall be obtained from a firm holding a valid certification from CARES [or fully equivalent scheme].

Support chairs for reinforcement shall be designed by the Customer in accordance with BS 7973-1.

To provide a continuous steel conductive path the Customers Design shall ensure that all reinforcement bars [i.e., in both faces] of floor slabs and walls shall be welded at crossover points at designed intervals prior to pouring concrete. Copper conductor as per the design shall be bolted to reinforcement at intervals using galvanised steel 'U' bolt and saddle to IS EN 13411-5 for clamping and connecting to the earth grid.

Earth tails shall be placed into concrete works and passed under shutters to be connected to the earth grid. Disks shall be placed on the soffits of slabs and inside walls to tie the earthing into the superstructure of the building.

Fibre reinforcement where used shall be in accordance with the manufacturer's instructions and the following standards.

- IS EN 14889-1 – Fibres for Concrete. Steel Fibres. Definitions, specifications & conformity
- IS EN 14889-2 – Fibres for Concrete. Polymer Fibres. Definitions, specifications & conformity
- IS EN 14845-1 – Test methods for fibres in concrete

4.11.2 CONCRETE FINISHES

Concrete finishes shall comply to the requirements noted in this section which is based on requirements in TII Series 1700 (Specification for Road Works) . However, equivalent finishes as per I.S. EN 13670 are acceptable subject to confirmation from EirGrid.

All concrete surfaces shall be smooth and true. All fines which may occur between boards or panels shall be removed and air holes filled with mortar of approved composition and colour. Any area requiring treatment after stripping as outlined above shall afterwards be rubbed down with a carborundum block and washed perfectly clean. No surface treatment shall be carried out until the surface has been inspected by the Customer.

Where uniformity of colour is required in the surface finish of concrete, each material shall be obtained from a single consistent source. Where surfaces are to be formed using large formwork panels made up from individual plywood or timber sheets, the individual sheets shall have uniform properties of absorption and surface texture.

Where a concrete surface is to be permanently exposed, only one release agent for the formwork shall be used throughout the entire area. Release agents shall be applied evenly and contact with reinforcement avoided. Where the surface is to receive an applied finish, care shall be taken to ensure the compatibility of the release agent with the finish.

The Customer's Quality systems shall ensure that full scale reinforced samples are constructed as to demonstrate finishes in accordance with the Customers Design. . The samples shall incorporate junctions, joints, and applied finishes. If acceptable, the samples may be incorporated in the works. Subsequent finished work shall not be inferior to the samples, which shall be used as models. The remainder of the work shall use the same methods as the models.

Finishes shall be as per Table 3 Concrete Finishes Schedule' below.

Finishes to formed surfaces shall in general be as follows:

4.11.2.1 CLASS F1- ROUGH FINISH FOR BURIED OR RENDERED WORK

This finish is generally intended for surfaces against which backfill, further concrete or grout will be placed, including recesses for bolts and other built-in parts or for surfaces which would otherwise be concealed from view. The surface shall be uniform, without honeycombing or sand runs and shall be free of surface defects.

4.11.2.2 CLASS F2- NORMAL FINISH OF EXPOSED WORK

This finish is required for structural surfaces permanently exposed to view, but where finish is not critical, such as walls of fire escape stairs or plant rooms or columns and beams to structures that are normally viewed in the shade, e.g., carparks and warehouses. The finish is intended to be left as struck; however, imperfections such as fins and surface discolouration shall be made good to comply with Customer's detailed design.

4.11.2.3 CLASS F3-SUPERIOR FINISH FOR EXPOSED WORK

This finish is required for surfaces permanently exposed to view such as prominent or important architectural features, or for precast concrete units. The surface shall be smooth and of uniform texture and appearance without staining, discolouration, board marks or surface pitting. Formwork shall be of the same type and obtained from only one source throughout any one structure. All surface blemishes shall be removed and/or filled to match the colour of the original concrete. Provision for internal ties and embedded metal formwork supports in the permanent works shall be permitted but shall be on a regular spacing.

4.11.2.4 CLASS F4-ENHANCED SUPERIOR FINISH FOR EXPOSED WORK

This finish is required for buildings requiring only the highest standard of finish. This finish shall be obtained in the same way as Class F3 finish except that while the concrete is still green all surface blemishes shall be filled. Internal ties and embedded metal formwork support shall not be allowed.

All formwork joints for all classes of finish except for Class F1 shall form a regular pattern with horizontal and vertical lines continuous throughout each structure and all construction joints shall coincide with these horizontal and vertical lines.

Unformed finished concrete surfaces shall be classified in accordance with the class listed below.

4.11.2.5 CLASS U1 - UNFORMED FINISH ("SCREEDED")

This finish shall be required for the surface of foundations, bases, slabs, and structural units to be covered by backfill, subsequent stages of construction, bonded concrete toppings or mortar beds, and also for exposed surfaces of paving where a superior finish is not required and as the first stage for finishes U2 or U3.

It shall be obtained by levelling and screeding the concrete to produce an even, uniform, plain or slightly ridged surface without laitance; surplus concrete shall be struck off by a straight edge immediately after compaction.

4.11.2.6 CLASS U2 - UNFORMED FINISH ("FLOATED")

This finish shall be required for the surface of beds and slabs intended to receive further finishes or for exposed surfaces where a steel-trowelled finish is not required. Floating shall be done only after the concrete has hardened sufficiently and shall not be continued to the extent of bringing excessive fine material to the surface, but only so as to produce a uniform

surface free from screed marks, and within any tolerance stated or implied for the thickness of bedding or bonding material.

4.11.2.7 CLASS U3 - UNFORMED FINISH ("STEEL TROWELED")

This is a hard smooth finish which shall be required for surfaces of high-quality concrete floors and paving's, tops of wall copings, tops of bases to directly receive steelwork, unformed surfaces of architectural features (including precast units), for surfaces of beds and slabs to receive thin flexible sheet and tile paving's bedded in adhesive, and seatings for metal items where the metal is in direct contact with the concrete. Trowelling shall not commence until the moisture film has disappeared and the concrete is sufficiently hard to prevent the working of excess laitance to the surface. The surface shall be trowelled firmly and left free from trowel marks.

Class U3 finish may be produced by power floating of concrete subject to the requirement that such work is carried out by experienced and skilled workmen.

4.11.2.8 CLASS U4 - BRUSHED FINISH

This is a textured finish with average depth of 1mm, obtained by producing a floated finish and then drawing a wire broom over the concrete surface at right angles to the flow of traffic.

Table 3 Concrete Finishes Schedule

Description	Formed Surface	Unformed Surface
General Electrical Equipment Bases	F1 (Chamfer F2)	U3
Capped Bases, e.g., gantry and busbar bases	F1	U2
Transformer bund walls	F2	U3
Transformer bund Floor	-	U2
Transformer plinth	F2	U3
Transformer fire walls	F2	U2
Block Surface Ducts	-	U3
Retaining walls	F1 – Earth retaining face F2 – Visible face	U2
Non-Retaining Boundary Walls	F2 – Visible face F1 (if face to be stone clad)	U2
Footing of retaining/boundary walls	F1	U2
Concrete OCC roads, paths, and ramps	F1	U4

Description	Formed Surface	Unformed Surface
Building foundations	F1	U1
Cable pit floor	F1 – Buried face F2 – Visible face	U2
Cable pit walls	F2	-
Control room sub floor	-	U2
Floors at finished floor level	-	U3 (power float - minimum standard)
Exposed soffit of suspended slabs	F2	-
Internal Walls above Cable pit Level	F3	-
Precast Concrete Elements	F3	U3

4.11.3 PRODUCTION OF CONCRETE

Concrete specification, performance, production, and conformity shall be in accordance with the requirements of IS EN 206. Notwithstanding this requirement, all structural concrete which is continuously under water shall have a minimum cement content of 325 kg/m³ and a maximum water cement ratio of 0.55.

The Customer shall produce a site-specific report titled "Concrete Mixes" which shall detail the proposed concrete mixes for the project. This report shall include details of tests conducted (including chemical), analysis of results to confirm site / soil environment and shall demonstrate full compliance with the requirements of the approved codes and with the structural design. This report, which shall also include results of trial mixes/testing and/or an accredited concrete batching plant with calibration certificates. The frequency of samples trial mix and testing requirements shall be as per Customers Quality systems.

The Customer shall procure concrete only from producers that have had their production control procedures certified by an approved certification body in accordance with the provisions of Annex C of IS EN 206. In addition, the Customer shall provide, through the producer, a 'Declaration of Conformity' in accordance with IS EN 206 for all concrete produced.

Details of the quality control procedures in operation at the producer's works shall be submitted to the Customer for approval and facilities shall be provided there for him to inspect the batching and mixing of the concrete and materials used. Samples of materials shall be provided for any tests which the Customer may wish to carry out. Any inspection or testing carried out shall not relieve the Customer of their obligation to provide concrete fully in accordance with this Specification.

The Customer shall provide either an EPD (Environmental Product Declaration) or a calculation of the lifecycle product stage A1-A3 for embodied carbon of their proposed concrete in accordance with EN 15978 (2011) and EN15804 (2019). The concrete should cover the (GWP) Global Warming potential of all emissions associated with concrete from the point at which materials are extracted until the mixed concrete leaves the batching plant. Transport to the construction site stage A4 and construction emissions stage A5 are not required.

However, the stage A1-A3 calculation should include any transport emissions associated with transporting the constituents from their place of origin to the batching plant. For precast concrete the process emissions associated with the placement and any thermal curing shall be included.

The calculation should be in accordance with IS EN 15978: (2011) and shall provide the total GWP (Global Warming Potential) for the concrete expressed as kg of CO₂ per m³ wet concrete. A breakdown for the GWP values used for each constituent shall also be provided to EirGrid as part of the Customer Quality documentation.

4.11.4 TRANSPORTATION AND ACCEPTANCE OF CONCRETE

The Customer shall plan the route to the Site in advance of any deliveries and shall plan contingencies for any ambient conditions such as high or low temperatures or traffic congestion, etc. that are likely to affect the quality of the concrete as delivered. Where the period from batching to placing is deemed unacceptable by the Customer, the use of admixtures may be permitted, subject to the approval of the Customer. Only admixtures with a proven documented record of accomplishment of use with the design mix proposed will be accepted. The addition of water and admixtures to the concrete shall not be permitted.

Concrete shall be placed and compacted with minimum delay after mixing and shall be compacted and in its final position within 2 hours of the introduction of cement to the aggregate unless a longer time is agreed by the Customer. The addition of water and admixtures to the concrete in the truck is forbidden.

4.11.5 PLACING OF CONCRETE

No concrete shall be placed until the site of placing (including forms, reinforcement, and embedded items) has been inspected by the Customer for sampling, testing, inspections and checks ensuring that they are agreed and signed off by the Customer. This shall be completed by the Customer at least 4 hours before the placing of any concrete. To facilitate this, the Customer shall ensure that their Quality control forms are completed as part of their pre pour inspections ..

The Customer shall ensure the efficiency of the proposed methods of placing and compaction on a trial section have been undertaken. When a trial section has been approved by the Customer, this section shall be maintained as a control for the duration of the Works. Placing and compaction of concrete shall only be carried out under supervision of qualified personnel. Control procedures shall be established to cover all aspects of workmanship including placing, compacting, finishing, curing, hot and cold weather concreting, large concrete pours, underwater concreting, etc.

Curing shall be in accordance with IS EN 13670. Curing and protection shall start immediately after the compaction of the concrete. The Customer shall submit and ensure all curing and protection systems are implemented, approved and recorded in their Quality procedures .

Construction and movement joints shall be in accordance with the requirements of IS EN 1992-1-1, IS EN 1992-3 (for water retaining structures) and IS EN 13670.

Aggregates and mixing water shall be free from snow, ice, and frost.

All surfaces with which the fresh concrete will come into contact are to be free from snow, ice and frost and preferably be at a temperature close to that of the fresh concrete. Water curing shall not be applied in conditions where freezing of concrete is anticipated. This shall apply regardless of the air temperature at the point of placing.

The minimum concrete temperature at the time of placing shall be 10°C. The temperature of the concrete should, at no point, fall below 5° until the concrete in the structural element reaches a strength of 5 N/mm².

Concrete shall not be placed while the air temperature is below 2°C measured on a rising thermometer or below 4°C measured on a falling thermometer.

Any concrete damaged by freezing shall be removed from the Works. Concrete shall not be allowed to come into contact with water at a temperature greater than 60°C.

Concreting in hot weather shall be in accordance with IS EN 13670.

4.11.6 SAMPLING AND TESTING OF CONCRETE

Samples (a minimum of 10% of deliveries or higher) for identity testing, shall be taken from the point of discharge of the concrete into the works by the standard method of sampling as defined in IS EN 12350-2. Rates for Sampling Testing Concrete pavement layers shall be as per Table 10/9 of the TII 800 Series.

Samples for identity testing, shall be taken from the point of discharge of the concrete into the works or as otherwise directed by the Customer by the standard method of sampling as defined in IS EN 12350-1. Each set of specimens shall be accompanied by a certificate of sampling and manufacture as required by IS EN 206. Testing shall only be carried out by an independent testing laboratory approved by the Customer which is fully accredited to IS EN ISO/IEC 17025 by an approved accreditation agency such as INAB or UKAS.

Results of laboratory testing shall be sent independently by the laboratory to the Customer.

The following tests should be performed, and results submitted to the Customer:

- Compressive Strength Testing in accordance with IS EN 206:2013 /EN 12390-3
- Consistence (slump) Testing

The Customer shall ensure by proper supervision, execution, and inspection that the Works are completed in accordance with the Specification.

Testing for hardened concrete shall be in accordance with IS EN 12390-Parts 1,2,3,4 and 7

The Customer shall complete dedicated forms for all concrete works. This contains separate inspection requirements for:

- Inspection of pre-concreting operations
- Delivery records / Inspection of fresh concrete
- Inspection of placing and compaction
- Inspection of post-concreting operations

Where non-conformity is confirmed, the measures necessary to make the component acceptable or the necessity of rejection and replacement will be the responsibility of the Customer.

4.11.7 PRECAST AND PRESTRESSED CONCRETE

Precast and prestressed concrete structural elements shall be in accordance with the requirements of IS EN 1992 and IS EN 206:2013.

Precast concrete units shall be handled and erected in accordance with IS EN 1992 and IS EN 13670.

The Customer shall carry out a pre- installation inspection of pre-cast units. Where non-conformity on site is confirmed, the measures necessary to make the component acceptable or the necessity of rejection and replacement will be decided by the Customer in accordance with their QC\QA procedures.

Note that all pre-cast concrete roof elements with hollow cores shall have pre-drilled 20 mm holes on the soffit in each core at 250 mm from each support. Alternative systems without cores should be considered where possible.

4.11.8 ANCILLARY CONCRETE ITEMS

4.11.8.1 HOLDING DOWN ANCHOR BOLTS

The combination of bolt, nut and washer for pre-loaded bolted assemblies shall be to the requirements of BS 7419 and IS EN 14399 Part 4 & 8.

Threads for holding down bolts shall be protected with an industry approved material selected by the Customer during delivery storage and during / following concreting (associated nuts and washers shall be similarly protected during / after concreting).

Bolts sleeves (when used for foundation anchors) shall be mild steel and shall not allow the passage of cement grout into the tube.

After concreting, the bolt projections with attached nuts and washers shall be protected against corrosion with sealing tape and protected against mechanical damage until the erection of the steel works or other plant or fixtures commences.

Holding down bolts and holding down bolt assemblies shall be in the position shown on the Customer's Design drawings. Bolts shall be in accordance with the requirements of IS EN 1090-2. The position of the centre of any bolt shall not vary by more than +3 mm from its specified position for bolts cast rigidly and + 10 mm for bolts cast in sleeves. The position of the other end of the bolt shall be set such that the slope of the bolt can be accommodated by the clearance provided in the boltholes. The projection of the end of the bolt shall not deviate from that specified in the project specification by more than the following:

- For bolts set vertically +10 mm or – 5 mm
- For bolts set horizontally +45 mm or – 5 mm

4.11.8.2 DOWEL BARS

Dowel bars shall be straight round smooth mild steel bars complying with BS 4449, unless specified otherwise. The free end shall be sawn and free from burrs or other irregularities. Bond breaking at expansion or contraction joints may be achieved by means of dowel sheaths. The sheathed end of the dowel bar shall be cast in first. Caps shall be securely fixed and shall permit free movement of one end of the bar.

Dowel adhesive shall be provided by an approved supplier and installed in accordance with the manufacturer's instructions.

Pull out testing of dowels shall be carried out at a frequency of 1 in 10 dowels subject to a minimum of 1 or as deemed necessary by the Customer.

4.11.8.3 GROUTING WORKS

Grouting of baseplates to structural steel and plant shall be carried out using proprietary high strength non-shrink high flow cementitious grout.

Transport, handling, storage, placing and curing of the grout shall be in accordance with the producer's instructions.

Testing of grout shall be carried out in accordance with IS EN 480 by carrying out bulk density and 7-day compressive testing on 40 mm x 40 mm x 160 mm prisms of grout. 1 set of 3 prisms shall be cast for the grouting of 10 or less bases.

4.11.8.4 POST FIXED ANCHORS

If the Customer proposes to use post fix anchors, they shall be designed in accordance with EN 1992-4:2018) and "Concrete Advice No. 5" published by The Concrete Society in the United Kingdom.

Reference shall also be made to the "Code of Practice for the Design and Installation of Anchors" published by the HSA . Sample forms shall be completed and integrated into the Customers Quality documentation.

Anchors (including post drilled reinforcement) are not permitted to support key structural elements such as floors, beams, walls, roofs, columns, stairs etc. unless specified otherwise by the Customer.

Unless otherwise specified, bolts and nuts forming part of the anchor system shall be Grade 8.8 in accordance with BS 3692 and BS 4190.

The Customer shall assume that the concrete is "cracked" for design purposes.

Unless specified otherwise by the Customer design, all anchors shall be safety critical.

The selection and installation of anchors shall be in accordance with the Construction Fixings Association (CFA) guidance note 'Anchor Selection' and 'Anchor Installation' and the anchor manufacturer's recommendations. All installed anchor systems shall have a current valid European Technical Approval (ETA). The Contractor shall obtain evidence in advance of installation into the permanent works that the selected anchor system has an ETA suitable for the intended application.

Post fixed anchors shall not be installed prior to the completion of the 28 days curing time of the concrete.

The selected anchor system shall have a corrosion protection treatment sufficient to give a working life of at least 50 years for the atmospheric exposure condition pertaining to the location of the installation. Minimum corrosion treatment shall be hot dip spun galvanised in accordance with IS EN ISO 1461, BS 7371-Part 6, ISO 17668 and IS EN 13811 as applicable.

Unless otherwise specified, a minimum of 1 in every 4 (25%) of the installed anchors shall be proof load tested by a UKAS accredited testing company in accordance with the CFA guidance note 'Procedure for Site Testing of Construction Fixings'. The test Proof Load shall be 1.75 times the Manufacturers Recommended Load for the fixing.

All testing shall be in accordance with the Customers Quality procedures.

4.12 INSPECTIONS BY EIRGRID

Inspection of the construction works will be carried out on an ongoing basis by EirGrid. The following, which are considered key elements of construction, may be inspected:

- Setting out of building in accordance with planning permission
- Earth grid installation
- Formation level of foundations
- Foundation / cable pit construction
- Buried cable ducts and testing
- Concrete works to include sample panel if requested
- Masonry and plasterwork to include sample panel if requested
- Precast units
- Structural steelwork construction and fabrication
- Installation of roofing system
- Cladding construction
- Finish of steel doors
- Building superstructure to be weatherproof on completion
- Transformer bay bunds to be tested successfully on completion
- Drainage to be tested successfully on completion
- Roads
- Fencing panels to be approved by the Customer before erection and the first panel shall be erected and reviewed by EirGrid prior to the rest of the fence being erected
- OCC aggregate – samples to be approved prior to laying in-situ.

At project inception, a schedule of construction inspection points will be agreed between the EirGrid and the Customer. EirGrid shall be contacted by the Customer at least 2 weeks in advance of agreed inspection point dates at which point EirGrid will confirm whether an inspection will be carried out.

Following any inspection, the Customer shall remedy any defects.

4.13 QUALITY ASSURANCE

4.13.1 MATERIAL WORKMANSHIP

All materials and workmanship shall be of a suitable type and quality to ensure that the equipment will operate satisfactorily in accordance with the specification.

4.13.2 QUALITY ASSURANCE SYSTEM

The Customer and equipment Manufacturers shall have ISO 9001 registration and maintain a documented quality control and quality assurance system which shall be in accordance with ISO 9001 or an equivalent international standard". The QA/QC documentation for the project (refer to Section 4.10) shall be submitted in duplicate to EirGrid as part of final handover documentation in 'pdf' and 'dwg' digital format.

Details of quality control and assurance requirements shall have observed and recorded:

- Maintenance of a risk register.
- Recording of non-conformances and follow-up corrective action.
- Evidence of continuous improvement and reviewing of targets and objectives.
- Procedures and work instructions to facilitate quality production.
- Statistical data and records of Quality Control Tests:

Completed pro-forma sheets and sample copies of records for all tests and quality control checks for both the factory and/or on site works production, including associated certification materials showing compliance with the specification and Customers Design, shall be provided for confirmation that Customers Quality Control/Assurance Procedures have been implemented for the OCC works.

Details of the inspection tests and procedures for incoming raw material shall be provided. Where the Supplier relies on Quality Control testing being performed by the Supplier, details shall be provided of the tests carried out by the Supplier and the confirmatory control tests by the Customer. Copies of the actual record sheets being used are required.

4.13.2.1 AUDITING:

In the event of quality problems which are likely to cause an impact on EirGrid equipment being supplied, the Supplier must inform EirGrid immediately. In the case of faulty equipment being returned by EirGrid, the Supplier must provide a preliminary report within two weeks of receipt of the goods, and a final comprehensive report within a further 4 weeks.

The Customer also undertakes that in the event of any contract award, the Customer will notify EirGrid immediately of any quality issues or defects which may subsequently come to light either with this equipment or with similar equipment with other customers.

EirGrid reserves the right to conduct an audit to ensure compliance.

4.13.2.2 CHANGES IN PRODUCT DETAILS:

As per the initial submission documentation, the Customer undertakes that the product(s) will be manufactured as specified and agreed and that there will be no change to the product or manufacturing process during the life of the contract without prior written approval from EirGrid. In addition, the Customer undertakes to notify EirGrid in advance of any proposed changes to the installation/maintenance procedures of the product(s) on this contract.

4.13.3 CUSTOMER SUPPLIER

The Customer Supplier shall fully declare all sub-suppliers of material associated with or used in the final product. This declaration shall include Sub-Suppliers' names and countries of origin and shall consider any changes in sub-suppliers.

All sub-supplier information must be provided in accordance with the Customer Technical Schedules as part of Customer QA documentation.

It is desired that all sub-suppliers will have an implemented Quality Assurance system conforming to ISO 9001:2015 or similar standard.

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4.14 PRODUCT QUALITY ASSESSMENT

If requested during the Customer evaluation process, the Customer shall make available in the factory, and on site with a fully assembled example of each of the items offered for inspection by EirGrid.

This inspection will cover three areas:

Witnessing by EirGrid of the full assembly and adjustment process to evaluate the level of skill and experience required to complete each key works activity successfully.

Access to quality documentation within the Projects Quality Control plan, including RAMS (method statements), work procedures, checklists, samples, Inspection schedules & test plan, certifications for materials used, products and services used in the key Civil, Structural and Building activities required for the delivery of the OCC.

A detailed inspection of the Civil, Structural, Building works and Electrical plant and equipment by EirGrid to evaluate the compatibility and quality of the design and on site and factory shop supplied manufacturing processes in relation to finishes, structural integrity and corrosion resistance for the minimising or control of possible failure mechanisms and ease of operation.

4.14.1 CONCRETE CONSTRUCTION RECORDS

The Customer shall ensure all Construction records for the preparation, pouring and curing of concrete structures shall be included in their Quality documentation (refer to Section 4.11)

4.14.2 TOLERANCES

Construction tolerances are as specified in this Civil Works Specification. Tolerance checks on slabs and plinths shall be recorded and kept available for audit.

4.14.3 BUND TESTING RECORDS

Bunds shall be tested in accordance with BS 8007, and the bund test results recorded in the Customers QA/QC documentation. Notwithstanding compliance with the test requirements, if leakage is visible external to the bund it will be deemed to have failed.

4.14.4 DUCT PROVING RECORDS

Ducts shall be tested, and the duct test results recorded.

4.14.5 MASONRY DUCT SIGN-OFF

Masonry ducts shall be signed off by the Customer.

4.14.6 SERVICES AS-CONSTRUCTED RECORDS

As-Constructed records of services (refer to Section 4.10.2) for the OCC as laid and compliant with utility providers and statutory requirements.

5 AIS AND GIS SUBSTATION WORKS

5.1 SITE PREPARATION OCC WORKS AND RETAINING WALLS

The Customer shall be responsible for all site preparation including but not limited to the OCC areas and clearance of vegetation, rubbish, foreign materials etc. prior to the commencement of scrubbing and grading of the site to accommodate the proposed structure and OCC levels. Allowance shall be made for grading banks where necessary.

The earth grid design shall be complete in advance of the OCC design. An allowance for HDPE ducting for earth grid shall be made at service and road crossing points where a clash may occur due to relative levels.

The surface level of all roads and electrical equipment bases, and duct covers shall be 50 mm above the OCC stone level.

The OCC works shall include grading, excavation of unsuitable material, hauling, dumping, spreading and compaction of the entire yard area, as well as the building of retaining walls necessary to ensure that the OCC area is established as a stable platform suitable for accommodating the substation switchgear and buildings.

Hardstanding areas and roads shall be constructed in accordance with the requirements of Transport Infrastructure Ireland (TII) Specification for Road Works and in accordance with this Specification.

The over site preparation for the hardstanding shall be based on the Soils Investigation Report.

An OCC design drawing, clearly indicating the terrace levels, slopes and drainage arrangements shall be submitted to EirGrid for review prior to commencement of site works. Refer to the project deliverables listed in Section 4.10 of this Specification.

5.1.1 ACCEPTABLE AND UNACCEPTABLE MATERIAL

The Customer shall employ only plant and working methods which are suited to the materials to be handled and traversed. They shall be responsible for maintaining the nature of all fill material so that when it is placed and compacted it remains acceptable in accordance with the Contract. Acceptability shall be determined in accordance with Tables 6/1 and 6/2 of the TII Series 600 – Earthworks (CC-SPW-00600)'.

"Acceptable Material" shall comprise all that which is acceptable in accordance with the Contract for use in the Works other than landscape areas and earth bunds. "Acceptable Material" shall be Granular material Class 6B, 6F1, 6F2, Clause 601.1 TII Series 600 .

Fill materials for use under and adjacent to concrete slabs and footpaths shall comply with the requirements of 21:2014 + A1:2016 (S.R 1) Annex E.

"Unacceptable Material" shall mean material other than acceptable material as defined in Clause 601. Unacceptable Material, if approved by EirGrid, may be incorporated in landscape areas and earth mounds. Unacceptable material shall include: -

- Material which does not comply with the permitted constituents and material properties of Table 6/1 and Appendix 6/1, of the TII Series 600,
- Pyrites

- Material from swamps, marshes, or bogs.
- Peat, logs, stumps, and perishable material,
- Material susceptible to spontaneous combustion,
- Material in a frozen condition,
- Clay of liquid limit exceeding 80 and/or plasticity index exceeding 55, materials having a moisture content greater than the maximum permitted for such materials in the Contract,
- Silts defined for the purposes of this contract as uniformly graded material having a uniformity co-efficient of 10 or less and containing 80% or more in the particle size range 0.06 - 0.002 mm and having a moisture content greater than the optimum moisture content of the material,
- Material having hazardous chemical or physical properties requiring special measures for its excavation, handling, storing, transportation, deposition, and disposal.
- Argillaceous material

All unacceptable material as defined above and not required to be processed or used in the works, shall be disposed of in accordance with applicable regulations and enactments by the Customer. Any material taken offsite for disposal shall be disposed of in a licensed tip only.

5.1.2 PYRITE INDUCED EXPANSION

The Customer shall provide certification from the quarry or fill material supplier to show that all granular fill material for use under or within 500 mm of concrete structures (including electrical equipment bases, concrete roadways, footpaths, floor slabs and transformer bunds) has a total sulphur content not exceeding 0.1% by mass as determined in accordance with EN 1744-1, clause 11.

Where the total sulphur content exceeds 0.1%, a petrographic assessment involving transmitted and reflected light evaluation of sections is required. The petrographic assessment should address the following:

- the presence and amount of pyrite, the form of pyrite (i.e., framboidal, other fine-grained forms, euhedral, etc.) and its distribution throughout the sample.
- evidence of oxidised pyrite (discolouration and oxidised rims).
- presence of clay minerals.
- presence of any carbonate (e.g., calcite).
- presence, form, and distribution of any secondary gypsum.
- observations on structure including indications of porosity.

Where, in the opinion of the Competent Person (Professional Geologist), the petrographic assessment identifies pyrrhotite, the aggregate is deemed suitable (with respect to its petrography) only if its total sulphur content is $\leq 0.4\%$ and if the Competent Person (Professional Geologist) has no other concerns.

5.1.3 CONSTRUCTION OF FILL MATERIAL

Construction of fills shall be in accordance with TII 600 Series. The following tables and clauses relate to this Series. The material adopted for the OCC shall comply with the Customers Design and shall be one of the following classes:

- Class 6B material for use as a starter layer in poor ground. Material shall be in accordance with Tables 6/1 and 6/2.
- Class 6F1 or 6F2 material for use as a capping layer. Material shall be in accordance with Tables 6/1 and 6/2.
- 6N shall be used for fill to structures.
- 6P shall be used for fill below structures.

The Customer shall ensure that the construction of fills, including embankments as follows:

- During construction of embankments and other fills, exposed fill material shall be protected against scour and erosion from any source.
- Grading of acceptable fill material shall conform to Table 6/2
- Deposition of fill material occurs as soon as practicable after excavation, in layers to meet the compaction requirements of Clause 612. Earth moving plant shall not be accepted as compaction equipment.
- With a maximum gradient of 1 vertical to 2 horizontal and/or to an angle of repose based on material used and site conditions..

Construction of fills including embankments shall be constructed as per Clause 608 and compacted in accordance with Clause 612 and Table 6/1. Starter layer fill shall not be deposited in layers greater than 600 mm uncompacted. Method of compaction and plant used shall be appropriate to the Class of fill and the site conditions as set out in Table 6/4.

- Sub formation and Capping material shall be in accordance with Clause 613 and shall not be deposited in layers greater than 250 mm uncompacted. It shall be compacted in accordance with Clause 612 and as per Method 6 as set out in Table 6/4 using plant appropriate to the Class of fill and the site conditions.
- Geotextiles if required Geotextiles Used to separate earthworks materials shall conform to Clause 609. All geotextile products incorporated into the works shall be affixed with a CE marking symbol in accordance with EN 13249. Durability testing shall be in accordance with EN ISO 13249 and EN ISO 12224
- The use of recycled aggregate shall be approved by the Customer in advance of any works. All recycled aggregate shall conform to Clause 601. 9.
- Property, testing and acceptable limits of Earthworks limits shall be as per the Clauses stated and / or as per standard defined in Table 6/1.

Fill materials for use under and adjacent to concrete slabs and footpaths shall comply with the requirements of 21:2014 + A1:2016 (S.R 1) Annex E..

Soft spots shall be identified by the Customer and excavated below formation and replaced with material aggregate of concrete to achieve a CBR of not less than 10% taken at formation levels.

5.1.4 TESTING FOR CONSTRUCTION FILL

Earthworks Materials Tests shall be in accordance with Clause 631 and shall be carried out in accordance with BS 1377: Part 1 to Part 9 inclusive except where noted otherwise in

Clauses 632-643 Sampling shall be 1 per source and type of materials and techniques applied shall ensure that each sample is representative of the average properties of the material to be sampled.

Sampling of material shall be carried out in accordance with IS EN 932 and BS 5930. When sampling from stockpiles, the location and number of sampling increments shall consider the way in which the stockpile was built, its shape and the possibility of segregation within the stockpile. Methods of testing per Class of materials are defined in table 6/1. Compaction shall be as per Clause 612.

Samples for Geotextiles shall be taken from the consignment of geotextile to be used in the OCC shall be in accordance with EN ISO 9862 - 1 per source and type.

All testing, sampling and recording shall form part of the Customer's Quality documentation.

5.2 PILING

The Customer shall make their assessment of the ground conditions and establish whatever specific site investigations including drillings and testing they consider necessary to guarantee the performance of the piles.

Piles shall be designed to safely support a minimum of two and a half times the specified working load in all cases.

The Customer shall submit to EirGrid for review, design calculations, including settlement calculations to meet specified acceptable settlement (including differential settlement) tolerances supplied by machine / equipment manufacturers, and drawings for proposed piled foundations at least three weeks before commencement on site (refer to Section 4.9). The calculations shall also specify the acceptance criteria for test piles and consider action of pile groups (if applicable).

Piling shall be designed, installed and tested in accordance with IS EN 1997-1 and the "ICE Specification for Piling and Embedded Retaining Walls" published by the Institution of Civil Engineers, London, (latest edition) hereinafter referred to as the ICE Specification and such other Euro-norms as may apply (including BS EN 1536 for bored piles, IS EN 12699 for displacement piling, BS EN 12794 for precast concrete piles, etc) or other approved equivalent standard.

Pile load testing shall be carried out as stated in IS EN 1997-1 -Section 7.5. The Working pile shall be installed once the pile testing has been successfully completed and the adequacy of the proposed pile design has been demonstrated and documented. The Customer's programme shall include sufficient time set aside for the construction and testing of piles to reflect this requirement.

The following tests shall be carried out on working piles:

- Maintained Load Testing of working piles
- Additional suite of maintained load testing of non-working piles, uplift, etc
- Integrity Testing of All Cast-in-Place Working Piles

The Customer shall ensure that during the work, displacement or damage which would impair either performance or durability does not occur to completed piles.

Piles shall not be bored so close to other piles, which have recently been cast and which contain workable or unset concrete, that a flow of concrete could be induced from or damage caused to any of the piles.

Reinforcement left protruding above pile cut off level shall be protected by wrapping in dense tape and surrounding in lean mix concrete.

5.3 OCC AGGREGATE AND GRAVEL FILLING

Use of unbound aggregate shall be in accordance with TII 800 Series. The following tables and clauses relating to this Series. The unpaved areas within the OCC plus one meter outside the fencing shall be finished with a minimum 150 mm layer of 50 mm single sized crushed limestone. The properties of the limestone aggregates shall comply with the selected requirements of IS EN 13242 as listed in Table 8/2. The grading requirements for the aggregate to the OCC unpaved areas is as follows:

- 100% passing a 60 mm sieve.
- 85 - 100% passing a 50 mm sieve.
- 0% passing a 40 mm sieve.

The OCC unpaved areas shall be separated from the subsoil / capping layer by a suitable and approved geotextile membrane as per Customers Design

The Customer shall ensure that a capping layer or additional aggregate conforms to the specification and laid, compacted and consolidated to prevent rutting of the OCC stone by construction and maintenance vehicles. As described in Section 5.1.3 the capping layer, if required, shall be either 6F1 or 6F2 as per TII 600 Series. If required in poor ground conditions a starter layer maybe required, this shall be formed using 6B material and shall be placed to create an adequate subgrade (not less than CBR 10% at formation level). Compaction and laying of construction fills and capping layer material shall be in accordance with Clause 612, Table 6/1 and Table 6/4 of the TII Series 600. Compaction and laying of unbound aggregate material shall be in accordance with TII Series 800 Clause 802, and Table 8/4.

No unprotected sub grade at formation level which is to receive capping shall remain exposed as it may cause potential degradation.

A sample of the finished layer of the 50mm clean stone to the unpaved areas shall be sampled and tested with all results logged in the Customers Quality Control documentation for EirGrid's review as required. The following documentation shall be sampled and tested with:

- Evidence based on testing that the material on top layer is limestone and grading have the specified particle size distribution as per TII 800 Series.
- Evidence based on testing that the starter layer and capping layer materials conform to TII 600 Series.

The finished stone level generally shall be 50 mm below the level of bases and duct covers.

5.4 OCC DRAINAGE

The Customers OCC surface water drainage network shall be designed so that no flooding or surcharging of the network occurs for all rainfall events with a 30-year return period, and properties are protected against flooding for all rainfall events with a 100-year rainfall return

period. Supporting calculations shall be forwarded to EirGrid for review prior to construction. Road storm drainage is further referred to in section 5.11

Allowance for climate change shall be incorporated in the rainfall data used in surface water drainage calculations.

Where applicable, source control disposal of surface water shall be designed in accordance with British Research Establishment (BRE) Digest 365 and submitted for approval.

Erosion control and sediment management plans shall be drawn up and implemented for the management of surface water during construction.

Where construction works are within or adjacent to or otherwise impact upon an existing watercourse, it is recommended that the relevant statutory authorities shall be notified and consulted. It shall be noted that such works can only proceed subject to relevant licences and approval from the relevant authority(s) have been obtained. These licences and approvals shall form part of the Customer's Quality documentation.

Design and construction of all building drainage shall be in accordance with IS EN 752, IS EN 12056 and the requirements of the TGD Parts H, M, Local Authority and all drainage construction works shall be carried out in accordance with the approved planning documents and any conditions specified by the planning authority.

Roof drainage and drainage internal to buildings shall be in accordance with IS EN 12056. Surface water drainage [including roof drainage] shall be designed using the appropriate meteorological rainfall data for the site location subject to a minimum design rainfall intensity of 75 mm/hour.

The drainage system shall be designed to operate by gravity without pumps and shall only provide for pumping if necessary.

Drainage design shall follow industry best practice in accordance with Irish planning guidelines and policy documents. Relevant industry design manuals from the Construction Industry Research and Information Association (CIRCA) shall be followed and referenced in the design justification and calculations.

SUDS (Sustainable Drainage Systems) shall be used where practicable. The Customer is responsible for any permits required to connect to the public drainage system. If the public drainage system is not adequate, or if there is no suitable public drainage system to connect into, the Customer should design and incorporate suitable storage / attenuation into the drainage design based on CIRIA C697: 2007 (the SUDS manual) & BRE Digest 365: 2007 edition.

Gradients shall be adequate to achieve the required minimum flow velocities for self-cleansing.

The storm water drainage system shall be as per Customers Design and use of uPVC pipes is preferred with a minimum diameter of 150 mm. All RWP from buildings to the storm water pipes shall be provided with rodding eyes at the base of all runs and at all branches and junctions.

All pipes and drains laid shall be surveyed in situ after laying. The survey information shall be presented on an AutoCAD drawing referenced to the ITM Grid. Topographical information such as levels and contour lines, bases for electrical equipment, drainage, footways, roadways, buildings, fences, associated notes etc shall all be drawn on different colour coded layers allowing the user to switch off different features for clarity. Cover levels and

invert levels shall be clearly shown adjacent to manholes. All drainage and relevant non-drainage features shall be clearly marked on the drawing and shall form part of the as-built drawing (refer to Section 4.9.2).

Foul water drainage shall be connected to the public sewerage system where available. The Customer is responsible for any permits required to connect to the public sewerage system.

If there is not a suitable public sewerage system to connect into, the Customer shall install a suitable foul water handling system in accordance with local environmental regulations and or planning permission.

Storm and foul water drainage systems are required to be fully separated from adjacent customer stations. Potable water systems are also required to be fully separated from other stations.

5.4.1 OIL / WATER SEPARATING SYSTEMS

Oil interceptors shall be provided in the areas of the site where contamination due to oil is possible. A full retention class 1 separator is required to accept the discharge from all bunds; other run off can be passed through a bypass separator. Oil interceptors shall be constructed, inspected and tested as described in IS EN 858 and shall be accessible for maintenance.

Oil / Water separating pump systems, which remove water while leaving behind oil and contaminants, shall be fitted in a minimum 500 mm x 500 mm x 500 mm deep sump or as per Customers Design in all external transformer bunds as directed.

The system shall be instrumented and an approved oil sensitive bund dewatering system with a 1 l/s low shear vortex pump with oil separation detection with an approved bund interceptor class 1 full retention oil separator with independent certification of compliance with IS EN 858.

The submersible pump shall be a single phase 230 V stainless steel submersible pump, capable of pumping 1.5 litres per second at a head of 3m, unless a greater flow rate or head is required for the installation.

The system shall be supplied, installed, and fully commissioned before handover. A full maintenance check shall be carried out immediately before handover.

5.4.2 RAINWATER GOODS

Gutters, downpipes, and fittings shall be in accordance with the following standards:

- Sheet metal rainwater goods -IS EN 612
- Cast iron rainwater goods- British Standard (BS) 460
- Concrete pipes and ancillary concrete products – BS 5911-6:2021
- Unplasticised PVC rainwater goods- IS EN 12200-1

All materials shall be checked for soundness before erection.

Gutters, downpipes, and fittings shall be erected in accordance with IS EN 12056-5.

Downpipes shall be external to rooms housing electrical equipment unless otherwise agree by EirGrid.

During erection, care shall be taken to ensure that no damage is caused to existing buildings and structures.

Steel and iron shall have a proprietary protection against corrosion. Any protective coatings which may have been damaged before or during erection shall be made good immediately as instructed by the Customer.

All materials shall be inspected after installation and those parts of the work which will be concealed shall be tested before being finally enclosed in accordance with IS EN 12056-5.

5.4.3 WATER MAINS

Irish Water has developed Standard Details and a Code of Practice for water supply infrastructure. As of January 2017, it is mandatory to comply with the guidance in these documents. All water supplies shall be installed as per the latest revision of the following documents:

Water Infrastructure Standard Details – IW-CDS-5020-01

Design Risk Assessment for Water Infrastructure Standard Details – IW-CDS-5020-02

Code of Practice for Water Infrastructure – IW-CDS-502-03

Changes to these details shall be subject to EirGrid approval.

Pipes shall be polyethylene (MDPE, HDPE)). All plastic water pipes shall be blue in colour. uPVC shall not be used on water mains networks.

Where specific approval has been provided by EirGrid to use MOPVC, they shall conform to the UK Water Industry Specification No. 4-31-08 and manufacturers shall operate a quality system in compliance with IS EN ISO 9001.

5.4.4 POLYETHYLENE PIPES

MDPE pipes should be of type PE-80, have an SDR rating of 11 and conform to IS EN 12201: Parts 1&2.

MDPE and HDPE fittings shall conform to IS EN 12201: Part 3 and UK WIS 4-32- (all parts).

HPPE pipes should be of type PE-100, have an SDR rating of 17 and conform to IS EN 12201: Parts 1&2.

Fusion jointing and compression fitting for polyethylene pipes shall comply with -

WIS 4-32-08 specification for the fusion jointing of polyethylene pressure pipeline systems using pe80 and pe100 materials

WIS 4-32-11 issue 3 specification for mechanical and compression fittings made principally from thermoplastics for polyethylene pressure pipes with or without an aluminium barrier layer of nominal size ≤ 63

Valves and Fire Hydrants

Valves and Fire Hydrants shall comply with the following: -

IS EN 1074-1- Valves for water supply. Fitness for purpose requirements and appropriate verification tests. General requirements.

IS EN 1074-2- Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Isolating valves.

BS 750- Specification for underground fire hydrants and surface box frames and covers

5.4.5 SECURITY FENCING AND GATE WORKS

All OCC shall be surrounded by a min 2.6 m high galvanised and powder coated steel palisade fence.

The palisade fencing and gate shall be manufactured and assembled in accordance with Part 12 of BS 1722-12. Galvanising shall be in accordance with EN ISO 1461 and powder coating to be in accordance with BS EN 13438:2005 to RAL 6005 'Moss Green'. Planning and/or local authority requirements shall be taken into account in case of conflict and alternative shall be agreed with EirGrid.

Typical palisade fencing and gates details are referred to in Appendix G (OFD-SSS-515 STANDARD ONSHORE COMPENSATION COMPOUND -DETAILS OF PALISADE FENCING and OFD-SSS-516 STANDARD ONSHORE COMPENSATION COMPOUND. DETAILS OF PALISADE DOUBLE GATE

Other fencing details included is drawing OFD-SSS-514 STANDARD ONSHORE COMPENSATION COMPOUND. CONCRETE POST AND RAIL FENCE AND GATE DETAILS.

This fence should be self-supporting and not require the use of stays for support.

This fence shall incorporate a double leaf lockable palisade vehicle access gate with an opening of 4900 mm between the posts, incorporating a separate lockable personnel gate.

The top of the uppermost gate rail shall be level with the top palisade fencing rail.

The overall height of the gate, when fixed, shall not be less than the adjacent fence height.

The spacing of pales shall not be greater than that used on the referenced detail above.

A cowl shall be fitted over the lock on personnel gates. The height to the underside of the cowl shall be 1155 mm.

All gate frame joints shall be continuously welded.

All MV/HV plant outside of the GIS building shall be fenced off with additional gate access to enter MV/HV plant area of the OCC.

The gate locks shall be accessible from the outside. S/S Padlock Type & Number of Keys shall be made available for Operational maintenance and Spares.

The OCC fence shall be connected to the substation earth mat as per the EirGrid Earthing and Lightning Specification OFS-SSS-407 and in accordance with the Customers detailed Design and the relevant earthing details / drawings listed in Appendix G and Section 5.13.

A concrete plinth, 150 mm deep by 200 mm wide, consisting of grade C28/35 concrete shall be constructed for the full length of fence with pales embedded into the plinth. The maximum clear spacing between the pales or between pale and post shall be 50 mm.

Pales shall be triple pointed and sprayed and welded to rails in accordance with Cl. 5.1 of BS 1722-12 to withstand a load of 18 kN

A property boundary perimeter fence shall be provided. Refer to Appendix B for details.

The Customer shall ensure that all fencing components shall be transported, delivered and stacked in such a manner as to avoid damage to coatings. Large scale touch-up of coatings on site is unsightly and to be avoided.

5.5 OUTDOOR OCC STRUCTURES

5.5.1 FOUNDATION WORKS FOR OCC STRUCTURES

The design of the foundations shall take account of the ground conditions and the forces exerted by the structures. Steel reinforcement shall be provided where necessary. Limit State method of design and/or crack checks shall be used to calculate the reinforcement. A suitable bolting arrangement shall be provided to connect the equipment supporting structures to the foundation. Foundation tolerance shall be such that water does not collect on foundations. Shimmering and grouting should be avoided ,however, If required all grouting shall be undertaken using a proprietary high strength non-shrink high flow cementitious grout . Base concrete shall be to graded class C30/37 as a minimum and conform to Customers Design.. All support structure edging shall have a chamfered finish and must not represent a tripping hazard. Design and construction of foundations shall be in accordance with IS EN 1997.

5.6 HV CABLE DUCTING

This part of the specification sets out the requirements for the supply and installation of ducts for High Voltage (HV) cables for the OCC.

The supply and installation of ducts and couplers for High Voltage (HV) cables shall be in accordance with the latest revision of the EirGrid Cables specifications.

All ducts and couplers for HV cables shall comply with Customer's detailed design and shall be supplied to satisfy the criteria given in the Table in Appendix C, refer to OFS-CAB-100.

Cable ducts to HV plant shall be directly encased in the concrete plinth for each item of plant. On exiting, the duct shall be suitably located within the concrete plinth to minimise the length of exposed cable to the equipment. The Customer shall ensure that the cable is appropriately supported by means of metal cable tray along its exposed length to ensure secure support and to prevent damage.

Ducting routes exiting the site shall be coordinated with the fencing layout to avoid clashes between fence post foundations and cable ducts.

The utmost care shall be taken during handling, laying, backfilling, and testing of ducts to prevent damage. The ducts shall not be stored in a place where they are likely to be in contact with surface water or any foreign matter, which could make its way into the ducts. When in storage, dust caps must be fitted to the ducts. The method of stacking shall be such to avoid distortion and the integrity of the ducts shall be maintained.

Duct Installation bed, surround and backfill requirements shall be in line with the Cable Duct Installation Guidelines described in Appendix C of the Specification. All ducts have warning and marker tapes provided above and shall be roped and tested.

A typical cable detail is referred to Appendix G - see detail OFD-SSS-521-STANDARD – AS-BUILT CABLE ROUTE.

Further Details for specific cable crossing and through poor ground conditions are as follows: -

OFD-SSS-527STANDARD - 3RD PARTY CROSSING (300 MM ABOVE)

OFD-SSS-528STANDARD - 3RD PARTY CROSSING (300 MM BELOW)

OFD-SSS-529STANDARD - RIVERBED CROSSING

OFD-SSS-530STANDARD - BRIDGE CROSSING

OFD-SSS-531STANDARD - TRENCH THROUGH PEAT

Recording of as built cabling information including requirements for horizontal and vertical accuracy shall be in accordance with Appendix E

5.7 NON HV CABLE TRENCHES AND COVERS

Appropriate cable trenches shall be provided for routing of cables in the OCC.

Telecommunication, LV and CCTV trenches (refer to Sections 5.9 and 5.12) shall be sized to hold current and future cables as required but they shall be a minimum of 400 mm wide internally with depth and locations as per Customers Design . The trench shall have a longitudinal slope not shallower than 1 in 500. The lowest end of each trench shall be designed to cater for storm drainage.

The cable trench inspection chambers C2 and joint Bays shall be generally constructed of precast concrete, cast in-situ (refer to Appendix D), reinforced concrete or masonry walls on a reinforced concrete base.

Covers to inspection chambers, C2 and joint Bays in non-trafficked areas shall be designed to BS EN124: 1994 -B125. Covers in trafficked areas shall be designed for the load of vehicles to a minimum standard of BS EN124: 1994 -D400 classification.

Traversable duct coverings are to be designed in accordance with EN 1433:2002, with a suitable cover chosen to withstand appropriate traffic loadings in non-trafficked and trafficked areas as mentioned above. The traversable duct is required to be removable, either manually or mechanically.

5.7.1 DUCT COVERS [NON-TRAFFICKED AREAS]

External duct covers shall be hydraulically pressed, precast concrete duct covers, either 900 x 600 x 65 mm thick or 600 x 600 x 65 mm thick depending on the duct width, reinforced with A142 mesh in accordance with BS 4483 with 30 mm cover. The slabs shall meet, as a minimum, the requirements of IS EN 1339. However, concrete shall have a minimum compressive strength class C30/37.

The top of the duct covers shall have a non-slip mottled finish. One in every six slabs shall incorporate 2 no. stainless steel plain socket lifting inserts.

After cutting, any exposed reinforcement shall be immediately coated with zinc rich (galvanising) paint. Where necessary to fill small, corner, or angular sections, duct slabs shall be cut to fit.

Each slab shall incorporate the manufacturer's clear mark / symbol that the slabs are reinforced. The Customer shall ensure that all slabs are tested and recorded in accordance with their Quality procedures to ensure the slabs are reinforced by: break test sampling check installed slabs with a cover meter to ensure the presence of reinforcement.

All pre-cast concrete slabs are to be accompanied by a slab lifter. The lifter shall include a VZ1 Kerb Stone Handle. The slab lifter shall be made available on site at taking over of the works.

Trenches within 5 m of oil containing equipment in bunds shall be connected, as a per Customers Design, to a proprietary CE approved interceptor conforming to EN 858-1 and 2.

5.8 FIBRE OPTIC CABLE DUCTS

Where fibre optic links to remote stations are specified, the Customer shall design and install C2 jointing chambers (refer to drawing OFD-SSS-522-Standard C2 chamber and OFD-SSS-523 Standard – link box chamber) to join the incoming fibre to the OCC fibre network. The C2 chambers shall be precast concrete or cast in-situ (Refer to Appendix D) as per Customers Design and located as required at the bottom of the station end masts or adjacent to the cable sealing end structures.

For overhead line connections, the Customer shall provide a duct down the mast to the C2 chamber.

A dedicated sub duct is required between the C2 chamber and the control building. It should be noted that if the jointing / pull chamber is operating via a WAN (Wide Area Network) provider then the joint chamber used may need to be compliant with the WAN provider requirements. The bed, surround and backfill for telecommunication ducting shall be as specified for LV lighting and CCTV - refer to Section 5.7 and 5.12. Depths of trench and cover to be as per Customers Design.

5.9 STEELWORK

The specification for external structural steelwork included in Part 5 of the document (refer to OFS-SSS-419) includes all steelwork supporting external equipment, gantries, masts, lightning masts, lighting poles, etc. All external metalwork shall be hot dip galvanized to IS EN ISO 1461, refer to OFS-SSS-420.

It shall be noted that this part of the Specification is equally appropriate for internal steelwork such as OCC building frames, roofs and floors, ancillary steelwork, cable support systems, etc.

5.9.1 EXECUTION CLASS

All appropriate structural steelwork intended to both form part or to support part of the works, temporarily or otherwise, shall have an Execution Class 2 (EXC2) as given by IS EN 1090 and bear a CE mark. The following documents shall be obtained by the Customer in advance of any steelworks and be included as part of their Quality systems. :

- Factory Production Control (FPC) Certificate, appropriate for the Works, originating from a Notified Body.
- Welding Certificate, appropriate for the Works, originating from a Notified Body.

- Declaration of Performance (DOP) Certificate as required by the European Construction Products Regulations 305/2011 (ECPR) . A performance shall be declared to meet all the requirements of this Specification and as set out in IS EN 1090 as a minimum.

5.9.2 MATERIALS

Except where noted as part of the Customers Design the grade of steel used shall be determined in accordance with the design standard IS EN 1993 or approved equivalent standard.

All steel in plate, section and bar forms shall comply with IS EN 10025 or similar approved standard.

Structural hollow sections shall be hot rolled in Grade S355J0H to IS EN 10210 and as per the Customer's Design. Welded cold formed structural hollow sections shall not be substituted for hot rolled sections.

Cold formed sections (i.e. Cladding Rails and Purlins etc.) shall comply with IS EN 10219.

Identifying marks for the different grades of steel shall be provided in accordance with IS EN 10025.

Except in the case of special plate with through thickness properties guaranteed by the manufacturer, all plates and sections 40 mm or over in thickness shall be ultrasonically tested for laminations and shall meet the requirements of Class S1 of IS EN 10160. The Customer's Design may specify that other plates be ultrasonically tested and, unless otherwise specified, they shall meet the requirements of Class S1 of IS EN 10160.

Dimensional tolerances of:

- i) Hot rolled sections shall comply with IS EN 10365, IS EN 10210-2, IS EN 10056-1 and IS EN 10034
- ii) Cold formed section shall comply with IS EN 10162
- iii) Plates and flats shall comply with IS EN 10029 / IS EN 10051

Electrodes for metal arc welding shall comply with the requirements of IS EN ISO 2560. Ordinary bolts and nuts shall comply with BS 3692 and BS 4190.

Unless otherwise agreed, ordinary bolts and nuts shall generally be Grade 8.8. Pre-loaded bolts, nuts and washers shall comply with IS EN 14399. Design and associated detailing for fatigue, where relevant, shall be in accordance with IS EN 1993-1-9.

5.9.3 CERTIFICATION

Two copies of the manufacturer's test certificate and mill certification verifying that the materials comply with the relevant European Standards or approved equivalent standards. These shall form part of the Customers Quality documentation which will form part of the handover documents that shall be submitted to EirGrid in relation to all structural steel, bolting materials and welding consumables.

5.9.4 DRAWINGS

For all structural steelwork the Customer shall design and prepare the necessary general arrangement drawings and shop drawings for fabrication and shall be fully responsible for checking the accuracy of these drawings. Drawings shall be in accordance with IS EN ISO 4157.

The Customer shall ensure the following forms part of the as- built drawings (refer to Section 4.9.2) hard copy and a digital copies in Dwg and Pdf format of 'As Erected Drawings' comprising:

- General arrangement drawings
- Fabrication drawings
- Connection calculation or references to standard connection (to include baseplates)
- Drawings made after fabrication showing revisions

The fabrication drawing register.

5.9.5 INSPECTION

The Customer shall inspect the steel fabrication works to ensure specified standards are being met. As part of the Customers Quality documentation, detailed records of such inspections shall be recorded and shall be made available to EirGrid as part of the handover documentation. EirGrid also reserves the right to inspect the fabrication works before and / or during fabrication and should be given every cooperation during these visits.

5.9.6 FABRICATION

The fabrication and workmanship shall be to the best modern practices and shall comply with the requirements of IS EN 1090 EXC2 or similar approved. Only CE marked fabricators shall be engaged for the work.

Drainage holes shall be provided in members where water could collect during and after erection.

To facilitate grouting, holes shall be provided in stanchion bases for the escape of air.

To facilitate connection of the steelwork to the earth grid, suitable cleats are to be incorporated during fabrication and before any protective coatings and the face of cleat, to connect to earth, to be protected from painting

Where notches are necessary, they shall have smooth radiused internal corners, produced by drilling holes not less than 20 mm diameter before cutting the rest of the notch or by carefully controlled flame cutting.

5.9.7 HOLES

Holing shall be in accordance with IS EN 1090 or equivalent approved standard. Holes for pre-loaded bolts shall be in accordance with IS EN 1993-1-8 or equivalent approved standard.

5.9.8 WELDING

Welding shall be a metal arc process in accordance with IS EN 1011-1, and the guidance given in IS EN 1011-2 as appropriate, together with other clauses contained in this section.

The Customer's QC/QA system for the management of welding shall meet the standard quality requirements described in IS EN ISO 3834-3.

All welding Quality documentation (welding procedures [WPS], welding procedure qualification records [WPQR], welding procedure qualifications and associated work instructions) shall be audited and reviewed by the Customer's person responsible for welding coordination.

The Customer shall ensure that constituent product materials to be welded are compatible with the welding procedure being used. Joints shall be prepared in accordance with IS EN ISO 9692-1 and -2. Precautions shall be taken to ensure cleanliness of the connection prior to welding.

The Customer shall ensure that welding operators are tested to meet the requirements of IS EN ISO 9606-1 and IS EN ISO 14732, as appropriate.

The Customer as part of their Quality systems shall produce welding procedures that comply with IS EN ISO 15609-1. All welding shall be carried out in accordance with these approved procedures.

The Customer shall ensure that all welding is carried out under the supervision of a competent and experienced welding supervisor. The Customer shall keep records as part of the Quality procedures to ensure all main welds, in particular butt welds, to be identified with the welder responsible for production.

5.9.9 TESTING OF WELDS

Ongoing control of welding quality shall be maintained by routine testing. Routine testing includes 100% visual inspection and a supplementary programme of non-destructive testing (NDT) which shall be undertaken by the Customer to ensure that the welding processes and welders / welding operators are producing work of a quality that is consistent with Execution Class 2. The benchmark for the quality of work required for Execution Class 2 is generally quality level C to IS EN ISO 5817. The supplementary programme of NDT shall be in accordance with IS EN ISO 17635.

The Customer shall undertake a 100% visual inspection before welding, during welding and on completion as part of the Customer's Quality procedures. All welds are to be visually inspected in accordance with IS EN ISO 17637 over the full length of the weld and before NDT inspection is performed.

Non-Destructive Testing [NDT] shall be carried out in accordance with the guidelines in IS EN ISO 17635. The Customer shall ensure that NDT is carried out by a competent person who shall be certified by an authorised qualifying body in accordance with IS EN ISO 9712.

If examination of a weld surface is required, magnetic particle testing shall be used in accordance with the recommendations given in IS EN ISO 17638 and this shall be preceded by visual inspection undertaken by the Customer. If magnetic particle testing is impractical, penetrant testing may be used in accordance with the recommendations given in IS EN ISO 3452-1. Operators carrying out final surface flaw detection of the weld shall hold a current certificate of competence to Level 2 according to IS EN ISO 9712 in surface flaw detection of the relevant types of work, from a recognised authority.

If ultrasonic testing is required, it shall be carried out accordance with IS EN ISO 17640, IS EN ISO 11666 using reference level to technique 1, evaluation reference level -14dB and testing level B unless determined otherwise by the Customer's Design.

5.9.10BOLTING

The use of bolts, including permissible stresses, size and pitch of bolts shall comply with the requirements of IS EN 1993, IS EN 14399 Series and IS EN 1090 .

The combination of bolts and nuts (and washer if used) which may be used shall be to the requirements of IS EN 15048.

Fasteners shall have CE marking for loadability as specified in IS EN 15048-2.

Unless otherwise agreed, bolts shall be provided with a washer under the nut. A suitable plate or heavy-duty washer shall be used under the head and/or nut against plies that have oversize or slotted holes. Plate washers shall not be thinner than 4 mm.

If the bolt head or nut is in contact with a surface which is inclined at more than 2 degrees from a plane at right angles to the bolt axis a taper washer shall be placed to achieve satisfactory bearing.

Nut blanks shall be tapped after being galvanised. Galvanising and re-tapping of nuts is not permitted.

Bolts may be assembled using power tools or shall be fully tightened by hand using appropriate spanners in accordance with BS 2583.

Counter nuts or spring washers to be used on connections subjected to a dynamic or quasi-dynamic loading.

5.9.11CRANE RUNWAY BEAM

Crane rail erection tolerances and Connections of runway beams shall comply with IS EN 1993-6

Runway beams shall be tested in accordance with IS EN 1993-6 or BS 2853 . - notice shall be given by the Customer to all other relevant bodies, including the Health & Safety Executive/Insurance Representatives, prior to testing.

The marking of safe working loads on runway beams shall comply with IS EN 1993-6 or BS 2853.

Robust stop-ends, of minimum height 150 mm, shall be positioned at each end of each runway beam.

5.9.12STEELWORK ERECTION

Steelwork erection shall be in accordance with IS EN 1090 . A detailed written risk assessment and method statement for each erection process shall be produced by the Customer prior to commencement of erection.

The Customer shall be responsible for the correct alignment and level of all steelwork and for the accurate plumbing of stanchions. The alignment, level and plumb of the steelwork shall be in accordance with the tolerances outlined in Part 6.15 of this Specification.

Methodology for the erection of Steelwork shall ensure members are securely bolted or otherwise connected together and provided with temporary bracing and/ or effectively anchored using steel guy ropes to resist the following:

all dead loads,

loads due to erection equipment and its operation

all lateral forces, including wind.

Temporary bracing and guy ropes shall be left in position and maintained for as long as is necessary to ensure the safety of the structure without undermining or unduly affecting the permanent or other temporary works.

Any damage to protective coating(s) shall be restored to comply with Customer Design protection requirements.

5.9.13 ANCILLARY STEELWORK

Stairs, ladders and walkways shall be designed and constructed in accordance with IS EN ISO 14122, Parts 1 to 4 and BS 4211 in conjunction with Part K, Stairways, Ladders, Ramps and Guards, of the Building Regulations.

Ancillary steelwork shall be hot dip galvanized to a minimum thickness of 610 grams per sq. metre to IS EN ISO 1461 before delivery.

Chequer plate shall be raised pattern, self-draining type, to IS EN 10025 Grade S275.

Handrailing shall generally consist of tubular steel standards and tubular steel railing cut and bevelled where necessary. Handrailing shall comply with the loading requirement for horizontal loads as set out in IS EN 1991-1. The tubing shall be in accordance with IS EN 10210-2 and IS EN 10025 Grade S 275JOH.

Open grid flooring shall be of mild steel to IS EN 10025 S275. The depth of open grid shall be as shown on the drawings. The pattern shall be square or rectangular and the maximum spacing of bars shall be 50 mm. The maximum area of each opening shall be 1500 sq. mm.

Panel sizes shall be restricted to maximum size of 1660 x 1000 mm. Panel shall be supplied with 4 No. clips. Each clip shall be drilled to suit an 8 mm diameter stud. The clip shall be designed to fasten over the top of one load bearing bar.

Stair treads shall in general be either 800 mm or 500 mm long. Stair treads shall have a steel slip resistant front edge. Spun galvanized bolts, nuts, and washers to IS EN ISO 1461 shall be supplied with the stair treads for fixing treads to stringers.

5.9.14 STRUCTURAL STEELWORK PROTECTIVE COATINGS

All internal steelwork shall be treated and protected in accordance with Customers Design and as referred to in section 6.6 of this Specification.

Fire protection coatings shall be as specified by the Customers Design. Structural steel members for all buildings in the OCC shall be treated with intumescent paint coating to provide a 60 minute fire resistance (or higher if required by the Fire Safety Certificate) in accordance with TGD -Part B (Refer to section 4.5 of this Specification. These coatings shall be shop applied.

Customer shall ensure that at the time of coating the surface cleanliness of the steelwork shall be coated in accordance with IS EN 8501-1. All surfaces to be coated shall be free of scale, rust, grease, oil, dust, and other deleterious materials.

Steelwork shall be blast cleaned to remove all mill scale and other contamination to IS EN ISO 8501-3 and BS 7079. The surface finish shall be to standard preparation grade Sa 2½ in accordance with IS EN ISO 8501-1 and IS EN ISO 12944-4. Abrasive used during blast cleaning shall be selected in accordance with IS EN ISO 11124 and IS EN ISO 8501-3 and BS 7079. Sand blasting shall not be used.

Under no circumstances shall the friction contact surfaces be painted, greased etc. Friction contact surfaces shall have an approved robust masking material securely applied before the application of any priming, painting coats to the surrounding steelwork.

In the following locations the steelwork shall be unpainted:

- Steelwork to be encased in concrete and other surfaces in contact with concrete
- Crane rails

Any contamination of the treated steelwork surface shall be removed, using an approved solvent solution, before further protective coatings are applied. The finishing coats to all structural steel shall be a colour as specified by the Customer's Design, in accordance with BS 381C and BS 4800.

Where fire protection coatings are required to indoor steelwork members, associated bolts shall also be treated with intumescent paint to provide the appropriate fire resistance. The application of these coatings will be undertaken in situ.

All external steelwork unless otherwise specified by the Customers Design , including externally exposed holding down bolts and internal steelwork below ground floor level shall be hot dipped galvanised (Refer to Section 6.6) .

All external steelwork including doors and louvers and internal secondary steelwork such as platforms, stairs, ladders, handrails, chequer plates and open grid flooring which shall be appropriately galvanised to the site corrosion rate and design life of structure. Refer to EirGrid Functional specification OFS-SSS-419, 'Galvanised Fabricated Steelwork'.

All galvanising shall be carried out by the hot dip process and shall conform with IS EN ISO 1461 or equivalent approved standard (Refer to OFS - SSS – 42 'Hot Dip Galvanising of Iron and Steel Other Than Wire').

Customer's design of steel members shall be in accordance with IS EN ISO 14713-2. Adequate provision for filling, venting and draining shall be made for assemblies fabricated from hollow sections. Bolts, nuts and washers shall be hot dip galvanised, and subsequently centrifuged (spun galvanised) in accordance with BS 7371-6.

5.10 ACCESS ROADS, FOOTWAYS AND HARDSTANDING'S.

The access road to the OCC site shall be geometrically designed by the Customer in both the vertical and horizontal alignments based on Table 1.3 of the TII Rural Road Link Design DN-GEO-03031. This is to ensure that all vehicles intended to travel along it can be safely accommodated. Turning areas and adequate parking and footways should be integrated into the design for the OCC that meets the needs of all road users whilst being compatible with TGD -part M and the approved Planning Approvals

Where the access road crosses ditches, streams or creeks, a permanent bridge structure shall be structurally designed by the Customer to withstand proposed loading of vehicles along the access road. As per Customer's Design Entrance access to the OCC shall be provided by a double gates (5m wide) which shall open inwards. The Design shall cater for additional gates within specific areas of the OCC to secure and allow for maintenance access to relevant buildings, electrical plant and equipment. Access road(s) within the OCC shall be provided by means of a 4.5 m wide road constructed using reinforced concrete, bituminous or a combined concrete / bituminous access road pending ground conditions and geotechnical study. The road layout, turning, parking and footways shall be validated by the Customer's site layout drawings. Refer to Drawing OFD - SSS – 501 and 503 – which may be used as a basis for the OCC general arrangement Layout.

Where a transformer is required in the station the road shall be designed to take the load of the transformer transporter fully laden with the transformer.

Temporary haul and/ or permanent access roads (includes hardstanding's) shall be suitably designed to cater for road width and loading that is required for transporting the type of transformers and other large structures, electrical plant and equipment required to be installed at the OCC. Working platforms shall be provided at all offloading points to access points at buildings, structures and concrete bases within the OCC.

Customer's Pavement design shall be on the GIS report to establish sub grade and as per TII Pavement & Foundation Design DN-PAV-03021. Road Pavements, hardstanding's and footways materials to be used in their construction shall be in accordance with the relevant Series of the TII specification, using the following materials: -

5.10.1 SUBBASE

Subbase unbound materials for subbase layers shall be in accordance with clauses and tables within the TII 800 Series as follows:-

- Granular material Type B as per Clause 804 with crushed rock, other than argillaceous rock. The material shall be well graded and lie within the grading limits of Table 8/2 & 8/6. The liquid limit, moisture content, Los Angeles Coefficient, and Flakiness Index, shall be in accordance with Clause 804.
- All unbound mixtures deposited within 500 mm of cement bound materials, concrete pavements, concrete structures or concrete products shall comply with testing requirements for Clause 808 and 809.
- The use of all recycled aggregate shall be approved by the Customer in advance of any works. All recycled aggregate shall conform to Clause 801.3, 803 and 807 of the TII 800 Series
- Geotextiles
- All geotextiles shall be as per Section 5.1.3 and in accordance with EN 13249 with durability testing in accordance with EN ISO 13249 and EN ISO 12224

5.10.1.1 TESTING UNBOUND AGGREGATE

- Granular Material Type B Grading shall be in accordance with Clause 804 and Table 8/6 of TII Series 800 specification. A sample for Grading particle size distribution and test Los Angeles Coefficient as specified in IS EN 1097-2:2020 Cl 5 shall be submitted to the Customer prior to delivery of Type B Granular material on site with a minimum of one and/or one for each subsequent 200

tonne of material delivered to site. (Note - Refer to section 5.1.2 for restrictions on Sulphur content regarding the prevention of pyrite induced expansion)

- Testing for laying Subbase shall be in Type B as per Clause 804 -Table 8/6 ,808 and 809 of the TII Series 800. The vertical strength and stress loading for the compacted and consolidated subbase shall be undertaken using CBR and Plate load testing methods. The Frequency of the sub-base testing shall be a minimum of one or one per 30 m, subject to the length of road to be tested.

All testing, results shall be recorded in accordance with the Customers Quality documentation

5.10.2 CONCRETE PAVEMENTS

Concrete Pavements functional requirements shall comply with IS EN 13877-2 and 3 and the relevant clauses and tables of the TII 1000 Series and the following criteria:-

- Pavement concrete shall be Class C32/40, exposure class XF4. Finishes to pavement as per Table 3 - Concrete Finishes Schedule
- A separation membrane shall be used between all concrete slabs and the sub-base. The membrane shall be impermeable plastic sheeting, 125 microns thick laid flat without creases, with minimum 300 mm laps.
- Road slab reinforcement shall be C503 long mesh fabric in accordance with BS 4483. The 8 mm bars at 100 mm centres in the fabric shall be placed parallel with the longitudinal direction of the slab. Laps in longitudinal direction shall be 450 mm minimum. Laps in transverse direction shall be a minimum of 300 mm.
- Transverse joints comprising of contraction or expansion joints shall be provided at the following spacings:
 - Contraction joints maximum 14m centre's
 - Expansion joints maximum 42 m centres.
- Contraction joints shall comprise of the following-
 - A sawn groove joint 10 mm wide at least one-quarter the slab depth
 - Dowel bars shall be 20 mm diameter at 300 mm spacing conforming to IS EN 10060 and IS EN 13877-3 with a minimum tensile strength of 250 MPa
 - A sealing groove (seals shall be hot applied sealants Type N1 or Type F1 complying with IS EN 14188-1 and applied in accordance with BS 2499-2)
- Expansion joints shall consist of the following:
 - A joint filler board 25 mm thick self-expanding cork seal or from another approved compressible material.
 - Dowel bars in an approved sheath shall be 25 mm diameter at 300 mm spacing conforming to IS EN 10060 and IS EN 13877-3 with a minimum tensile strength of 250 MPa
 - A sealing groove (as above)

5.10.2.1 TESTING CONCRETE FOR PAVEMENTS

Rates for Sampling and Testing Concrete for Pavement and footway Layers shall be as a minimum as per Table 10/9 of the TII 1000 Series . Concrete cores of 150mm diameter shall be taken from the agreed trial areas, cured and tested in accordance with BS EN

12504-1 with the exception that the core shall be cured under water at $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ from as soon as practically possible. A minimum of 6 cubes and 4 cores taken and at a minimum of 3 locations shall be taken from the trial areas (as defined by the Customer) . For each set of 4 cores, two shall be tested at 7 days and two at 28 days. Workability Slump testing shall be minimum 1 per production day.

All testing and results shall be recorded in accordance with the Customers Quality documentation.

5.10.3 BITUMINOUS PAVEMENTS

Bituminous pavements as per Customer's Design shall be in accordance with TII 900 Series and the relevant sub- sections in relation to the use of bituminous materials for the pavement layer design constructed using:

- Dense Base and Binder Courses with Asphalt Concrete in accordance with Section 3.
- Surface courses options shall be-
 - Close Graded Asphalt Concrete Surface Course in accordance with Section 3
 - Hot Rolled Asphalt (HRA) Surface Course in accordance with Clause 910 with Coated chippings in accordance with Section 4
 - Stone Mastic Asphalt (SMA) Regulating Course in accordance with Clause 942 Section 5
- Surface dressing if required shall be as Section 7 in accordance with Clause 919* and the recommendations of the Institute of Asphalt Technology (IAT) – 'Guidelines for Surface Dressing in Ireland' current revision.
- Tolerances for horizontal Alignments, surface levels and surface regularity of pavement Courses shall be in accordance with TII 700 Series, Clause 702 (refer to 6.15.4) of this Specification.
- Bitumen and bituminous binders for polymer modified bitumen's shall comply with IS EN 14023

5.10.3.1 TESTING BITUMINOUS MATERIALS

Bituminous Materials used for Road Pavements -The testing of bituminous bound materials shall be in accordance with TII series 900. The Customers Quality procedures shall ensure that test certificate has a CE Mark for each bituminous mixture used. Minimum Frequency of testing shall be 1 per source. Aggregates for resistance to polishing (PSV) used for Surface courses shall be 1 per source in accordance with IS EN 12697-49. Coated chippings for application to Hot Rolled Asphalt Surfacing's shall be tested 1 per source and conform to IS EN 13108-4 Annex C, this Clause, Table 4 and Table 5.

5.10.4 ROAD DRAINAGE

Road drainage shall comply to TII 500 Series and relevant Clauses

- Pipes for drainage shall comply to Clause 501,504,518 ,with bedding and surround complying to Clause 503 requirements.

- Geotextiles and membranes shall comply with Clause 519
- Chambers for Drains to be in accordance with Clause 507 with Gullies and Pipe Junctions to conform to Clause 509.
- Sustainable drainages may be considered as per Customers Design and subject to Local Authority agencies and Planning Approvals. Attenuation systems, pollution control and Soakaway's systems if deemed necessary and shall be based on the requirements of Clauses 520,521 and 522, complying with CIRIA C697 , BRE Digest 365 and the TII 'Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control DN-DNG-03066.

5.10.4.1 TESTING DRAINAGE

Testing of Drainage shall comply with the following requirements for testing and Cleaning of drainage pipes and ducts with reference to Tables 5/10 and 5/11 for structured wall pipes and fittings. Bedding, Backfill and Surround Material (Refer to 0) shall be installed in accordance with the pipe and bedding combinations given in NRA HD140. Other combinations shall be supported by design calculations in accordance with IS EN 1295-1. Bedding backfill and surround materials are further classified in Clause 503 and Clause 505. Chambers shall comply with Clause 507 with Gullies and pipe junctions complying with Clause 508

5.10.5 FOOTWAYS AND KERBING

Footways and Kerbing shall be in accordance with TII 1100 Series –

- Sub bases for Bituminous and Concrete footways shall be formed pending sub grade ground conditions, using a minimum sub-base of 100 mm thickness of granular material complying with Clause 803 or 804, laid and compacted in compliance the TII 800 Series.
- Bituminous and Concrete Footways shall be in accordance with the TII 1100 Series with flexible bituminous surfacing for footways complying with Clause 1105 and laid using 10 mm size open graded asphalt concrete surface course made and laid in compliance with the 900 Series.
- In -situ concrete footways shall comply with Clause 1106 with in situ concrete for footways to have expansion joints at not less than 3m transverse centres using Class C32/40 concrete, with exposure class XF4 in IS EN 206-1. Finishes to concrete footway shall be as per Table 3- Concrete Finishes Schedule
- Precast concrete kerbs, channels, edgings and quadrants shall be in accordance with Clause 1101 and conform to IS EN 1340. They shall be laid and bedded in accordance with BS 7533-6 on a mortar bed. In Situ Concrete Kerbs, Channels and Edge Details shall comply with Clause 110 and comply with the recommendations of BS 7533-101:2021.
- Testing for footway materials refer to Sections 5.10.2 and 5.10.3

5.10.6 ROAD MARKINGS AND SIGNAGE

Road Markings and Signage

- Traffic Signs and Road Markings shall conform to the TII 1200 Series

- Permanent traffic signs shall consist of the sign face, sign substrate, stiffeners, brackets, posts and foundations. Sign systems shall be manufactured in accordance with IS EN 12899. Performance classes specified in IS EN 12899-1 and included in Table 12/1. All road Signage shall confirm to Traffic Signs Manuals.
- Permanent road marking materials shall be one of the following types:
 - Reflective thermoplastic road marking material conforming to the requirements of I.S.EN 1871 Road Marking Materials Physical Properties shall meet the requirements of the relevant classes of I.S. EN 1436 Performance for Road Users.
 - Preformed road markings in accordance with I.S. EN 1790.
- Note- Premix and drop-on glass beads shall conform to the requirements of I.S. EN 1424 and I.S. EN 1423 respectively
- Performance Requirements for road markings shall comply with Table 6 of I.S. EN 1436.
- Road markings shall not be laid when the road temperature is below 5°C.
- For other related signage refer to Drawing 'OFD-SSS-511-STANDARD SIGNAGE FOR EIRGRID STATIONS'

5.10.7 LANDSCAPING

Landscaping – planting and other ground works / boundaries as required for the OCC and associated lands to be undertaken in accordance with agreement of landowners, local council and as stipulated in relevant planning approval conditions.

5.10.8 RAMPS ACCESS

Ramps shall be structural concrete ground slab not steeper than 1:20 (Note if ramps pass over footpaths, then that section of the ramp shall not exceed 1:40) with mesh fabric reinforcement with a minimum top cover of 50 mm. Finish shall be Class U4 brushed finish. This is textured finish with average depth of 1 mm.

5.10.9 VEHICLE BARRIERS

Approved barriers level of containment shall be installed to protect electrical equipment from vehicular traffic based on design risk assessment e.g. exposed cable sealing ends. pedestrian movement, topography of the OCC. Barriers, if deemed necessary shall meet the requirements of TII Series 400, NRA BD 52 and DN-REQ-03034 complying with IS EN 1317-1,2,4,5.

5.11 ACCESS FROM PUBLIC ROADS

The access road to site from the main road shall be a minimum of 4.5 m wide, compacted stone road with concrete or bituminous pavement constructed as described above in Section 5.10. The geometry and sightline requirements of the junction of the access road with the National public road shall comply with TII Geometric Design of Junctions -DN-GEO-03060 and to Local Authority requirements.

Where the access road crosses ditches and streams or creeks, a permanent bridge structure designed by the Customer to safely take all loading shall be provided based on the

frequency and type suitable for the construction vehicles and electrical plant and equipment transporting vehicles required for the OCC. The geometry of the access road shall accommodate the safe passing and turning movements for all vehicle types intended to travel along it.

The public road shall be restored to its original specifications upon completion of the project in accordance with 'Guidelines for Managing Openings in Public Roads' (Department of Transport , Tourism and Sport – 2017 2nd Edition) reinstatement requirements and meeting Local Council Requirements.

5.12 OPERATIONAL LIGHTING AND CCTV

Lighting shall be provided for in the OCC compound to facilitate operations during night-time as per relevant EirGrid specification OFS-SSS-418. The Customer's design of this lighting system shall be submitted to EirGrid for review.. Provision for and LV Lighting and CCTV ducting, inspection chambers , bedding , surround of ducts and trench backfill (refer to 0) shall be in accordance with TII 500 Series Clause 503 and 524.

5.13 EARTHING SYSTEM

The Customer Design of the earth grid shall function in accordance with the latest version of the EirGrid Earthing and Lightning Protection' document reference OFS-SSS-407 for further details. The earthing design of the OCC building, structures and associated civil works shall be submitted to EirGrid for review prior to construction commencement. OFD-SSS-513 "General Arrangement Earthing Practice" indicates standard arrangements for integration of internal OCC plant, equipment and building elements with the external buried station earthing system including the following drawings :

- Earthing Practice Installation Details
- Control Building Earthing (AIS Substation).
- GIS Room Earthing.
- GIS High Frequency Mesh/ Rebar.
- GIS Floor Rebar Earthing Detail.
- Earth Tail entering raised floor
- Earth Tail entering cable pit.
- Earth Tail entering ground floor level.
- Structural Steel Earthing.

The above drawings represent minimum functional earthing requirements and should be verified for their suitability by the Customer's Design on a case-by-case basis. Other References to earthing systems refer to Appendix G and Drawings 'OFD-SSS-512 EARTHING OF CONTROL CABINETS' and 'OFD-SSS-513 GENERAL ARRANGEMENT. EARTHING PRACTICE'

5.14 TRANSFORMER AND EQUIPMENT BUNDS

Transformers shall be sited with clearances to building and other transformers in accordance with IEC 61936-1.

Transformer bunds, tanks and other equipment containing oil shall be designed as waterproof structures to IS EN 1992-3 and shall be tested in accordance with EirGrid bund testing requirements. Joints, if required, shall incorporate PVC water bars. Swellable / Hydrophilic water bars shall not be used.

The following shall be used in calculations for bund sizing:

- Minimum void ratio of 30% in stoned area
- 110% capacity of oil volume
- 200 mm freeboard

As per Customers Design bund slabs shall incorporate a fall to a suitably designed sized sump for drainage using an acceptable oil sensitive fixed pump. . The effluent from the bund shall be routed through a suitably sized Class 1 compliant (EN 858-1+2) full retention oil interceptor before joining the surface water drainage.

If bunds do not incorporate an above ground wall, then another acceptable physical barrier preventing possible vehicular contact with a transformer shall be incorporated in the permanent site works.

A design risk assessment shall be carried out considering access into the transformer bund.

IEC 61936-1 guidance shall be followed regarding clearance from other transformers and non-combustible building surfaces. Otherwise fire-resisting separating walls shall be used.

All cables to pass over bund walls as opposed to through the bund walls. The bunds shall be filled with 50 mm single sized crushed limestone up to 50 mm below the level of the transformer plinth. Assume a void ratio of 30% for this stone.

EirGrid is open to permitting the use of proprietary products, such as Fire Protecting Grating, which could be used as alternatives to the single size stone in equipment bunds provided that the Customer demonstrates that their proposal is at least equal in performance in regard to fire resistance and storage volume.

Access shall be provided into the transformer bunds by means of steel or GRP stairs manufactured in accordance with this Specification.

Concrete Finishes shall be as described in Table 3 Concrete Finishes Schedule.

The permissible tolerances in finished surfaces shall not exceed the limits.

The Bund Test Report shall be completed by the Customer.

5.15 LINE BAY GANTRIES & FOUNDATIONS

5.15.1 DESIGN

The Customer shall design the line bay gantries and their Concrete foundations in accordance with IS EN 1990, 1991, 1992, 1993, 1997, 1999 Eurocodes, various parts and dates and Irish National Annexes

5.15.2 GANTRY LOADING

The Customer design shall use the specified load combinations for the design of gantries. Any physical loading due to the electrical or mechanical operation of the gantry shall also be included in the Customers design calculations.

6 OCC BUILDING WORKS

This section covers requirements for all building works at OCC, including STATCOM, Control and other buildings.

6.1 FOUNDATIONS WORKS

The building foundations shall be designed to take all the dead and imposed loadings into account.

A land drain shall be constructed around the building at the level of the cable pit floor slab.

Below ground walls shall be designed for a head of water of three quarters of the full depth below ground subject to a minimum of 1 m in accordance with BS 8102.

A suitably sized pump sump and fixed pump shall be supplied in cable pits. Pumps shall comply with the requirements this Specification.

Regardless of the exposure class used in design a minimum cover of 50 mm is to be provided for all buried mass concrete. Calculation for reinforced concrete foundations nominal concrete cover for reinforcement steel shall be in accordance with EN 1992-1-1:2004+AC2:2010 Section 4.4 and in accordance with the Customers design. Cover shall be achieved by using spacers and chairs which meet the performance requirements of BS 7973-1

6.2 ARCHITECTURAL WORKS

The buildings shall be of concrete frame, steel frame or of masonry construction.

All block / brick internal walls are to be fair face block / brick and of natural colour. Where waterproof exterior renders are used, they shall be self-coloured.

A minimum clear height from the floor finish of 3 m is required to the underside of any beam or ceiling in the control room unless agreed with EirGrid.

The control room shall be accessed via an internal lobby area.

The minimum heights of doors are as described in section 6.4.12 of this specification.

The battery room door shall open outwards and shall be lockable. A cable entrance below ground from the OCC, into the control room shall be provided. It shall be possible to seal off this entrance once the control cables have been installed.

Sufficient openings shall be provided for control cables between the battery and control rooms.

Where a standby generator is supplied, an opening between the control room and the generator shall be provided.

An appropriate agreed lockable storage facility shall be provided outside the control room for storage of SF6 gas unless otherwise specified.

The battery room shall accommodate all the station batteries as well as the free supply telecommunication battery.

The workshop shall contain a workbench and accommodate the storage facilities for the portable maintenance earths and tools for the OCC.

6.3 RAMP REQUIREMENTS

A ramped concrete apron, to act as gradual gradient up to the building shall be provided at locations where vehicular access is required, such as the external delivery areas. The apron shall be constructed at a gradient that is not steeper than 1:20, falling away from the building. The apron shall extend a minimum of 3 meters away from the building.

All thresholds to and within buildings to be step/obstruction free where it is necessary to use trolleys for deliveries.

Where a ramp concrete apron, with an incorporated perimeter footpath to the building is required, the gradient of the ramp shall commence at the footpaths kerb line and not at the threshold to building access points. The construction of the concrete apron and footpath shall be such that water flows away from the building. Cross fall of the footways shall fall away from the buildings in the OCC and should normally be constructed at a fall of 1:40 but not steeper than 1:20.

Doors shall not swing across the sloping part of any ramp.

Finishes to ramps and footways shall be constructed in accordance with Section 5.11 Concrete pavements with finishes as defined in TABLE 3 -Concrete Finishes Schedule.

6.4 SUPERSTRUCTURE WORKS TO INCLUDE WALL, MASONRY AND DOORS

6.4.1 WALLS AND MASONRY

The walls in the WC shall be skimmed plaster finish painted in washable 'fleck' paint or other approved heavy duty easy clean treatment. Selected 150 mm x 150 mm matt white wall tiles shall be provided on adhesive to splashback.

All face brick shall comply with the requirements of IS EN-1996-1-1, IS EN1996-2 for facing quality bricks. Units shall be laid in full bed mortar where appropriate. All joints shall be filled and compacted, and a joint thickness of 10 mm shall be maintained.

Fair faced walls to have struck joints.

The following two documents shall be submitted for the Customers approval and added to their Quality documentation prior to commencement of procurement of the relevant masonry product:

- Factory Production Control (FPC) Certificate, appropriate for the works, originating from a Notified Body.
- Declaration of Performance (DOP) Certificate in conformance with the standard form in Annex III of the CPR. A performance shall be declared to meet all the

requirements of this specification and as set out in the relevant harmonised European Normative.

Mortar strength class to be M6. Mortar shall be pigmented to match the masonry colour. Mortar for jointing shall be cement mortar in the proportions 1:½:4 to 4½ by volume of cement to lime to sand unless otherwise specified. An M6 cement sand mortar may be used with a plasticizer in accordance with the plasticizer manufacturer's instructions.

6.4.2 MATERIALS – MASONRY UNITS

Blockwork masonry structures should be designed in accordance with– SR 325:2013 (+A2:2018). Recommendations for the design of masonry structures in Ireland to Eurocode 6 (EN1996).

Masonry units should be selected from the types listed below and should conform to the appropriate clause in the relevant Standards:

- clay masonry units to IS EN 771-1
- calcium silicate masonry units to IS EN 771-2
- aggregate concrete masonry units to IS EN 771-3
- autoclaved aerated concrete masonry units to IS EN 771-4
- manufactured stone masonry units to IS EN 771-5
- natural stone masonry units to IS EN 771-6
- Clay bricks of special shapes and sizes to BS 4729

Masonry units shall be from a manufacturer whose products shall be examined and approved by the Customer's before work commences.

Masonry units shall be manufactured on a static block making machine using cement certified to IS EN 197-1 as appropriate together with aggregate conforming to the quality requirements of IS EN 771-3, IS EN 12620 and S.R. 16:2016 (i.e. Guidance on the Use of IS EN 12620). Pigments shall conform to IS EN 12878. All units shall incorporate an efflorescence inhibitor. The blocks shall be cured in purpose-built chambers.

Lime shall be in accordance with IS EN 459-1.

Sand shall be clean sharp river or pit sand, well graded and entirely free from loam, clay, dust or organic matter to the requirements of IS EN 13139 and S.R. 18:2021 Guidance on the use of IS EN 13139:2002.

Water shall be in accordance with IS EN 1008.

Plasticisers shall be in accordance with IS EN 934-3 and shall be free from calcium chloride or similar salts.

Cement Type CEM 1 shall be in accordance with IS EN 197-1.

Mortar shall be accurately gauged and thoroughly mixed, using the minimum amount of water required for workability. It shall be made in small quantities only. All mortar shall be used within half an hour of the addition of water to the dry mix and any mortar which has begun to set. All mortars shall be to IS EN 1996.

All internal walls shall be finished to the full height of the underside of the roof structure, with all the necessary independently certified fire penetration seals (in accordance with the fire

certification provisions) incorporated. All service penetrations shall also be appropriately sealed. Allowance shall be made for trims, closures, standard door apertures, including lintels, beams etc.

All internal walls shall be constructed from suitable thickness, fair faced concrete blockwork incorporating appropriate expansion joints. Fair faced walls shall have struck joints.

External Walls shall be cavity masonry construction, insulated to meet the requirements of the TGD Part L, Conservation of Fuel and Energy – Buildings other than Dwellings.

Fair faced block walls, except in the WC, shall be finished with a Polybond seal coat applied to the manufacturer's instructions. Two coats shall be applied.

6.4.3 BRICKWORK

A 3 m x 1.2 m panel of brickwork incorporating an expansion joint and a return shall be constructed in advance of the main brickwork construction and approved by the Customer.

All possible measures shall be taken to prevent efflorescence in the brickwork including but not limited to laying the bricks dry, ventilating and keeping water out of the cavities.

If efflorescence appears on brickwork, it should be removed by brushing off with a stiff dry bristle brush after the wall has dried out. The surface should then be cleaned with a dry synthetic chamois or high suction sponge using very little water and rinsing the sponge frequently in fresh water. Chemical methods should not be used for removal.

6.4.4 BLOCKWORK / ARCHITECTURAL MASONRY

Blocks shall have a mean compressive strength of 7.5 N/mm² in accordance with the Technical Guidance Document - Part A.

A 3 m x 1.2 m panel of blockwork shall be constructed for each type of blockwork utilised for the project in advance of the main blockwork construction and approved by the Customer.

When blockwork is complete it shall be signed off by the Customer.

Collar bonded walls are not permitted unless specified by EirGrid.

Architectural masonry walls shall be constructed using Forticrete Masonry Blocks manufactured and supplied under an IS EN ISO 9001 registered quality system.

Where specified in the planning conditions, a 2 m x 2 m panel of architectural masonry shall be constructed in advance of the main brickwork construction and approved by the Customer.

Stone facing shall be constructed in uncoursed squared specked rubble carefully laid in mortar with no stone more than 150 mm deep backed with concrete blocks. All stones shall be well treated and bonded with all internal joints well filled. In laying out the joints care shall be taken so that not more than four side faces form any continuous vertical face joint.

Joints generally shall be 10 mm thick. Joints on external walls which are to be pointed. Joints on all other walls which are to be plastered or tiled shall be raked out 20 mm deep as the work proceeds.

Brickwork, blockwork or stone masonry shall not be carried out during frost or when the air temperature in the shade is below 3°C, unless special precautions are taken which are approved by the Customer.

All materials associated with masonry reinforcement where required shall comply with the relevant clauses of IS EN 1996. Sealants shall comply with IS EN ISO 11600.

6.4.5 LAYING DAMP PROOF COURSES

Materials for damp proof courses shall be in accordance with BS8215 and BS 743 or other material as approved by the Customer.

Damp proof courses (DPC) shall be bedded on a 1:3 (cement: sand) mortar bed. The courses shall be laid in lengths if practicable. Laps in damp proof courses shall be 225 mm long and sealed with an approved bituminous water proofing compound.

6.4.6 WALL TIES

Wall ties shall be in accordance with IS EN 845-1.

Wall tie spacing for 100 mm cavity shall be 450 mm vertically and 750 mm horizontally.

Additional ties should be provided around openings at 225 mm centres vertically and within 150 mm of the opening.

All ties shall be embedded a minimum depth of 50 mm in the horizontal mortar joints at the tie the course is laid and should be a minimum of 100 mm from any edges or corners.

6.4.7 MOVEMENT JOINTS

Movement joints should be provided in general in accordance IS EN 1996 -2.

Movement joint fillers shall be built in as the work proceeds. The filler shall be accurately placed in the thickness of the wall or leaf and not less than 12 mm nor more than 20 mm from the face of the work unless otherwise shown on the drawings. The raking out of joint fillers will not be permitted.

Movement joint sealants shall be applied in accordance with the manufacturer's written instructions to clean, dry surfaces.

Movement joints should be provided in general in accordance with the following guidelines:

1. Fixed Clay Masonry:	12 m centers
2. Calcium Silicate Masonry	8 m centers
3. Concrete Masonry	6 m centers

Wall Ties shall be provided at all wall junctions with Steelwork and Concrete at 450 mm centres unless specified otherwise by the Customer.

6.4.8 CHASES AND HOLES

Chases and holes shall only be cut with a mechanical tool made for the purpose with the approval of the Customer and are subject to the following:

- When the masonry is less than 75 mm in thickness. Chases shall not be used.
- Where the masonry construction is of solid units in single leaf or cavity walls horizontal or raking chases shall not exceed $\frac{1}{6}$ of the thickness of the construction and vertical chases shall not exceed $\frac{1}{3}$ of the thickness of the construction.
- Where the masonry construction is to be penetrated by services, the holes for such services shall not exceed 300 mm x 300 mm without further consideration by the Customer.
- Vertical chases on opposite sides of a wall shall be offset relative to one another by a clear distance equal to the wall thickness.

6.4.9 LINTELS

Lintels should comply with IS EN 845-2. Reinforced concrete shall be used for openings over 2 m. Stainless steel lintels shall be used in cavity walls with brick outer leaf. Prestressed concrete planks shall be used for openings up to 2m only in non-loadbearing walls unless agreed otherwise with the Customer.

Prestressed concrete lintels shall be placed rough side up and be propped in accordance with the manufacturer's requirements unless agreed otherwise with the Customer. Lintels should be bedded on M6 mortar with a minimum of 150 mm bearing onto a full block. Galvanised steel lintels shall be used when specified on the drawings.

6.4.10 MORTAR TESTING

All testing of mortar shall be in accordance with IS EN 1015 and the results shall be available to the Customer prior to the blocks being laid and added to the Quality documentation.

Trial mixes shall be carried out and half of the samples shall be tested at 7 days and the remainder at 28 days. The minimum 28-day crushing strength of the cubes shall not be less than the values specified minimum compressive strength of 8N/mm². Minimum of two cubes are required from 12 m³ or 2 batches whichever represents the lesser volume.

6.4.11 TESTING OF BLOCKS

Blocks shall be tested in accordance with the requirements of IS EN 772.

As soon as the sources of the units have been approved by the Customer, suppliers' certificates of recent tests carried out in accordance with the relevant Standards shall be obtained giving the following information:

- Compressive strength
- Absorption percentage
- Soluble salt content.
- Drying shrinkage or moisture expansion
- Density and tolerance in dimensions

- Freeze/thaw class
- Thermal conductivity

10 No. blocks per 1,500 of each type of block (subject to a minimum of 10 blocks per type) shall be selected at random and sent to an accredited Testing Authority for testing during construction. Results of all tests shall be added to the Customers Quality documentation .

6.4.12 DOORS / WINDOWS

No windows are to be included in the building envelope.

All doors shall have a CE mark in accordance with section 3.4 of the Specification.

All doors, including internal doors, shall have a minimum clear opening height of 2.25 m and a minimum clear opening width of 950 mm.

All doors shall be capable of being opened to 180° so that they can be held open by a suitable retainer. All doors shall be lockable from the outside and easily opened from the inside using the emergency mechanism. All doors are also to be fitted with panic bars and shall swing outwards when opened.

Doors, as per Customers Design, shall have the following minimum dimensions:

- External Doors:
 - Personnel Single – 2.25 m (h) x 0.95 m (w)
 - Double Equipment – 2.4 m (h) x 1.8 m (w)
- Internal Doors:
 - Personnel Single – 2.25 m (h) x 0.95 m (w)
 - Battery – 2.25 m x 0.95 m (w)
 - Double Equipment – 2.4 m x 1.8 m (w)

These minimum dimensions shall be checked against the equipment proposed for each station and internal door dimensions must match the external door dimensions. All internal doors except the toilet door shall incorporate a visibility panel.

Industrial doors as per Customers Design including roller shutter doors, folding shutter doors and sectional overhead doors shall be designed in accordance with:

- IS EN 12433-1: Industrial, commercial and garage doors and gates - Terminology - Part 1: Types of doors.
- IS EN 12433-2: Industrial, commercial and garage doors and gates - Terminology - Part 2: Parts of doors.
- IS EN 12444: Industrial, commercial and garage doors and gates -Resistance to wind load - Testing and calculation.
- IS EN 12425: Industrial, commercial and garage doors and gates. Resistance to water penetration. Classification.
- IS EN 13241: Industrial, commercial and garage doors and gates - Product standard.
- EN 1627 Pedestrian door sets, windows, curtain walling, grilles and shutters. Burglar resistance. Requirements and classification.

External doors shall meet resistance classification RC 4 or higher in accordance with EN 1627.

Industrial doors shall be categorised as Wind Load Class 5 in accordance with IS EN 12444 unless agreed otherwise with EirGrid. For design wind loads less than 1.00 kN /m², less onerous classes will be permitted subject to Customers Design.

Industrial doors shall be categorised as Resistance to Water Penetration Class 3 in accordance with IS EN 12425.

6.4.13 INTERNAL DOORS / FIRE DOORS

6.4.13.1 INTERNAL DOORS – GENERAL

The internal doors shall comprise the following types:

- Flush 6 mm ply-faced, solid cored, 46 mm overall leaf thickness with hardwood lipping to all edges with hardwood timber frame and 6 mm plywood veneer finish suitable for painting.
- Flush 6 mm ply faced, solid cored, 56 mm overall leaf thickness with hardwood lipping to all edges with hardwood timber frame and 6 mm plywood veneer finish suitable for painting.

All timber door frames shall be taken from solid timber sections without the use of planted timber stops. The clearance gap between door edge and frame shall not exceed 3 mm at any point. The clearance gap between the bottom door edge and floor shall allow for floor finishes as necessary. Toilet cubicle and lobby doors shall be undercut as necessary to provide make up air for the extract system.

Timber doors shall be finished as follows:

Door leaves shall be finished with hardwood lips and 6 mm plywood veneer finish, suitable for painting. Door frames and leaves to be painted by brush on site as follows:

- 1 no. coat wood primer, sand lightly.
- 2 no. coats oil-based undercoat, sanding lightly between coats.
- 1 no. coat eggshell oil-based paint in selected RAL colour.
- Glazing panels shall be installed in doors as follows:
- Non-Fire Resisting Doors that have glazing panels, shall be designed in accordance with BS 6262-3 and BS 6262-4.
- 30- and 60-minutes Fire Resisting Doors shall be designed in accordance with the Building Regulations Technical Guidance Document Part B

6.4.13.2 FIRE DOORS

A fire door refers to a complete 'door-set' assembly which includes the door leaf or leaves, the door frame, ironmongery (hinges, latches, closers, etc.) and any seals where required between the frame and leaf or between leaves. The performance of the fire door shall critically depend on the correct installation of the complete 'door-set' assembly.

Fire doors shall be manufactured, installed and maintained in accordance with BS 476 Part 8, 20-24 and BS 8214 and BS ISO 3864-1.

Fire-resisting door-sets shall be provided with construction and ironmongery tested to BS 476-22 providing a fire resistance of no less period than that specified in the Fire Safety Certificate. Intumescent strips shall be fitted to door frames and leaves as required.

Manufacturer's test certificates, reports, supplements and evaluations shall be issued and approved by the Customers prior to manufacture and added to the Customers Quality documentation as evidence that all functions, sizes and glazing arrangements supplied are certified. The Customer shall ensure that the proof of Fire rating performance is acceptable to the Fire Office / Fire Consultant and that all doors are certified. Fire rated door frames and leaves shall be sourced from the same manufacturer.

All fire doors shall be fitted with an automatic self-closing device as per Customer's design and be able to close the door from any angle and against any latch fitted to the door.

Doors shall be hung on stainless ball bearing steel butt hinges with a melting point of at least 800°C unless otherwise specified with floor pivot hinges, etc. The number of hinges shall be in accordance with the fire certification.

All fire doors shall be marked (at about eye level, 1650 mm above floor level) with the appropriate fire safety sign complying with BS 8214 and BS ISO 3864-1.

All fire doors shall be identified by a permanently fixed small flush metal plate, indicating the period of fire resistance, manufacturer, year of manufacture and all other pertinent details complying with the Building Regulations. Fire doors to cupboards shall be marked on the outside; all other fire doors shall be marked on both sides.

Fire check glazing channels shall be an approved proprietary product, fixed with stainless steel screws and cups at centres not exceeding 100 mm staggered (minimum 2 no. per length).

Intumescent strips, seals, caulking and paste, shall be of an approved quality, design and manufacture to comply with BS 476. Where intumescent mastic is exposed, it shall be 2-part colour black.

6.4.13.3 IRONMONGERY

Ironmongery shall have a stainless-steel finish and be fitted as indicated in the Ironmongery Schedule in Appendix B of this Specification. Alternative ironmongery may be used, provided it complies to the Customers Design and has been reviewed by EirGrid in advance of supply and fitting.

All ironmongery shall be concealed fixed. All pull handles shall be fitted with adequate fixings to ensure firm steady performance of pull handles. All forends, face plates and other accessories to timber doors shall be stainless steel to match all door furniture. Locks supplied have adequate springs to ensure lever handles are maintained in the horizontal position when not in use.

All ironmongery products shall be as specified or equal approved to the Customers design. Lever handles must have metal bearings and be through screwed. Kick plate shall be a minimum 2 mm thick stainless steel and 200 mm high.

Samples required of all proposed ironmongery shall be approved by the Customer prior to fitting.

All surface mounted door closers fitted to timber doors are to be fitted on the inside face of the door to each room. Closers shall not be fixed on door faces to circulation areas.

6.4.13.4 GLAZING

All glazing shall meet the requirements of BS 6262 and where relevant IS EN 12600 or BS 6206 until withdrawn. Fire-rated glazing shall be ideally restrained by hardwood beads and intumescent strips.

6.4.14 EXTERNAL STEEL DOORS

The external doors shall comprise purpose made insulated galvanised 5 mm steel security doors with paint finish.

The Customer shall be responsible for the design, testing, fabrication, fitting of the door and frame including ironmongery, finishing and completion work. This information shall form part of the Customer's Quality documentation. Shop drawings shall be issued based on the Customer's Design drawings and shall include all interfaces with surrounding building fabric.

All door leafs and fixed panels shall be filled with flexible / semi-rigid slabs or equivalent approved insulation with aluminium foil facing on slab side facing into the building, except for any louvered elements.

All doors and frames shall be galvanised in accordance with IS EN ISO 1461 with paint finish as specified below. The Customer shall obtain certification of acceptance inspection and sampling in accordance with IS EN ISO 1461 for all galvanised doors.

Door Protection Measures shall be provided to protect the paint finished with two-pack polyurethane-acrylic anti-corrosion and adhesion topcoat in RAL 6020 'Chrome Green' or other specified and RAL colour as per agreement with EirGrid or Planning Approval Conditions. Paint shall be applied in two coats to achieve a total dry film thickness of 120 microns.

A suitable manually operated hold-open device shall be incorporated in the design. This may take the form of wall-mounted or ground mounted hooks/devices and must restrain against the door leaf's closing in the event of strong winds without damaging the door leaf or adjacent wall finishes. Where wall mounted devices are proposed there should be suitable anchor points incorporated in the adjacent wall.

6.4.15 MULTI-POINT DOOR LOCK

All single doors and all lockable steel doors shall be fitted with Mico Tindall MICO INT-3 AD2 Single Action to Escape (SATE) Surface Mounted Security 3-point Lock. The MICO INT-3 AD2 SATE is a surfaced mounted high security 3-point locking with integrated mechanical automatic deadlocking. The SATE override fitting that always offers panic escape via a full width push plate.

The MICO INT-3 AD2 Sate shall

- include all accessories for fitting to doors of varying heights
- be in left hand and right-hand configuration or be universal in design
- have a single action to escape mechanism on the interior
- be compatible with Euro profile DIN cylinders
- conform to IS EN 179

The Euro profile DIN cylinders shall confirm to the DIN Standard 18251.

Where required, steel doors shall be fabricated to receive a 102 mm long Euro profile mastered Federal cylinder fitted with a thumb turn. Doors shall be supplied on site with a 102 mm long Euro profile temporary builders' cylinder. The provision of temporary cylinders shall be facilitated by EirGrid.

Cylinder for all locks excluding padlocks shall have a pickproof mechanism that is protected against manipulation. No components shall be used that could wear out.

6.4.16 CEILING

Plasterboard ceilings shall be in accordance with section 6.4.19 of this specification. Alternative materials may be considered for ceilings provided they are, safe, meet structural strength, durability and functional. The proposed materials shall comply with fire requirements as stipulated in TGD -Part B. The Customer shall ensure proposed alternative ceilings materials are fit for purpose and fully meet their Design requirements in advance of any relevant works.

6.4.17 JOINERY

Timber shall be sound, well-conditioned, properly seasoned to suit the particular use and free from defects or combination of defects which could render it unsuitable for the purpose intended.

Timber used for grounds, battens, exposed grounds, exposed battens or fillets shall be red deal.

Permitted types of timber to be used for joinery shall be as follows:

- Red deal of Northern Swedish or Canadian origin.
- Iroko of African origin.
- Southern Yellow Pine of American origin.
- Ash

All timber used for the OCC shall have certification confirming it is obtained from a sustainable timber source recorded as part of the Customers Quality documentation.

Hardwood, which is exposed to view in joinery work, shall be ash and shall be free from the following defects: knots, sapwood, dieback, waney edges, warping, pith, brittle heart, rot, stain and beetle attack.

Softwood timber, where used in joinery which will be exposed to view, shall be Red Deal of first quality. The following defects will not be permitted: pith shown on the surface; sloping grain exceeding one in eight; checks, splits and shakes; knots, excepting isolated sound tight knots of less than 19 mm diameter; any evidence of beetle attack or rot.

Softwood not exposed to view may be accepted with minor defects except for beetle attack or rot.

Joinery timber shall comply with EN 942. Samples of hardwood shall be agreed by the Customer and conform to Customer Design requirements.

The moisture content of the timber when the joinery is manufactured shall be within the following permissible limits:-

- Minimum 15%

- Maximum 20%

All plywood shall conform to EN 636 and be Weather and boil-proof (WBP) bonded first grade and faced with veneer .

Medium density fibreboard (MDF) shall comply with IS EN 622-1.

Fire-proof board shall be tested to BS 476: Parts 6 and 7 and be non-combustible, asbestos free, laminate board with calcium silicate matrix reinforced with vermiculite and natural organic fibres.

Screws shall comply with 93/703417 DC : MAR 93 and nails with BS 1202. The size and material of screws and nails shall be appropriate to the nature of the fixing and of the materials involved.

Timber shall be stored under cover clear of the ground and protected from dampness.

Workmanship generally shall be in accordance with BS 1186-2. Plates, ceiling joists, etc., shall be in one length where possible. All joints shall be made directly over supports and these shall be scarfed and spiked where required.

6.4.18 STRUCTURAL TIMBERWORK

The provisions of this clause govern the use of softwood structural timber members in roofs or floors. Structural timbers shall conform to TGD part A -

The Customer shall ensure that prefabricated trusses conform to I.S. 193:2006 and in advance of manufacture of the trusses the following information shall be captured in the Quality documentation :

- Design calculations (IS EN 1995-1-1),
- A design risk assessment,
- A permanent works design certificate
- A drawing outlining trusses and bracing.
- A materials specification

Structural timberwork shall comply with IS EN 1995-1-1 for softwood structural member with sizes, permitted deviations meeting the requirements of I.S. EN 336:2003 and all strength class C16 compliant with I.S. EN 338:2009. The species group and stress grade shall be marked on the timber.

The moisture content of all structural timber shall comply with EN 1995-1-1 and not exceed 22% at the time of installation.

The Customer as part of their Quality procedures shall ensure documents certifying that all structural timber complies with the specified grading treatment and moisture content requirement.

All structural timber described in this Section shall be protected as necessary during the progress of the Works, cleaned down and left in perfect condition on completion.

6.4.19 PLASTERWORK

All plasterwork External and Internal shall be carried out in accordance with IS EN 13914-2.

Gypsum plaster shall be an approved product to IS EN 13279-1 and used in strict accordance with the manufacturer's instructions.

Plasterboard shall be an approved gypsum product.

Galvanised plaster stops for external use and uPVC plaster stops for internal use, fixed back-to-back, shall be provided at all junctions of dissimilar materials [e.g. concrete and blockwork] to prevent cracking in the plaster. The finished surface of plaster is to have smooth flush junction in the same plane of the wall.

Internal Sand/cement render 1:5-6 Cement / Sand (with plasticiser) complying to IS EN 13914 which is to be applied to concrete blockwork shall comprise of a sand coat, a sand / cement float coat and a napped sand/cement topcoat giving an overall depth 16-20 mm.

Internal Sand/cement render 1:5-6 Cement / Sand (with plasticiser) complying to IS EN 13914 to be applied to in-situ concrete shall comprise of a sand/cement scud coat with an approved bonding agent, a 16-20 mm nominal overall depth sand/cement float coat and a napped sand/cement topcoat.

Plasterboard ceilings shall consist of 3 no. coats of approved vinyl matt emulsion with roller applied texture on 12.5 mm plasterboard mounted from a suspended ceiling system. The finish on plain ceilings shall be 3 mm skim on 12.5 mm plasterboard on an approved gypsum suspended ceiling system.

Boards are to have a tapered edge with taped and filled joints. One coat of gypsum drywall primer shall be applied to all boards before painting.

Installation of all products shall be strictly to manufacturer's recommendations.

External render 1:3-4 Cement / Sand (Cement : ready mixed material) shall comply with IS EN 13914-1 "Design, preparation and application of external rendering and internal plastering, Part 1 - External rendering".

6.4.20 METAL CLADDING

Cladding panels shall be composite metal panels provided by an approved manufacturer.

Each panel types shall be appropriate for its application considering such factors as roof / wall construction, roof pitch, direction of lay, etc.

The core insulation shall be a closed cell, CFC free and LPCB certified polyisocyanurate (PIR).

The panel thickness shall be indicated on the construction drawings and be sufficient to provide a U Value in accordance with current Building Regulations TGD Part L Conservation of Fuel & Energy.

The Customer shall ensure that the cladding manufacturer provides external coating and product warranties and guarantees on an individual project basis.

Firewall specification panels and supports, including suitable cladding rails/cleats, shall be used in buildings where the construction requires a period of fire resistance to BS476-22 for wall applications as may be indicated on the construction drawings. Steel and aluminium outer and inner facings shall have a Class 1 surface spread of flame rating to BS476-7 & shall be Class 0 as defined by the Building Regulations.

The panel surfaces shall be rated EXT.F.AA [flat panels] and EXT.S.AA [sloped panels] for fire penetration and flame spread when tested to BS 476-3. The System shall have passed all the requirements of Loss Prevention Standard LPS 1181: 2003: Part 1: Issue 1 Ceiling Lining Test published by the Loss Prevention Certification Board [LPCB].

The Customer shall be responsible for the design and specification of the system in accordance with BS 5427:2016 -1.

Responsibilities shall include determination of profiles, sizes and thicknesses of panels and sheets, the sizes, number and spacing of fixings, and incorporation of other accessories and fittings to ensure cladding / covering system will resist factored dead, imposed and design live loads, and accommodate deflections and thermal movements without damage, all in accordance with BS 5427-1.

Fasteners shall be to Customers specification and to manufacturers design and details. The number and location of cladding fasteners shall be as recommended by the cladding manufacturer to resist OCC bespoke wind loads calculated in accordance with IS EN 1991-1-4 .

Junctions between the roof panel system and walls / penetrations shall be insulated with PIR board insulation. Any gaps shall be filled with a proprietary fire rated gun applied canister urethane insulation product.

The Customer shall determine the surface condensation risk of the cladding system using the method described in IS EN ISO 13788. Thermal insulation shall provide a satisfactory temperature factor (f_{min}), to ensure that damage and nuisance from surface condensation does not occur.

Flashings, trims and lap joint treatment shall be in accordance with the manufacturer's instructions. End laps and side laps including sealing details shall be in line with the manufacturer's instructions arranged with laps away from prevailing wind. An anti-condensation tape shall be applied at the butt joint between panels.

An approved EPDM faced polyethylene foam to suit the cladding profile shall be used as a profile filler.

Junctions between cladding and flashings shall be weathertight and neatly dressed down.

Purpose-made cold formed metal accessories, for both internal and external use, shall have the same material / finish as the face of the cladding.

To prevent electrolytic action at contact surfaces of supports and sheets of dissimilar metals, the Customer shall provide for isolating tape as recommended by cladding manufacturer at these locations.

When the roofing and / or the wall cladding to the building is completed, a label identifying the insulated panels shall be fitted. This label shall illustrate the type of Insulated panels fitted, to aid Insurers, Fire Officers, Owners and Occupiers in identifying the envelope composition.

The Customer shall ensure full shop drawings form part of the Customers Quality documentation and submitted to EirGrid for review prior to fabrication on site as follows:

Schedule of all cladding showing true elevations of each variation and cladding type at 1:50.

All details full size showing the proposed system and all adjacent fabric in section and in elevation.

The Customer shall be fully responsible for the suitability of the system proposed particularly with relation to weather tightness, durability, structural adequacy and rigidity.

The Customer shall ensure that the cladding manufacturer / supplier, before commencing detailed design, submits labelled samples of the following for Customer approval:

- Cladding panel,
- Selected paint finish,
- Top hat sections / gaskets as required by the proposed system,
- Fasteners.

6.4.21 OVERPRESSURE RELIEF

Where a building is to accommodate GIS equipment, the Customer shall ensure that all electrical and equipment designs have considered whether over pressure relief vents are required in the building envelope.

6.4.22 PENETRATION SEALS (FIRE PROOFING DETAILS)

This part of the specification sets out the requirements for the design, supply, delivery and installation of Penetration Seals (fire & smoke seals) for service penetrations in walls, floors and ceilings and any other fire seals required for compartmentalisation.

The Customer shall ensure that installation of penetration seals are certificated as part of a third-party certification scheme for installation of passive fire protection products such as FIRAS (run by Warrington Fire Certification) or LPCB (run by the UK Loss Prevention Council) in the installation of penetration sealing and cavity barriers. The Customer shall be required to obtain evidence of such certification and be able to demonstrate by means of references (i.e., previous contracts) that the subcontractor can design and install penetration seals of a type and scale required.

Penetration seals design / installation shall be as simple as possible and be constructed using one or more of the following fire stopping products as per the Customer Design:

- Cementitious mortar (10:1 mix of vermiculite and cement or similar).
- Silicone based sealant material
- Mineral fibre
- Intumescent and / or ablative coatings and materials.

Where steelwork forms an interface with a penetration seal, this shall be protected by means of encasing in fire resistant material, intumescent paint, or equivalent. The fire resistance of the material shall be in accordance with the Fire Safety Certificate.

Where cables could act as a means of heat transmission through the penetration seal, these shall be coated with the same intumescent or ablative mastic used to form the penetration seal (which has test evidence for such "coat back" usage) to a distance of at least 150 mm either side of the penetration seal or as directed by the product manufacturers installation literature.

The penetration seal surface shall be smooth and finished off flush with the surrounding floor / wall surface.

All penetration seal materials shall be non-combustible in accordance with BS 476 Part 4 or equivalent.

No material shall contain asbestos in any concentration. Penetration seals shall not affect cable ratings.

All penetration seals shall be affected using materials, products and systems which have been successfully fire tested (in an independent fire test laboratory) in accordance with BS 476 Part 20 in order to confirm that they can achieve 60 minutes (or higher as may be required in the Fire Safety Certificate) integrity and insulation when tested. The Customer shall obtain copies of such fire test evidence.

All penetration seals shall be labelled with a penetration seal number by means of a small robust indelible tag or nameplate (which should also include the fire rating, date installed and name of installer), securely fixed adjacent to the penetration seal to which it refers. On completion, a penetration seal schedule, listing penetration seal number, materials used to affect the penetration seal, fire rating and location shall be completed and included in the projects Safety File and/or added as part of the Customers Quality documentation. The label shall clearly identify that should the penetration seal become breached in anyway, repairs shall be undertaken in accordance with this specification.

6.4.23 TILING

The installation of tiling will generally be in accordance with BS 5385. Tiling is generally confined to splashbacks in the WC.

Tiles shall be selected tiles, size and finish to match Customer's detailed Design and be reviewed by EirGrid in advance of installation. The bedding and joint width shall be in accordance with the manufacturer's instructions. All adhesives, grout and edge protection products shall be proprietary products approved as per Customer's Design and installed in accordance with manufacturer's instructions. Movement joints shall be edge reinforced to BS 5385-3.

Before placing orders, the Customer shall submit representative samples of 2 no. of each tile proposed for each application for review to EirGrid.

6.5 SUBSTRUCTURE AND FLOORS

6.5.1 GENERAL SUBSTRUCTURE REQUIREMENTS

Building floors shall be designed by the Customer and conform to TGD-Part C. It is recommended that the internal floors shall be formed using a Ground bearing concrete floor slab laid on insulation with the radon barrier under the insulation laid on minimum sand blinding layer of 50 mm, over a minimum of 225 mm gas permeable hardcore layer comprising of clean, dry, well compacted broken stone, graded with 10-50 mm aggregate with no fines. The hardcore layer shall be finished with a separate layer of clean, dry soft sand blinding as per above and follow S.R. 21:2014+ A1:2016 Annex E.

Radon sump(s) to be actively ventilated via robust radon pipe and suitably located electric fan on the external façade of e building.

Where designated rooms of the building are heated such as the Battery Room, Mess Room, Control Room, Comms Room, etc. the requirements of TGD Part L, (Conservation of Fuel and Energy - Buildings other than Dwellings), is applicable. In such cases, the floor construction shall incorporate a layer of proprietary rigid insulation of thickness sufficient to provide a U-value in accordance with TGD Part L.

The structure shall be provided with a radon barrier having the following properties:

- Nominal thickness – 0.4 mm
- Tensile Strength 750 N/50mm in accordance with EN 12311-1
- % Elongation In accordance with EN 12311-1 <30%
- Moisture Vapour Transmission Rate MVTR (g/m²/24h) <0.2
- Radon Permeability (10⁻¹² m²/s) not greater than 10
- Radon Transmittance (10⁻⁷ m²/s) not greater than 17

The Radon barrier must have a current British Board of Agreement (BBA) Certificate and shall be included in the Customers Quality documentation. Radon Membrane must be installed and fixed in accordance with the Certificate holder's instructions and the relevant clauses of BRE Report BR 211 : 2015

All Radon protection measures shall be provided for under the slab , including the Radon membrane, a radon gas control system comprising a network of open based MDPE sump units linked by 110 mm uPVC pipes in accordance with IS EN 1401-1, each sump serving an area not greater than 200 mm². The 110 mm uPVC distribution pipes shall be installed falling gently toward the sump unit and should pass through the building wall and be connected to a 90° short radius bend and uPVC cap link at ground level. Capped and sealed vents shall be brought to a level of 150 mm above ground at the perimeter of the building.

Adjacent membrane layers should overlap by at least 150 mm and should be fully sealed using proprietary sealing tape and firmly rolled with a hand roller.

Where service ducts or pipes penetrate the membrane, gas tight joints shall be made using proprietary sealant tape and top hat units with retention clips.

Great care shall be taken not to puncture the membrane during subsequent construction activities.

On completion of the building, the Customer shall employ an independent specialist to test the radon levels over a 3-month period throughout the structure and issue the report forms as part of the Quality documentation to be forwarded to EirGrid as per section 4.10 .

The loading on the substructure shall comply with the relevant parts of IS EN 1991-1 except where the design requires otherwise, or a higher load specified in this Specification.

All rooms in the substation buildings shall be located a minimum of 150 mm above the surrounding ground. However, level access must be provided at all entrances / doorways in accordance with TGD Part M. All entrances / doorways shall incorporate a drainage channel such as an Aco-drain or similar approved. As stated in Section 6.3 , doors shall not swing across the sloping part of any ramp.

The below ground elements of the structure shall be waterproofed as a Grade 2 (better utility) basement utilising Type A, Tanked protection in accordance with BS 8102 'Code of Practice for Protection of Structures against Water from the Ground'. uPVC water stops shall be incorporated into all joints. The tanking shall be protected by a proprietary bituminous

board and drained by proprietary vertical drainage sheets connected to the surface water drainage system.

6.5.2 SUB-BASE TREATMENT

Floors as per Customers Design shall be structural concrete slab cast on a compacted hardcore sub-base of minimum depth 225 mm. Floors shall incorporate a layer of rigid insulation where required (see 6.5.1) and a radon barrier / damp-proof membrane and associated radon protection measures.

All necessary foundation works to be incorporated to ensure floor support or the design loading and usage requirements.

Requirements of Part A, C and Part L of the Building Regulations Technical Guidance Documents shall be incorporated in the design and construction works.

6.5.3 STRUCTURAL CONCRETE GROUND SLABS - GENERAL

Slabs shall be structural concrete slabs of minimum compressive strength Class C28/35 to IS EN 206:2013 designed in accordance with the design loading and usage requirements. Slabs shall incorporate as a minimum A393 mesh fabric steel reinforcement with a top cover of 40 mm.

Floor finish to be Class U3 finish as per Table 3 of this Specification produced by power floating or by steel trowelling or power-floating. This is a hard-smooth finish suitable for directly receiving thin flexible sheet and tile paving bedded in adhesive and sealing for metal items in direct contact with the concrete.

Trowelling shall not commence until the moisture film has disappeared and the concrete is sufficiently hard to prevent the working of excess laitance to the surface.

6.5.4 FLOOR FINISHES & ABUTMENTS

Floor finishes shall incorporate an approved surface hardener/anti-dust agent. Unless noted otherwise, all abutment of floors to walls shall be isolated with 10 mm close cell polyethylene compressible filter strip and sealed with polysulphide sealant. Finished surfaces shall be within the tolerances listed in section 6.15.3 of this Specification.

Finishes shall generally be power floated and coated with two coats of approved dust sealer to EN 13813:2002 SR - B 1.5 with CE – mark accreditation .

The control room concrete floor [i.e. under the raised access flooring] shall have thinned Polybond coating applied in two coats in accordance with the manufacturer's instructions.

All abutments of floors to walls shall be isolated with 10 mm close cell polyethylene compressible filler strip. All expansion joints shall be sealed neoprene or two-part polysulphide mastic sealant or equivalent agreed floor quality mastic.

The resistance of the floor covering to a ground able external point when measured in accordance with IEC 61340-4-1 shall be between 50 kΩ and 10 MΩ.

The toilet and lobby floor finishes shall be Altro Classic 2.5 mm with 150 mm formed skirting or equivalent agreed.

A proprietary slip resistant concrete floor paint, colour light grey, shall be applied to the stairs in two coats in accordance with the manufacturer's instructions. Yellow strips shall be included on the first and last step of each flights of stairs.

Where required by the Fire Safety Certificate adhesive photoluminescent markers may be required to be laid on the floor of the upper storey to delineate escape routes.

6.5.5 GIS CABLE PIT SLAB

Ground Floor / Cable Pit Slabs shall be reinforced concrete structural slabs as per Customers Design on 50 mm concrete blinding on grade designed in accordance with the design loadings and usage requirements.

The radon gas control system and hardcore is not required beneath cable pits as these areas will be tanked. Therefore, in the absence of a dedicated radon barrier, all tanking products must provide a warranty stating that the tanking system is capable of resisting radon gas penetration.

Adequate falls to a drainage sump (3-phase cast iron submersible pump) with approved / agreed pump shall be provided such that standing water cannot collect.

A stairs shall be provided, and the design should be compliant to relevant fire and safety standards. All openings including cable, duct and trench entries shall be appropriately sealed.

A proprietary slip resistant concrete floor paint, colour light grey, shall be applied in two coats in accordance with the manufacturer's instructions. The second coat shall not be applied until after installation of the cables.

The design shall incorporate confined space criteria as per HSA confined space documentation. Confined spaces shall be eliminated or mitigated at design stage.

6.5.6 GIS ROOM CONCRETE FLOOR SLAB

The GIS Room Floor shall consist of a structural concrete slab in accordance with this Specification. The floor construction shall generally be one of the following options:

- Insitu concrete slab
- Insitu concrete slab on metal decking, precast concrete planks or another permanent formwork
- Precast concrete floor consisting of hollow core slabs or similar

Other options should be included in the 'Design Criteria for Civil and Structural Works' and submitted to EirGrid for approval.

The concrete slabs will be supported by structural steel (or reinforced concrete beams) fixed to the main structural frame.

Properly designed joints (e.g. movement joints, contraction joints etc.) shall be incorporated in the floor as necessary and be sealed properly to achieve the required durability, fire resistance etc.

The floor level should be designed so to accommodate equipment rails and be within the tolerances specified by the GIS manufacturer.

The layout of the building shall be designed to sufficiently accommodate the safe installation and maintenance of equipment and all required clearances in accordance with the Electrical Engineer's requirements.

Stairs shall be provided to the GIS Room floor level and the design should be compliant to relevant fire and safety standards.

A proprietary slip resistant concrete floor paint, colour light grey, shall be applied in two coats in accordance with the manufacturer's instructions. The second coat shall not be applied until after installation of the GIS equipment and all associated electrical works.

All upper floor slabs shall be sealed around the external perimeter with suitably rated fire-stopping material.

The GIS room shall be sealed from any control room, access, egress area under the GIS floor level to prevent build-up of SF6 in these areas due to loss of SF6 from GIS or storage cylinders.

Earthing of the GIS building, and in particular the GIS floor slab, shall be undertaken in accordance with GIS manufacturer's recommendations.

Particular attention shall be paid to:

- laying of narrow meshed copper earth grid under the GIS floor
- bonding the reinforcing steel in GIS floor to narrow meshed earth grid

A letter of compliance from the GIS Manufacturer to the Customer confirming compliance with the GIS building earthing requirements, shall be submitted to EirGrid prior start of civil construction.

6.5.7 GIS ROOM FLOOR STEEL COMPONENTS

Typically, a suspended structural steel floor comprising a grid of suitably spaced beams is provided at first floor level to support the GIS concrete floor slab over the cable pit / ground floor slab. Alternatively, the Customer may opt for reinforced concrete beams subject to agreement by EirGrid.

The support steelwork shall be hot rolled mild steel to IS EN 10025-1 and coated in accordance with section 5.9.14.

Steel plates and grating will be required to cover large floor openings associated with cable installation.

Steel floor covers shall be galvanised in accordance with IS EN ISO 1461.

All steel components shall be designed to support the design loading and usage requirements.

Fastening of flooring panels onto support steelwork shall be by non-protruding approved proprietary fixing clips. All ring type Current Transformers (CT's) shall be positioned above the cable pit at finished floor level. Maximum floor plate size to be 2 m x 1 m. A pair of lifting holes shall be drilled in each plate prior to galvanising.

All plates shall be marked on the underside in stencilled yellow paint with a unique number and a drawing of minimum A3 size with the original layout of the numbered plates framed and mounted on the wall in the switchgear room.

Suspended steel flooring shall be equivalent proprietary system agreed by EirGrid. The depth shall be based on the specified loads and spans determined by the support steelwork design.

Where access to the underside of the steel flooring is possible or required, fastening shall be by an approved proprietary clip. Where access to the underside is not possible or required, fix using countersink 6 mm diameter Tek screws. Screws shall not protrude to become a hazard to those working below the floor.

Clearance between adjacent steel flooring units shall not exceed 3 mm.

Gaps at junctions / edges with concrete / block walls shall be unfilled with steel plate and shall not exceed 5 mm.

6.5.8 GIS FLOOR CABLE DUCTS / TRENCHES

Sufficient cable ducting should be provided. Covers to cable trenches to be open grating on hot rolled mild steel support angles fixed to the cable trench walls. Steelwork support for GIS local control/bay controller cabinets to be hot rolled mild steel to IS EN 10025-1 designed to support the weight of the cabinets.

Glass Reinforced Plastic (GRP) covers shall be used for floor cable ducts and trenches including closure pieces around installed cables. The covers shall be designed to withstand the GIS floor loading requirements. Covers that are cut out locally, to accommodate HV cables, may require additional beams to provide sufficient support. Such beams should be made of GRP. No steel beams are allowed around the HV cables. Any support beams required shall not impede the future installation of HV Cables. Future installation of fire protection shall also be considered in the design of these covers

Covers shall be required to have a solid surface and open grid covers shall not be provided. Appropriate tools for safely removing the covers by personnel shall be provided and made available as part of the maintenance requirements for the OCC.

Where possible cable entry points shall be in line with the floor trenches to enable easier installation of cables. The seating shall be such that the top of the grating is level with the top of the floor. The covers shall be removable.

The Customer shall make provision for mitigation measures in their Design Risk Assessment for risks associated with removing the cover plates during future maintenance of the Station.

6.5.9 HV CABLE ENTRY

For new GIS substations the top of the structural slab which forms the floor of the internal cable pit shall be 1.0 m below the external ground level -Refer to Drawing XDN-LAY-ELV-F-005 .

Cable ducts shall be cast into the wall for the receipt of each incoming circuit. The lowest point of each duct shall be 300 mm above the cable pit floor.⁷

⁷ To achieve this requirement the external cable depth shall be gradually reduced (level raised) within the area of the substation to match the level of the cast in duct, in accordance with Appendix C. Minimum burial depths of 450 mm to the top of cable ducts shall be observed.

The location and spacing between ducts shall be coordinated and approved as part of the cable route design. , ref drawing OFD-SSS-521. Ducts shall be in accordance with Appendix C

6.5.10 RAISED ACCESS FLOORS

Raised access floors shall be in the Control Room. Raised access floors shall be in accordance with IS EN 12825:2001. Elements shall be Class 6 in accordance with Table 1 of IS EN 12825.

Floors shall be designed for the following loadings:

- Ultimate load capacity: ≥ 12 kN Point load.
- Working load: 5 kN point load.

Steelwork support for cabinets shall be hot rolled mild steel to IS EN 10025 as per Customer's detailed design to support the weight of the cabinets.

Deflection shall be of Class A in accordance with Table 2 of IS EN 12825 (2.5 mm max deflection under working load). Raised access floors shall comprise of 600 x 600 mm panels of a high-density particle board with a 0.5 mm galvanised steel sheet soffit and uPVC edge trims. Panels shall be covered with an anti-static laminate. The height of the raised access floor shall be as per relevant drawing (generally 325 mm total). Pedestals shall be P1000 Unistrut with P2072 base plates and P1003 top plates.

Earthing connection shall be double nut on base plate bolt. Stringers shall be P1000 Unistrut with continuous stringers in one direction. Deviations on panel dimensions shall be in accordance with Class 1 of Table 3 of IS EN 12825:2001. Pedestal fixing shall be pedestal adhesive with every fourth pedestal base fixed with 2 no. 40 mm stainless steel hammer home anchors. All upturned sections shall be connected to main framework with M10 set screws. The top of the upstand unit shall finish flush with floor tiles. One suction lifter shall be supplied and stored in the control room.

The raised access floor shall be provided in accordance with the drawings and finished floor shall be flush with finished floor in the adjoining hallway.

The raised access floor shall be laid in accordance with the relevant supplier drawing with finished floor flush with finished floor in adjoining hallway. The Customer shall cut panels around the cabinets as required. Seal all exposed cut edges of panels using Class 0 Aluminium foil sealer to prevent dust generation and to prevent moisture penetration. All the cut panels to be numbered and identified on the raised access floor layout drawing.

A properly sealed perimeter expansion gap is to be left to allow for thermal expansion of the floor when the building is heated, in accordance with the manufacturer's guidelines.

All dimensions shall be checked on site.

Testing of raised access floor elements shall be in accordance with Clause 5 of IS EN 12825.

Raised access floors shall be protected from rain / moisture entering through external doors and causing swelling / dimensional change to the floor tiles. External doors to room containing raised access floors shall be locked closed whenever possible.

Cavity barrier and firestop systems to prevent the spread of fire and smoke, to be provided as required by the Fire Safety Certificate, sealing the voids between raised access floors and floor slabs.

The Customer's Design shall provide details of the raised access floor shall be submitted to EirGrid for review prior to installation.

6.5.11 CRANE

The Customer shall design, supply and install a single girder travelling crane of suitable safe working load (SWL) capacity to meet the requirements for installation and maintenance of the GIS equipment. The crane shall be operated from a pendant controller which shall cover the GIS room and cable pit areas.

The crane hook height from the GIS room finished floor level shall be in accordance with the manufacturer's guidelines. It shall facilitate unrestricted removal of the tallest part of GIS equipment and shall at least meet the minimum crane hook height requirements.

The crane shall conform to the requirements of I.S. EN 13001 (parts 1 to 3). It shall incorporate every reasonable provision for the safety of all operations and maintenance personnel and shall conform to all the appropriate statutory Safety Requirements. Cranes shall be finished in Hazard Yellow BS 4800 ref. 08-E-51 and clearly marked with the SWL .

Cranes shall be adequate for the anticipated loads to be lifted. Limit switches shall be provided in both longitudinal and transverse directions. Where required, physical and electrical controls shall also be installed to prevent the crane striking the building structure (e.g. stair core).

6.6 CORROSION PROTECTION OF METALWORK

The Customer shall ensure their design specifies the environmental classification used to IS EN ISO 12944 in designing the corrosion protection system for external metalwork. The exposure conditions to be catered for and other requirements for individual projects shall be agreed with EirGrid prior to commencement.

Notwithstanding the requirements for fire resistance, all interior metalwork shall have a corrosion protection system for environmental category 'C2' in accordance with IS EN ISO 12944 unless higher category is required (e.g. coastal areas).

All dissimilar metals to be separated from each other to avoid bimetallic corrosion.

The Customer shall ensure their design, specifies the environmental classification used (internal and external) to IS EN ISO 12944-2 in designing the corrosion protection system.

The cladding / roofing / glazing system shall take account of the provisions of BS 8104: 1992. The protection system for cladding and roofing shall have a life to first maintenance of 15 years.

6.7 HEATING AND VENTILATION

Heating shall be provided in the workshop/storeroom, mess room, toilet and electrical equipment rooms.

A temperature control system shall be installed to maintain the required ambient room temperatures as specified in OFS-SSS-418 and appropriate equipment standards.

Thermostatic controls shall be provided to control the temperature in each room, as required, through a timer.

Ventilation systems shall meet the requirements of TGD -Part F and be provided to ensure adequate ventilation for plant and personnel.

All vents shall be fitted into a maximum structural opening height of 225 mm. The opening width is to be established based on ventilation calculations carried out by the Customer.

The finishes shall match the wall finish.

Removable vents for cable pulling shall be custom fabricated galvanised steel vents with insect mesh.

Vent covers, where indicated, shall be internal plastic covers with insect mesh and external proprietary ductile iron 200 mm sq. vent covers. Vents shall be formed through the wall with a 160 mm uPVC pipe.

The WC shall be mechanically ventilated. Refer to OFS-SSS-418 for details.

The HV cable room and GIS switchgear room shall, as a minimum, have a passive ventilation system including vents at low and high level located on external walls.

For GIS stations, the Customer shall provide a design risk assessment addressing the following hazards:

Accumulation of SF6 gas in low lying areas.

Presence of heavier than air gases other than SF6 e.g. radon, methane etc. (for cable pit only).

The Customer shall assess the need for mechanical ventilation of these rooms based on this risk assessment and room temperature requirements and shall provide mechanical ventilation where required.

6.8 TOILET FACILITIES

A unisex WC and toilet shall be provided. Hot water to wash hand basins shall be provided by an instantaneous under sink heater.

A separate water tap shall be provided above the wash hand basin. Refer to 0 for Schedule of Sanitary Ware.

A plasterboard ceiling, in accordance with Section 6.4.16 , shall be installed in the toilet area.

6.9 ROOF

6.9.1 OVERVIEW

All roofs shall be designed in accordance with the necessary design codes and standards including but not limited to the following:

- Roof loading in accordance with IS EN 1991.
- Thermal performance in accordance with the TGD – Part L
- Fire Safety requirements accordance with the TGD – Part B

- Acoustic requirements accordance with the TGD – Part E

Regardless of the type of roof adopted for OCC buildings less than 5 m high from ground level to the top of the roof (e.g. pitched, hipped etc), the station must incorporate precast concrete slab with in-situ concrete screed (where appropriate) supported on a reinforced concrete ring beam or a reinforced concrete flat roof to ensure building security. This is not a requirement for roofs of height greater than 5 m.

6.9.2 ROOF CONSTRUCTION

OCC control building roofs shall generally be flat roofs of minimum 1:60 fall. This should take account of construction tolerances, permitted deviations and deflection under load, and, unless justified by more detailed structural analysis, to account for deflections/settlement, therefore all flat roof surfaces (including gutter beds) should be designed with a minimum fall of 1:40.

A pitched roof design may be used by prior agreement with EirGrid in order to comply with the requirements of any planning conditions. The roof shall be equipped with a fully functioning leak free guttering system laid to falls. There shall be no internal downpipes .

Where a flat roof type is used, a parapet with a minimum height of 1100 mm shall be used.

Flat roofs shall be detailed and constructed in accordance with the flat roof construction specification below. Trussed roofs shall be designed and erected in accordance with EN 1995-1-1.

The roof covering shall be laid to provide a secure, free draining and completely watertight roof. The following roof covering types are recommended:

- Ethylene Propylene Diene Monomer (EPDM)
- Sedum Roof (Green Roof)
- Mastic Asphalt Roof

Ballast roof finish solutions are not permitted on EirGrid OCC buildings.

Roofs to areas along maintenance and fire exit routes shall be finished with 600 mm x 600 mm x 50 mm thick approved concrete paving on proprietary paving supports in lieu of gravel. These slabs shall have 6 mm open joints and shall have a non-slip finish , refer to Table 3 Concrete Finishes Schedule for required concrete finishes.

A 25 mm x 25 mm chase shall be formed in a homogeneous structure backing to create a key for the top of upstands.

Two coats of external grade solar reflective emulsion shall be applied to all exposed asphalt in upstands.

Electronic Leak Detection shall be used to test the roofing system

The Customer shall certify the integrity of the roof.

6.10 FIRE DETECTION AND FIRE ALARM SYSTEMS

To be in accordance with EirGrid Specification (Fire Detection & Fire Alarm Systems) OFS-SSS-409 and IS 3218: 2013+A1:2019.

6.11 LIGHTNING PROTECTION

Customer to supply and fix comprehensive lightning protection including conductive strapping and requisite earth connection points in accordance with IS EN: 62305 and EirGrid Earthing and Lightning specification OFS-SSS-407.

6.12 WATER SERVICES

The Customer shall allow for bringing a suitably sized water main into the Control Building terminating at point of entry with stop cock. An external stop cock / meter pit shall be provided. Individual isolation stop cock and valves shall be provided to enable removal and maintenance of individual water fed appliances and fittings.

Supplies shall be run in polyethylene pipework to a drinking water point and tank. A suitably sized non-metallic (minimum 340 litre capacity) insulated cold water storage tank complete with lid shall be provided in a high-level position in the Control Building incorporating overflows (external discharge), ball valve, lids and lagging. Supplies from tanks to toilets etc. shall be run in copper pipework.

All materials and equipment shall be designed by the Customer considering design life of OCC. . Emphasis shall be placed on ensuring frost damage to water services and plumbing works does not occur.

6.13 PLUMBING AND SANITARY WARE

Materials shall be in accordance with the following standards:

Item	Reference Number
Copper pipes	IS EN 1057 (hEN)
Cold Water uPVC pipes	IS EN ISO 1452 Part 2 & 3
Sanitary Pipework	IS EN 12056 Part 1 & 2
Sanitary Appliances	BS 6465 Part 1 - 4
uPVC plastic waste pipes and fittings	IS EN 1329-1
Unplasticised waste pipes and fittings (external diameters of 34.6 mm, 41.0 mm and 54.1 mm)	IS EN 1329-1
uPVC soil and ventilating pipes and fittings (external diameters of 83 mm, 110 mm, 160 mm)	BS 4514
C.I. Soil waste and ventilating pipes	BS 416-1
Plastics connectors for use with horizontal outlet vitreous China W.C. pans	BS 5627
Plastics waste traps	IS EN 274
Waste pipes for sanitary appliances	IS EN 274

All above ground drainage and waste disposal installations shall also comply with TGD H – Hygiene, of the Building Regulations. All materials shall be checked for soundness before installation.

A sanitary ware schedule is attached in the O of this Specification.

A fire main shall generally not be required.

Where there is no local authority water main available in the vicinity, a bored well within the OCC fence, with commissioned pump and suitable treatment, shall be provided to provide potable water standard (if possible). This water will be used for supply to WC and handwash facilities and not for drinking. The bored well shall be lined as required by subsoil conditions but for a minimum of 3m from the top of the well. Samples should be taken for water quality 1 week and 1 month after boring and sent to an approved laboratory for testing.

Installation shall be in accordance with IS EN 12056-5 and BS 6465.

Testing of all materials after installation shall be in accordance with IS EN 12056-5 and BS 6465.

All pipes and fittings shall be fitted in strict accordance with manufacturer's instructions.

The soils and waste system shall be installed in uPVC. Adequate access shall be provided throughout for cleaning.

6.14 MECHANICAL AND ELECTRICAL SERVICES

Mechanical and Electrical Services to be provided in accordance with EirGrid specification for Mechanical and Electrical Services - OFS-SSS-418.

Emergency Lighting to be supplied and installed in accordance with IS 3217: 2013+A1:2017

6.15 TOLERANCES

6.15.1 PILES

Tolerances should not exceed the ICE Specification tolerances.

6.15.2 STEELWORK

Dimensional tolerances of rolled sections shall comply with IS EN 1090-2, IS EN 10365, IS EN 10210-2, IS EN 10056-1 and IS EN 10034.

Plates and flats shall comply with IS EN 10029 / IS EN 10025.

Cold formed section shall comply with IS EN 10162. The alignment, level and plumb of the steelwork shall be in accordance with the following tolerances unless superseded by more stringent tolerances dictated by installation and operation e.g. overhead maintenance cranes.

Table 4 Dimensional Tolerances Steelwork

Item	Description	Tolerance
Position	Permissible deviation of the erected column/support member from its specified Position	+/-5 mm
Level	Permissible deviation between erected column base, column cap, beam, truss and specified level. (Level of beam should be taken on top of upper flange)	+/-3 mm
Plumb	Permissible deviation from vertical per 15 m of height subject to a maximum deviation of	+/-5 mm +/-15 mm

Crane rail erection tolerances are to be in accordance with crane manufacturer's requirements. GIS equipment rail (if applicable) shall consider OEM Manufacturers guidelines.

6.15.3 IN-SITU CONCRETE

The permissible tolerances in finished surfaces shall not exceed the limits shown below. Tolerances for building elements other than those listed in below shall be in accordance with BS 5606.

Type of Structure	Type of Irregularity	Type of Finish: FORMED			Type of Finish: UNFORMED		
		F1	F2	F3/ F4	U1	U2	U3/U 4
Bases for Electrical Equipment							
Mast Bases with Cast in Bolts							
Transformer Plinths							
Buried Concrete in foundations, culverts, retaining walls, etc	Deviation from line	+/- 20	-	-	-	-	-
	Deviation from level	-	-	-	+/- 20	-	-
	Variation in cross section dimensions	+10 -5	-	-	-	-	-
	Deviation from	+/-	-	-	+/-	-	-

Type of Structure	Type of Irregularity	Type of Finish: FORMED			Type of Finish: UNFORMED		
		F1	F2	F3/ F4	U1	U2	U3/U 4
	straightness over 1.5 m	10			10		
Exposed concrete in columns, beams, retaining walls, abutments, bunds etc.	Deviation from line	+/- 10	+/- 10	+/- 10			
	Deviation from level					+/- 5	+ /-3
	Variation in cross section dimensions	+10 -5	+10 -5	+10 -5			
	Deviation from straightness over 1.5 m	+10 -0	+10 -0	+5 -0		+ /- 5	+ /-3
Floors	Deviation from specified thickness						+10 -0
	Deviation from specified level						+15
	Deviation from 3m straight edge				+5		

6.15.4 ROADS AND PAVEMENTS

Tolerances shall be in accordance with TII Specification for Road Works Series 700 Clause 702 as follows:

- Road surfaces: ± 6 mm
- Alignment ± 25 mm
- Kerb alignment ± 13 mm

Refer to TII specification for tolerances on surface regularity.

6.15.5 DRAINAGE

The permissible tolerances in line and level shall be 6 mm in level and 25 mm in line between inspection chambers or access points.

Appendix A Typical Sanitary Ware Schedule

FITTING	TYPE	QUANTITY
WC	<p>E8229(01) <i>Ideal Standard Concept Arc Close Coupled Toilet</i> with horizontal outlet</p> <p>E7855(01) Concept Arc close couple delay fill 4/2.6 litre cistern, dual button push button valve, bottom supply and internal overflow. E7726(01) Concept toilet seat and cover, slim with quick release, slow close</p> <p>S9101 Domex screws (pair)</p> <p>S4305(01) Plastic outlet connector for connection to 102 bore Soil pipe</p>	1 No.
Wash Hand Basin [WHB]	<p>E7852(01) Concept Arc 55 cm washbasin, 1 taphole with overflow</p> <p>E7837(01) Concept full pedestal</p> <p>B1811(AA) Ceraflex basin mixer with pop-up waste S9005 Volume Control valve, inlet and outlet each with compression nut and ring for 15 mm copper tube</p>	1 No.
Mains Water/ Supply Tap	Over WHB wall mounted stainless steel tap for mains water supply with anti-splash outlet - shall be agreed.	1 No.
Toilet roller Holder	Aluminium anti-theft type, plugged and screwed to blockwork/conc. Wall	1 No.
Mirror	600 x 600 x 6 mm with bevelled edges with 4 Nos. screw holes, shall be fixed to blockwork/concrete wall, provide 4no. chrome screw cover caps.	1 No.
Heater	Under sink water heater	1 No.

Appendix B Typical Ironmongery

LOCATION	IRONMONGERY
External Insulated Steel Single Door Lockable	3 No. Stainless Steel Ballbearing Hinges (must be suitable for weight of door) 1 no. specified lock, cylinder & handle must be non-lockable from inside (Sample required for customer approval) 1 No. Door Closer (must be suitable for weight of door) 1 No. SAA Flush Bolts 1 No. FA Easy Clean Socket Note: Recessed handle to be provided in door (EXTERNAL SIDE) External wall mounted retainer.
External Insulated Steel Single Door Pushbar	3 No. Stainless Steel Ballbearing Hinges (must be suitable for weight of door) 1 No. Door Closer (must be suitable for weight of door) 1 No. SAA Flush Bolts 1 No. FA Easy Clean Socket Note: Recessed handle to be provided in door (EXTERNAL SIDE) External wall mounted retainer.
External Insulated Steel Double Door Lockable	6 No. Stainless Steel Ballbearing Hinges (must be suitable for weight of door) 1 no. specified lock, cylinder & handle must be non-lockable from inside (Sample required for customer approval) 2 No. Door Closer (must be suitable for weight of door) 2 No. SAA Flush Bolts 2 No. FA Easy Clean Socket Note: Recessed handle to be provided in door (EXTERNAL SIDE) External wall mounted retainer.
External Insulated Steel Double Door Pushbar	6 No. Stainless Steel Ballbearing Hinges (must be suitable for weight of door) 2 No. Door Closer (must be suitable for weight of door) 2 No. SAA Flush Bolts 2 No. FA Easy Clean Socket Note: Recessed handle to be provided in door (EXTERNAL SIDE) External wall mounted retainer.
Internal Single Room Door Fire Rated 1hr FR	3 No. Class 8 Stainless Steel 110 mm Ballbearing Hinges Fire Rated 1 No. Randi-line 300 x 25 mm S.S. Pull Handle 1 No. Randi-line 300 x 75 mm S.S. Push Plate 1 No. Randi-line S.S. Doorstop 1 No. Chequer plate S.S.200mm Kicking Plate 1 No. Dorma TS73 Silver Door Closer 2 No. Randi-line SAA 'Fire Door Keep Shut' sign
Internal Single Toilet Door Fire Rated	3 No. Class 8 Stainless Steel 110 mm Ballbearings Hinges Fire Rated 1 Set Randi-line S.S. 21 mm Lever Handle on Back-to-Back Fixed Slimline Roses 1 No. Randi-line S.S. Cubicle Lock

LOCATION	IRONMONGERY
	1 No. Randi-line S.S. Slimline Indent Bolt & Thumb Turn 1 No. Randi-line S.S. Coat Hook 1 No. Randi-line 75 mm dia. SAA Unisex Symbol 2 No. S.S. 200 mm Kicking Plates 1 No. Randi-line S.S. Doorstop 1 No. Dorma TS73 Silver Door Closer
Internal Double Room Door Fire Rated 1hr FR	6 No. Class 8 Stainless Steel 110mm Ballbearing Hinges Fire Rated 2 No. Randi-line 300 x 25 mm S.S. Pull Handle 2 No. Randi-line 300 x 75 mm S.S. Finger Plate 2 No. Randi-line S.S. Doorstop 2 No. Chequer plate S.S. 200 mm Kicking Plates 2 No. Dorma TS73 Silver Door Closer 2 No. Randi-line SAA 'Fire Door Keep Shut' sign
Internal Door & Half Room Door Fire Rated 1hr FR	6 No. Class 8 Stainless Steel 110 mm Ballbearing Hinges Fire Rated 1 No. Randi-line 300 x 25mm S.S. Pull Handle 1 No. Randi-line 300 x 75mm S.S. Finger Plate 1 No. Randi-line S.S. Doorstop 2 No. Chequer plate S.S. 200 mm Kicking Plates 2 No. Dorma TS73 Silver Door Closer 2 No. Randi-line SAA 'Fire Door Keep Shut' sign
External Insulated Steel Single Door Lockable	3 No. Stainless Steel Ballbearing Hinges (must be suitable for weight of door) 1 no. specified lock, cylinder & handle must be non-lockable from inside (Sample required for customer approval) 1 No. Door Closer (must be suitable for weight of door) 1 No. SAA Flush Bolts 1 No. FA Easy Clean Socket Note: Recessed handle to be provided in door (EXTERNAL SIDE) External wall mounted retainer.
External Insulated Steel Single Door Pushbar	3 No. Stainless Steel Ballbearing Hinges (must be suitable for weight of door) 1 No. Door Closer (must be suitable for weight of door) 1 No. SAA Flush Bolts 1 No. FA Easy Clean Socket Note: Recessed handle to be provided in door (EXTERNAL SIDE) External wall mounted retainer.
External Insulated Steel Double Door Lockable	6 No. Stainless Steel Ballbearing Hinges (must be suitable for weight of door) 1 no. specified lock, cylinder & handle must be non-lockable from inside (Sample required for customer approval) 2 No. Door Closer (must be suitable for weight of door) 2 No. SAA Flush Bolts 2 No. FA Easy Clean Socket Note: Recessed handle to be provided in door (EXTERNAL SIDE) External wall mounted retainer.
External Insulated	6 No. Stainless Steel Ballbearing Hinges (must be suitable for weight of

LOCATION	IRONMONGERY
Steel Double Door Pushbar	door) 2 No. Door Closer (must be suitable for weight of door) 2 No. SAA Flush Bolts 2 No. FA Easy Clean Socket Note: Recessed handle to be provided in door (EXTERNAL SIDE) External wall mounted retainer.
Internal Single Room Door Fire Rated 1hr FR	3 No. Class 8 Stainless Steel 110 mm Ballbearing Hinges Fire Rated 1 No. Randi-line 300 x 25 mm S.S. Pull Handle 1 No. Randi-line 300 x 75 mm S.S. Push Plate 1 No. Randi-line S.S. Doorstop 1 No. Chequer plate S.S.200 mm Kicking Plate 1 No. Dorma TS73 Silver Door Closer 2 No. Randi-line SAA 'Fire Door Keep Shut' sign
Internal Single Toilet Door Fire Rated	3 No. Class 8 Stainless Steel 110 mm Ballbearings Hinges Fire Rated 1 Set Randi-line S.S. 21 mm Lever Handle on Back-to-Back Fixed Slimline Roses 1 No. Randi-line S.S. Cubicle Lock 1 No. Randi-line S.S. Slimline Indent Bolt &Thumb Turn 1 No. Randi-line S.S. Coat Hook 1 No. Randi-line 75 mm dia. SAA Unisex Symbol 2 No. S.S. 200 mm Kicking Plates 1 No. Randi-line S.S. Doorstop 1 No. Dorma TS73 Silver Door Closer
Internal Double Room Door Fire Rated 1hr FR	6 No. Class 8 Stainless Steel 110 mm Ballbearing Hinges Fire Rated 2 No. Randi-line 300 x 25 mm S.S. Pull Handle 2 No. Randi-line 300 x 75 mm S.S. Finger Plate 2 No. Randi-line S.S. Doorstop 2 No. Chequer plate S.S.200 mm Kicking Plates 2 No. Dorma TS73 Silver Door Closer 2 No. Randi-line SAA 'Fire Door Keep Shut' sign
Internal Door & Half Room Door Fire Rated 1hr FR	6 No. Class 8 Stainless Steel 110mm Ballbearing Hinges Fire Rated 1 No. Randi-line 300 x 25 mm S.S. Pull Handle 1 No. Randi-line 300 x 75 mm S.S. Finger Plate 1 No. Randi-line S.S. Doorstop 2 No. Chequer plate S.S.200 mm surface mounted Plates 2 No. Dorma TS73 Silver Door Closer 2 No. Randi-line SAA 'Fire Door Keep Shut' sign

Appendix C HV Cable Duct Installation Guidelines

iv) Introduction

This specification sets out the requirements for the supply and installation of ducts for High Voltage (HV) cables for the OCC.

v) Materials (HV Ducts and Couplers)

All ducts and couplers shall be supplied by the Customer. All ducts/couplers shall satisfy the criteria in the HV cable specification.

Table 5 HV Ducts for 110 kV and 220 kV Cables

Description	Requirement
Duct outside diameter for HV ducts	110 mm OD, SDR 17.6 – 38 kV 125 mm OD, SDR 17.6 – 110 kV 200 mm OD, SDR 21 – 220 kV
Duct Type	HDPE: 6 m lengths, 9 m on request
Duct Rating	Normal Duty per IS EN 61386-21 Specification
HDPE Quality	100% virgin material
Duct Colour – Outside	Red – BS 5252 Type 04 E 53 – 04 E 56. Minimum 1 mm thickness of colour material if dual layer extrusion
Duct Deformation Requirement	Shall pass IS EN 61386-21 < 5% deformation requirement for 450 N loading on 200 mm sample
Impact Resistance	Per IS EN 61386-21: 12 samples, 5 kg striker: 570 mm fall height: > 28 Joules – no crack in at least 9 samples
Duct Minimum Wall Thickness	The larger of the two criteria below: 1) Wall thickness to pass 5% deformation/impact requirement above 2) Minimum wall thickness as defined by SDR. (Required for cable pulling)
Duct End	Ends of each length bevelled to allow easy jointing of duct on site, minimum thickness of plain end shall be 2.4 mm, bevel length > 5 mm
Circumferential Mark on Pipe End for Correct Push-in	Circumferential mark required to indicate correct push-in distance for duct jointing. Location: to match half coupler length less half coupler centre stop thickness

Description	Requirement
Distance	
Duct Ovality	2.0 mm maximum
Duct Inner Surface	Smooth low friction surface completely free of ripples, sharp edges and protrusions. Friction coefficient <0.20
Duct Marking	"DANGER ELECTRICITY CABLES"
Repetition: Rate/Gap between Legend	150 mm max. gap between adjoining legends
Colour of Legend	Black
Size of Lettering (Legend)	2 x 20 mm height i.e. 2 lines of 20 mm height @ 180° apart
Batch No/ Manufacturer's Name and Date of Manufacture	To be stamped on the duct with a 6 mm minimum lettering size
Red Colour Fastness	1 year minimum required to provide 12-month storage period. 1-year outdoor weathering test required or suitable accelerated colourfastness test to prove
Endcaps for Ducting	Bag of 16 duct end caps shall be supplied with each bale of ducts – capable of fitting each duct end
Couplers	Slip or rubber gasket type with no internal obstructions/sharp edges. A centring ridge is required which does not protrude above the duct wall. The coupler shall effectively seal out water over the 40-year lifetime of the installation even at bend positions when buried 3 m below ground water level
Bends	38 kV and 110 kV ducts – No pre-formed bends. Form bends by evenly bending the duct (brace couplers so no bending stress on coupler) bending radius 6 m (under extreme circumstances can be reduced to 3 m minimum and shall be approved by the Customer) 220 kV, pre-formed bends of 6 m radius (absolute minimum radius of 3.2 m with approval from the Customer).

vi) Duct Installation

vii) Safety and other Underground Services

If the Works are in the vicinity of existing electricity cables, the Customer shall identify and bring to the attention of EirGrid any observations or reservations he may have in respect of the safe execution of the Works. All work areas shall have

adequate fencing, lighting and guarding for the prevention of accidents and the safety of the public. The Customer shall establish a "Safe System of Work for Digging" and the guidelines listed therein shall be strictly enforced during excavation works. This document shall be submitted to EirGrid prior to the commencement of the Works.

Extreme care shall be taken to detect the presence of existing underground services. The Customer shall be responsible for identifying the whereabouts of all services including electricity cables along the route. The Customer shall ensure that they have in their possession all available records on the location of all services (including electricity cables) prior to commencement of excavation and shall maintain these records on site for reference for the duration of the Works.

The Customer shall take measures to ensure the full protection of pipes, cables and other apparatus during the progress of the Works for obtaining the written consent of the appropriate authority to interrupt the services of supply and for keeping EirGrid informed of all arrangements they make with third party asset owners or supplies, statutory undertakers and public authorities as appropriate.

The Customer shall open an adequate number of hand excavated trial holes to determine the precise location of all services crossing or near the line of the proposed trench before the laying of the ducts commences. The Customer shall take all possible precautions to avoid damage to services.

The Customer shall, during the progress of the Works, take account of all the requirements from statutory undertakers or from the management of any other publicly or privately owned services provided that these requirements are acceptable to and approved beforehand by EirGrid.

viii) Trenching Materials and Equipment

The Customer shall provide all equipment and plant necessary for the trenching operation, including timber/plastic templates to correctly space the ducts.

ix) Trench 'Layout & Depths'

Ducts and cables shall be installed in strict accordance with the project specific design drawings and instructions.

The trench shall be as level as possible in both directions. When changing grade to accommodate other services, the change in grade shall be as gradual as possible, generally 1:20, from the commencement of grade change to the obstacle, unless they have prior approval from the Customer. Thus, the Customer shall prove the route, by excavation, two duct lengths ahead of each duct installation.

Clearances from other services shall be observed strictly. The minimum horizontal or vertical clearance is 300 mm unless instructed by the Customer. The maximum possible horizontal and vertical clearance shall always be maintained from main underground services. If a horizontal separation less than 1 m is proposed it shall be agreed in writing with the Customer and any protection of the existing service provided.

Excavated material should not be stored close to the sides of the excavation or stored in such a place that it gives rise to potential health or safety hazard. The storage location for any excavated material shall be agreed in advance with the Customer.

The sides of the trench shall be adequately supported against collapse or slip, and to prevent debris falling upon the formation, bed, CBGM B mix or ducts. Continuous support shall be provided where the depth of the trench exceeds 1.25 m or as required in poor ground and in accordance with the latest edition of the HSA 'Guide to Safety in Excavations'

Removal of material which falls into the open trench due to sides caving in, collapsing or for any other reason will be the Customer's responsibility. All excessive excavation, raveling etc. and its subsequent rectification to include removal of material and its replacement with compacted Clause 804 or CBGM B concrete as per the Customer's Design will be the sole responsibility of the Customer.

Appropriate measures shall be put in place to ensure the trench remains free of standing water throughout the ducting process.

Where any soft or unsound spots occur in the trench formation, they shall be excavated to a depth determined by the Customer and filled to the correct formation with compacted Clause 804 or CBGM B concrete as advised by the Customer, depending on the ground conditions.

The formation shall be trimmed to an even gradient, cleared of mud etc. and approved by the Customer before the bedding material is placed.

BEDDING , SURROUND AND BACKFILL

In trafficked areas bedding and surround using CBGM B (see specification below) to ducts shall have a minimum cover of 75mm and be compacted .

Backfill from top of CBGM to underside of pavement shall be with granular material as per Type B Clause 804 laid in 150 mm layers and compacted using vibrating plate compacted or power rammer in accordance with Clause 802 of the TII Series 800'. Warning strip and warning tape shall be placed in trench (refer to OFD-SSS-532 STANDARD – TRENCH CROSS SECTION) .

Backfilling in landscape areas such as cultivated grass verges, fields, parks and lawns etc. shall be carried out using acceptable excavated material as defined in TII 600 Series. The backfill shall be compacted in 150 mm layers using a vibrating plate compactor or power rammer in accordance with Clause 612 .

Backfill of trenches beneath paved footpaths or verges shall be carried out using Granular Material Type B -Clause 804 and compacted as described above,

x) Cement Bound Granular Mixture Type B

Cement Bound Granular Mixture (CBGM) for duct bed and surround and trench backfill shall be CBGM B and shall be in compliance with EN 14227-1 and relevant clauses of TII Series 800 including Clause 822 with aggregate requirements as per Table 8/2. Testing, controlled and checking shall be in accordance with Clause 825 and Table 8/15.

A copy of field and material requirements for CBGM B is reproduced below in Table 6 .

Table 6 Materials for Cement Bound Granular Mixture B

Field Requirements	Category	CBGM B
	Clause	822
	Mixing	Mix-in Plant
	Method of Batching	Mass
	Cement type to IS EN 197-1	Only cements and cement combinations in Chapter 6 of this Specification may be used.
		The Customer shall submit any addition proposals to EirGrid for approval
	Colour	RAL 3000-3002 or BS 5252 Red – 04 E 53 to 04 E 56; pigment 225.
		25 kg bag per 3 m ² of CGBM B
Specimen Requirements	Moisture Content	To be optimised to achieve workability around 125 mm – 200 mm ducts to eliminate voids and maximise compaction while at the same time maximising thermal conductivity
		To suit requirements for strength surface level regularity and finish
	Minimum Compaction	95% of cube density
	Compaction	Clause 813.10 and Table 8/4 (Specification for Road Works Series 800)
	Curing	Clause 813.14 (Specification for Road Works Series 800)
	Compressive Strength Testing	Clause 825 – 1 no. test for every 50 m ³ but not less than 1 no./day
	Min. 7 Day Cube Compressive strength	15 N/mm ²
	Compressive strength Class	C16/20

Ducts shall be encased in CBGM B material, below and within structural areas of sub stations in accordance with the job specific requirements.

CBGM B shall be placed within 2 hours of production. Batch sheets shall be retained on site.

Prior to commencement of works, the Customer shall ensure that all CBGM B mixes are supplied by a fully accredited CE-certified supplier. Certificates of supplier(s) and testing and sampling records shall form part of the Customers Quality documentation

The current ratings shall be calculated in accordance with the current edition of IEC 60287.

The following parameters shall be assumed for each season _

- Winter Concrete (CBGM B) Thermal Resistivity = 0.85 K.m/W
- Spring Concrete (CBGM B) Thermal Resistivity = 1.0 K.m/W
- Summer Concrete (CBGM B) Thermal Resistivity = 1.0 K.m/W
- Autumn Concrete (CBGM B) Thermal Resistivity = 1.0 K.m/W

xi) Thermal Resistivity Testing

The Customer shall ensure Testing is carried out by an independent laboratory UKAS accredited. Testing shall be in accordance with Energy Networks Association (ENA) Technical Specification 97-1 with a minimum of 4 No. 120 mm diameter x 220 mm high steel containers with 16 mm pin in the middle (concrete capacity 5 kg approx. each).

xii) Sand

Where instructed, the cables or ducts shall be surrounded with a compacted layer of natural unwashed sand in accordance with IS EN 12620. The grading, when determined in accordance with IS EN 933-1, shall comply with grading limit F in IS EN 12620.

The compacted sand shall have a maximum resistivity of 2.7 K.m/W at 0 % moisture content. As part of the Customers Quality procedures they shall ensure that before commencement of the Contract, selected samples of at least 5 sands which fall within the above grading, and subject them to testing for thermal resistivity, particle distribution and dry relative density. EirGrid shall be provided the results of the testing for their review including :-

- The source or sources of the material, and a 5 kg bag sample
- Certificates of Compliance with the specified grading limits
- Thermal resistivity test results demonstrating the ability of the material to meet the above criteria.

As part of the Customers Quality procedures Sample tests shall be performed and recorded on placed thermal sand in order to ensure compliance with the requirements of this Specification. One test will be required on each section of trench between joint bays.

xiii) Cement Bound Sand

Cement bound sand shall be delivered mixed and shall be made from sand within the grading limits of Table 2 of IS EN 12620:2013 'Aggregates from Natural Sources for Concrete' reproduced in Table 7 below.

The sand shall be mixed with cement at a ratio of sand to cement of 40 to 1.

The moisture content of the material shall be in the range of 8 % to 10 % when delivered and any water added to achieve this moisture content shall be added during the mixing process and not afterwards.

Cement bound sand shall be transferred directly from the truck to the work location in such a way as to prevent contamination and degradation of materials. Material shall be protected from the weather in the truck and prior to laying.

Table 7 Cement Bound Sand Grading Limits

<i>BS Sieve Size</i>	<i>Percentage by Mass Passing</i>
10 mm	100
5 mm	89-100
2.36 mm	60-100
1.18 mm	30-100
0.60 mm	15-100
0.30 mm	5-70
0.150 mm	0-15

The material shall be placed and spread evenly and concurrently. Compaction of the material in place shall be carried out within two hours of the addition of the cement to the sand. It shall be carried out immediately after the material has been spread.

Where physical constraints exist, i.e. within joint bays or at cable entry to buildings, compaction shall be carried out by hand ramming in layers of 200 mm max. Ramming shall be carried out using ramming tools, which are adequate for the purpose. Addition of subsequent layers shall be carried out immediately so that, once compacted, the matrix of the material is not disturbed. Therefore, the second layer of cement bound sand shall be placed within two hours of the manufacture of the cement bound sand in the first layer.

xiv) Fill Material to Structures

Fill material to and under structures (concrete chambers) shall be granular material Class 6N or 6P and complying with Table 6/1 in the locations described in Appendix 6/6 of the TII Series 600 Specification for Road Works.

The materials, Class 6N or 6P, shall be compacted in accordance with Clause 612* to satisfy the compaction requirements of the relevant class as listed in Table 6/1, but subject to the restrictions in the Clause 612.5 and Clause 612.6.

xv) Duct Laying

The Customer shall check ducts on site in advance of any relevant works are fully compliant with the Specification, in particular in respect of wall thickness, internal and external diameter along full length, straightness .

Each duct, coupler and joint shall be carefully examined for structural integrity and cleanliness immediately before and after laying.

Ducts may be cut if they are suitably held, supported in a safe manner and protected during the process. All ends shall be cut square to the longitudinal axis of the area and treated to ensure a smooth finish.

Ducts shall be spaced strictly in accordance with the Customers Design .

Ducts shall be laid in straight lines to even gradients whenever possible. Ducts as per Customers Design and in compliance with manufacturers data may be laid to slow and even curves on plan to avoid obstruction. If a change in direction is required, bends shall be formed by evenly bending the ducts only and the couplers shall be braced so that there is not bending or stress on the coupler/joints. Pre-formed radius bend fittings are not permitted, unless specified as part of the Customer's Design.

For HV ducts no radius shall not be less than 6 m. To avoid damage when bending ducts, no heat shall be applied to the ducts when joining ducts together via couplers.

When jointing ducts together with couplers, a suitable lubricant (specified by the Customer) shall be applied to the coupler to ease fitting. Ducts shall be tapped home until the white mark on the duct is reached. Ducts shall only be tapped with smooth timber or a plastic mallet to avoid damage.

Every effort shall be made to prevent dirt ingress into the ducts. Duct covers should not be removed until the duct is in the trench. The storing, handling and installation of the ducts shall be done in a manner to prevent the ingress of any foreign matter whatsoever. Ducts shall be capped with waterproof caps at the end of each day's work.

Proprietary expanding duct bungs shall be installed at the end of each duct laying section.

Note: Any dirt or pebbles trapped in the ducts could cause very expensive damage to the cables. During cable pulling, dirt or other sharp objects can be pressed between the duct and the cable resulting in deep scores and gashes on the cable sheath which can result in cable failure.

xvi) Draw Ropes

A 12 mm polypropylene draw rope shall be supplied by the Customer and installed in all ducts to facilitate pulling in the cable.

The draw rope shall be fixed to the rear of the proprietary duct bung.

Warning Strip and Warning Tape

Approved yellow warning tape and red warning strips shall be inserted in the trench at the locations shown on the Drawings. The warning tape shall be no deeper than 300 mm below ground. The Customer shall be responsible for collection and delivery of these items and for the correct placing of these items in the trench as detailed on the drawings of the trench cross sections.

xvii) Tying of Ducts

Ducts that are to be placed in trefoil formation shall be tied evenly at 3 m centres with an appropriate tie.

xviii) Cleaning and Proving

On completion of duct laying the ducts shall immediately be thoroughly cleaned internally to ensure no foreign matter including water remains inside. A sponge shall be used to remove the water from the duct section prior to proving. The sponges shall be minimum 10 mm greater than the internal diameter of the duct. The ducts shall be cleaned using a clean, stiff brush, with diameter as outlined in Table 8 S below, followed by two clear passes of a new foam plug.

Table 8 Sizes of Duct Cleaning Brushes

Outside duct diameter (OD) and material	Minimum length of brush	Minimum diameter brush
110 mm HDPE	250 mm	100 mm
125 mm HDPE	250 mm	110 mm
125 mm uPVC	250 mm	120 mm
160 mm uPVC	250 mm	160 mm
200 mm HDPE	250 mm	187 mm

The duct diameter shall be proven using a mandrel, with diameter as outlined in Table 9 below.

Table 9 Mandrel Sizes

Duct dimensions			Minimum mandrel diameter
OD (mm)	ID (mm)	Duct Type	
110	97	HDPE	90 mm
125	117	uPVC rigid – standard ducting	105 mm
125	111	HDPE, SDR 17.6	105 mm
160	152	Existing uPVC duct	135 mm
200	177	HDPE, SDR 21	165 mm

The cleaning and proving of the ducts shall be carried out under supervision by the Customer. Cleaning and proving shall be carried out using a winch which has a calibrated dynamometer and printout provided. The dynamometer shall be calibrated annually and certified by an independent calibration tester. The testing and certification shall form part of the Quality document for the OCC project.

As part of the Customers Quality documentation a duct cleaning/proving report shall be produced, completed and submitted to EirGrid for all ducts. The report shall be signed by the Customer and their representatives who has to witnessed the tests. Fully completed reports and print outs for each section of ducting shall be submitted to EirGrid for review.

The proving of the ducts will be deemed as failed if any of the following occurs :

- The pulling tension exceeds 1 tonne (10 kN)

- Mandrel is stuck
- Mandrel is moving with sudden bursts even if the pulling tension is less than maximum specified
- Rope shoots suddenly up the duct
- Ducts do not maintain the same formation as at the start of the pull

Actions to be taken should the duct testing and proving fail are as follows:-

The Customer can clean and prove the ducting in the opposite direction to the previous proving direction,

A camera can be placed down the duct to check the internal integrity of the duct.

If the above steps do not meet the pass criteria, then the Customer shall carry out repair works to rectify the fault.

Following the repair of the duct or ducts, the Customer shall retest all the ducts within the circuit section of the repaired duct.

If repairs to ducts or circuits are located within 500 mm of an existing bank of ducts, then these ducts shall also be tested..

Following the duct proving process, approved rubber bungs with internal securing eye shall be fitted to prevent ingress of water, sand or other debris.

The ducts shall then be roped and secured to the internal securing eye in preparation for cable pulling.

Appendix D Concrete for in-situ Joint Bays and Communication Chambers

xix) Concrete for joint bays and communication chambers

Customers Design for in situ concrete for chambers, including joint bays, shall be Class C30/37 in accordance with relevant clauses of this Specification.

Table 10 Concrete for Joint Bays & Communication Chambers

Item	Value
Exposure class	XC2
Minimum cement content	310 kg/m ³ .
Max. water/cement ratio	0.55
Cement type to IS EN 197-1:	Only cements and cement combinations in this Specification may be used. The following limitations apply.
Minimum air content	N/A
Chloride content class:	Cl. 0,40
Max aggregate (mm):	20
Min. cover (mm)	40
Compressive strength class	C30/37

Refer to typical detail Drawings

OFD-SSS-533-STANDARD – PRE-CAST JOINT BAY 8 X 2.6 M (220 KV) and

OFD-SSS-522 STANDARD – C2 CHAMBER

Appendix E As Built/Laid records

xx) Introduction

Accurate and up to date records and levels shall be kept by the Customer (refer to Section 4.9.3) for the location and depth as relevant for all as built features including Buildings, hardstanding, plant/equipment, underground electrical cabling, drainage and other utility services within the OCC.

Background OSI mapping in vector format shall be provided. Drawings shall be in dwg format with relevant pdf copies. Relevant existing and as built invert finished ground levels and maximum height levels to buildings and masts and overhead lines shall be noted on relevant drawings including plans, elevations, profiles and sections. Surveys shall be undertaken in accordance with the principals of the topographic surveys as stated and further defined Section III of the (OPW) Office of Public Works Specification for Surveying Services. The topographic survey shall include 3d points for: -

- Permanent buildings/structures
- Temporary/mobile buildings
- Road, path, track features
- Visible boundary features – walls, fences, hedges
- Street furniture
- Statutory authorities and utility providers', plant and utility covers
- Trees, wooded areas, limits of vegetation
- Pitches/recreation
- Water features
- Earthworks
- Industrial sites
- Coastal Lines
- Railway features

xxi) Method

Recording the As-Laid Record Information

The Customer may use an approved survey method of their choice to record the as-laid record, once the chosen method can record the information within the tolerances set out below by a qualified surveyor. At the project start-up meeting the Customer shall state their proposed method to capture the as-laid record. This proposal will be reviewed by EirGrid prior to ducting commencement on site.

Horizontal/Vertical/Accuracy

The buildings, roads, footways hardstanding's, fences, plant/equipment shall be surveyed, named and plotted on the background mapping to an accuracy of between ± 10 mm to ± 20 mm in the horizontal x,y plan (Easting and Northing). The same accuracy is required for the surveying of the earthing and underground

services. All features , levels shall be plotted on the as built drawings with a unique Polyline style and colour.

Building and hardstanding shall have finish floor and ground levels at all external and internal corners. Fences, Roads and footways will have levels at top and bottom of plinth/ kerbs at 10m centres or at changes in direction. All bends along the roads, footways services shall be reflected accurately as they exist on the ground. This shall be in the form of a continuous curve.. A minimum of three points need to be surveyed on a bend, one at the start, one in the middle and one at the end. On larger bends, equally spaced survey points will be required.

Vertical Accuracy

The earthing , cables/ducts for all underground electrical , telecommunication and drainage services shall be surveyed and plotted on the background vector mapping to an accuracy of \pm 25 mm in the vertical plane, the Z axis.

Points shall be recorded at a maximum of 15 m separation, where the trench installation is as per the standard trench cross section. The standard trench cross section is where the trench is at a total depth of 1000 mm – 1100 mm.

Where the trench depth deviates from the standard trench cross section, i.e. deeper or shallower than 1000 mm – 1100 mm, depths shall be recorded as often as is necessary to achieve the tolerance as specified above subject to a maximum of 15 m separation.

All reduced levels shall be referenced to OSi datum mean sea level at Malin Head.

All levels shall be taken on the upper crown of the top power ducts in the trefoil or flat formation. The reduced level shall be annotated on the as-laid record.

Tie-In Dimensions

Tie-in dimensions shall also be measured and clearly marked on the plot at a minimum of 40-50 m centres along the cable route or closer as required where there is a radii or change in direction . They shall also be at locations easily identifiable on the ground.

Cross Section Information

EirGrid has a requirement for regular cross section information. Cross sections are required where the vertical alignment of the cable/ducts deviates from the design depth to avoid an obstruction, major transmission gas mains or drainage pipes. The trench cross section should include details of these projects.

Cross sections are also required if the formation of the cable ducts deviate in any way from the standard trench cross section in the specification.

Existing Utility Services

EirGrid requires that all existing services exposed by the trench excavation be identified, recorded and plotted on the as-laid record. The location and depth of these services shall be recorded to the same tolerances as those outlined for recording the location of the cable ducts.

The as-laid record shall also be annotated with information detailing the type and size of the service e.g. Watermain 125 mm.

Plotting

The records information shall be plotted on the vector mapping.

Text shall be 2 mm high when plotted at a scale of 1:500.

The text shall also appear as horizontal to the sheet and shall not obstruct any linework.

Appendix F List of Key Standards / Codes of Practice

xxii) Building Regulations and Technical Guidance Documents

TGD Part A – Structure

TGD Part B – Fire Safety

TGD part C – Site Preparation and Resistance to moisture

TGD Part D – Material and workmanship (CE mark)

TGD Part E – Sound

TGD Part F – Ventilation

TGD Part G – Hygiene

TGD Part H – Drainage and wastewater Disposal

TGD Part J – Heat Producing Appliances

TGD part K – Stairways, Ladders, Ramps and Guards

TGD Part L – Conservation of Fuel and Energy – Buildings other than Dwellings: this regulation applies to the heated section of the building i.e. battery room, mess room, control room, comms room etc

TGD Part M – Access and Use

xxiii) General

IS EN 1991 Eurocode 1: Actions on structures.

xxiv) High Voltage Equipment

IEC 61936-1 Power installations exceeding 1 kV a.c

xxv) Earthworks and Fill

TII 600 Series -Specification for Road Works

IS EN 1097-2:2022- Tests for mechanical and physical properties of aggregates. Methods for the determination of resistance to fragmentation.

IS EN 13249 - Geotextiles and Geotextile-related Products - Characteristics Required for use in the Construction of Roads and Other Trafficked Areas (excluding railways and asphalt inclusion) Amendment, February 2015.

IS EN 12224- Geotextiles and geotextile-related products. Determination of the resistance to weathering.

IS EN ISO 10319- Geosynthetics. Wide-width tensile test.

IS EN ISO 11058– Geotextiles and geotextile-related products –. Determination of water permeability characteristics normal to the plane, without load.

IS EN ISO 12956– Geotextiles and geotextile-related products –. Determination of the characteristic opening size.

IS EN ISO 12236– Geosynthetics -- Static puncture test (CBR test).

BS 1377: Part 1 to Part 9 inclusive - Soil Testing.

IS EN 1097-2:2022- Tests for mechanical and physical properties of aggregates. Methods for the determination of resistance to fragmentation.

IS EN 1997-2: Eurocode 7 - Geotechnical design. Ground investigation and testing.

BS 5930- Code of practice for ground investigations

BS 10175:2011 investigation of potentially contaminated sites - code of practice (+A2:2017)

xxvi) Piling

EN 1997-1, Eurocode 7: Geotechnical design. General Rules.

“ICE Specification for Piling and Embedded Retaining Walls” published by the Institution of Civil Contractor’s Designers, London, (latest edition).

BS EN 1536- Execution of Special Geotechnical Work. Bored piles.

IS EN 12699- Execution of Special Geotechnical Work. Displacement Piles.

BS EN 12794- Precast concrete products. Foundation piles.

xxvii) Steelwork

IS EN 1090-1- Execution of steel structures and aluminium structures. Requirements for conformity assessment of structural components (CE-Marking).

IS EN 1090-2: 2018 - Technical requirements for the execution of steel structures.

IS EN 1993 Eurocode 3 subdivided in six parts: IS EN 1993-1, IS EN 1993-2, IS EN 1993-3, IS EN 1993-4, IS EN 1993-5 and IS EN 1993-6 Design of Steel Structures.

IS EN 10210 -1- Hot finished structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements.

IS EN 10210-2- Hot finished steel structural hollow sections. Tolerances, dimensions and sectional properties

IS EN 10219-1- Cold formed welded structural hollow sections of non-alloy and fine grain steels.

IS EN 10160- Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)

IS EN 10365– Hot Rolled Steel Channels, I and H Sections. Dimensions and masses.

IS EN 10056-1- Specification for structural steel equal and unequal angles. Dimensions.

BS EN 10056-2:1993 - Specification for structural steel equal and unequal angles. Tolerances on shape and dimensions

IS EN 10034- Structural steel I and H sections. Tolerances on shape and dimensions.

IS EN 10162- Cold Rolled Steel Sections.

IS EN 10029- Hot-rolled steel plates 3 mm thick or above.

IS EN 10051- Continuously hot-rolled strip and plate/sheet cut from wide strip of non-alloy and alloy steels.

IS EN ISO 2560– Welding Consumables.

BS 3692– ISO metric precision hexagon bolts, screws and nuts. Specification.

BS 4190- ISO metric black hexagon bolts, screws and nuts. Specification.

IS EN ISO 4157 -1- Construction drawings - Designation systems - Part 1: Buildings and parts of buildings.

BS 2853- Specification for the testing of steel overhead runway beams for hoist blocks.

xxviii) Vehicular Barriers

IS EN 1317-1, Road Restraint Systems - Part 1: Terminology and General Criteria for Test Methods.

IS EN 1317-2, Road Restraint Systems - Part 2: Performance Classes, Impact Test Acceptance Criteria and Test Methods for Safety Barriers.

IS EN 1317-4, Road Restraint Systems - Part 4: Performance Classes, Impact Test Acceptance Criteria and Test Methods for Terminals and Transitions of Safety Barriers.

IS EN 1317-5, Road Restraint Systems – Part 5: Product Requirements, Durability and Evaluation of Conformity

xxix) Welding

BS 499- Welding terms and symbols (superseded).

IS EN 2553- Welded, brazed and soldered joints. Symbolic representation on drawings.

IS EN 1011-1- Welding. Recommendations for welding of metallic materials. General guidance for arc welding.

IS EN 1011-2- Welding. Recommendations for welding of metallic materials. Arc welding of ferritic steels.

IS EN ISO 3834-3- Standard Quality requirements for fusion welding of metallic materials.

IS EN ISO 9692-1– Welding and allied processes. Types of joint preparation. Manual metal arc welding, gas-shielded metal arc welding, gas welding, TIG welding and beam welding of steels

IS EN ISO 9692-2:1998 - Welding and allied processes. Joint preparation. Submerged arc welding of steels

IS EN ISO 14732- Welding personnel - Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials.

IS EN ISO 15609-1- Specification and qualification of welding procedures for metallic materials. Welding procedure specification. Arc welding.

IS EN ISO 9606 series - Qualification test of welders - Fusion welding.

IS EN ISO 15614 series - Specification and qualification of welding procedures for metallic materials - Welding procedure test.

IS EN ISO 5817- Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections.

IS EN ISO 17637- Non-destructive testing of welds - Visual testing of fusion-welded joints.

IS EN ISO 17635- Non-destructive testing of welds -- General rules for metallic materials.

IS EN ISO 9712- Non-destructive testing - Qualification and certification of NDT personnel.

IS EN ISO 17638- Non-destructive testing of welds. Magnetic particle testing.

IS EN ISO 3452-1- Non-destructive testing - Penetrant testing - Part 1: General principles.

IS EN ISO 17640- Non-destructive testing of welds. Ultrasonic testing. Techniques, testing levels, and assessment.

IS EN ISO 11666- Non-destructive testing of welds - Ultrasonic testing - Acceptance levels.

xxx) Bolting

IS EN 15048 Parts 1 & 2 - Non-Pre-Load Bolt Assemblies CE Requirements

IS EN ISO 4018- Hexagon head screws - Product grade C

IS EN ISO 4017- Hexagon head screws -Product grades A and B

IS EN ISO 4016- Hexagon head bolts - Product grade C

IS EN ISO 4014- Hexagon head bolts - Product grades A and B

IS EN ISO 4034- Hexagon regular nuts (style 1) - Product grade C

IS EN ISO 4032- Hexagon regular nuts (style 1) - Product grades A and B

IS EN ISO 7091- Plain washers - Normal series - Product grade C.

BS 4933: 2010 - Specification for ISO metric black cup and countersunk head bolts and screws with hexagon nuts.

BS 2583:1955 Specification for podger spanners

IS EN 14399 Parts 1-10- High-strength structural bolting assemblies for preloading.

xxxi) Ancillary Steelwork

IS EN ISO 14122-1- Safety of machinery. Permanent means of access to machinery - Part 1: Choice of fixed means of access between two levels.

IS EN ISO 14122-2- Safety of machinery. Permanent means of access to machinery
- Part 2: Working platforms and walkways

IS EN ISO 14122-3- Safety of machinery. Permanent means of access to machinery
- Part 3: Stairs, stepladders and guard-rails

IS EN ISO 14122-4- Safety of machinery. Permanent means of access to machinery
- Part 4: Fixed ladders

IS EN ISO 14122 Part 4 / BS 4211- Specification for permanently fixed ladders.

IS EN ISO 1461- Hot dip galvanized coatings on fabricated iron and steel articles.
Specifications and test methods

IS EN 10025 parts 1 to 6 - Hot rolled products of structural steels

xxxii) Protective Coatings

IS EN ISO 8501-1- Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings

IS EN ISO 8501-3:2007, BS 7079-A3:2006 - Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Preparation grades of welds, edges and other areas with surface imperfections

BS EN ISO 12944-2:2017 - Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Classification of environments

IS EN ISO 12944-4- Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Types of surface and surface preparation.

IS EN ISO 11124-1- Preparation of steel substrates before application of paints and related products. Specifications for metallic blast-cleaning abrasives. General introduction and classification.

BS 381C- Specification for colours for identification, coding and special purposes.

BS 4800- Schedule of paint colours for building purposes.

IS EN ISO 2808- Paints and varnishes. Determination of film thickness.

IS EN ISO 14713-1:2017 - Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. General principles of design and corrosion resistance

IS EN ISO 14713-2- Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures. Part 2: Hot dip galvanizing.

BS 7371-6- Coatings on metal fasteners. Specification for hot dipped galvanized coatings. BS 7371-8- Coatings on metal fasteners. Specification for sherardized coatings.

IS EN ISO 17668- Zinc diffusion coatings on ferrous products. Sherardizing. Specification.

xxxiii) Concrete

Standards and Codes of Practice

IS EN 206, Concrete - (including Irish National Annex, 2015): Specification, performance, production and conformity.

IS EN 1992-3Eurocode 2 - Design of concrete structures. Liquid retaining and containing structures.

IS EN 13670- Execution of concrete structures.

IS EN 197-1 Cement. Composition, specifications and conformity criteria for common cements.

IS EN 12620- Aggregates for concrete

IS EN 1008- Mixing water for concrete. Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete

IS EN 934-2- Admixtures for concrete, mortar and grout - Part 2 (including Irish National Annex, 2009): Concrete admixtures - Definitions, requirements, conformity, marking and labelling.

IS EN 12878- Pigments for the colouring of building materials based on cement and/or lime. Specifications and methods of test.

IS EN 15978:2011 - Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method

Formwork and Falsework

BS 5975- Code of practice for temporary works procedures and the permissible stress design of falsework.

IS EN 12812– Falsework, performance requirements and general design.

IS EN 12813– Temporary works equipment – load bearing towers of prefabricated components – methods of structural design.

CIRIA Report No. 108: Concrete Pressure on Formwork.

Reinforcement

IS EN 10080- Steel for the reinforcement of concrete. Weldable reinforcing steel.

BS 4449- Steel for the reinforcement of concrete. Weldable reinforcing steel. Bar, coil and decoiled product. Specification.

BS 4482- Steel wire for the reinforcement of concrete products. Specification.

BS 4483- Steel fabric for the reinforcement of concrete. Specification.

BS 6744- Stainless steel bars for the reinforcement of and use in concrete. Requirements and test methods.

BS 8666- Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete. Specification.

BS 7973-1- Spacers and chairs for steel reinforcement and their specification. Product performance requirements.

IS EN 14889-1– Fibres for Concrete. Steel Fibres. Definitions, specifications & conformity

IS EN 14889-2– Fibres for Concrete. Polymer Fibres. Definitions, specifications & conformity

IS EN 14845-1– Test methods for fibres in concrete.

Sampling and Testing of Concrete

IS EN 12390-1- Testing hardened concrete. Shape, dimensions and other requirements for specimens and moulds.

IS EN 12390-2- Testing hardened concrete. Making and curing specimens for strength tests.

IS EN 12350-1- Testing fresh concrete. Sampling and common apparatus.

IS EN 12350-2 -Testing fresh concrete. Slump-test.

IS EN ISO / IEC 17025-General requirements for the competence of testing and calibration laboratories.

IS EN 12390-3 - Testing hardened concrete. Compressive strength of test specimens.

IS EN 12390-4 - Testing hardened concrete. Compressive strength. Specification for testing machines.

IS EN 12390-7- Testing hardened concrete. Density of hardened concrete.

BS 1881-204 - Testing concrete. Recommendations on the use of electromagnetic covermeters.

BS 1881-206 - Testing concrete. Recommendations for determination of strain in concrete.

IS EN 12504-2 -Testing concrete in structures. Non-destructive testing. Determination of rebound number.

IS EN 12504-4 - Testing concrete. Determination of ultrasonic pulse velocity.

Precast and Prestressed Concrete

BS 5606 - Guide to accuracy in building

IS EN 81-20 - Safety rules for the construction and installation of lifts. Lifts for the transport of persons and goods. Passenger and goods passenger lifts.

IS EN 81-50 - Safety rules for the construction and installation of lifts. Examinations and tests. Design rules, calculations, examinations and tests of lift components.

BS 6954-1- Tolerances for building. Recommendations for basic principles for evaluation and specification.

ISO 3443-1-Tolerances for building - Part 1: Basic principles for evaluation and specification.

BS 6954-3 - Tolerances for building. Recommendations for selecting target size and predicting fit.

Ancillary Items

ASTM C1019 – 14: Standard Test Method for Sampling and Testing Grout.

“Concrete Advice No. 5” published by The Concrete Society in the United Kingdom.

“Code of Practice for the Design and Installation of Anchors” published by the HAS.

xxxiv) Masonry

IS EN 1996-2 Eurocode 6 -Design of masonry structures. Design considerations, selection of materials and execution of masonry.

IS EN 771-1- Specification for masonry units. Clay masonry units

IS EN 771-2 - Specification for masonry units. Calcium silicate masonry units

IS EN 771-3 - Specification for masonry units. Aggregate concrete masonry units (dense and lightweight aggregates)

IS EN 771-4 - Specification for masonry units. Autoclaved aerated concrete masonry units

IS EN 771-5- Specification for masonry units. Manufactured stone masonry units

IS EN 771-6 - Specification for masonry units . Natural stone masonry units

BS 4729 - Clay bricks of special shapes and sizes. Recommendations.

IS EN 998-2 - Specification for mortar for masonry . Masonry mortar.

IS EN 459-1 - Building lime. Definitions, specifications and conformity criteria.

IS EN 13139 - Aggregates for mortar

IS EN 934-3 - Admixtures for concrete, mortar and grout. Admixtures for masonry mortar. Definitions, requirements, conformity and marking and labelling.

IS EN 845-1- Specification for ancillary components for masonry. Wall ties, tension straps, hangers and brackets.

BS EN ISO 11600:2003+A1:2011 - Building construction. Jointing products. Classification and requirements for sealants

BS 743 - Specification for materials for damp-proof courses

BS 6398 - Specification for bitumen damp-proof courses for masonry

BS 6515 - Specification for polyethylene damp-proof courses for masonry

BS 8215- Code of practice for design and installation of damp-proof courses in masonry construction

IS EN ISO 1015-1-18: 2003 + A1: 2011 - Building construction. Jointing products. Classification and requirements for sealants.

IS EN 845-2- Specification for ancillary components for masonry. Lintels.

IS EN 1015-21- Methods of test for mortar for masonry. Determination of the compatibility of one-coat rendering mortars with substrates.

IS EN 772-1-21 - Methods of test for masonry units. Determination of water absorption of aggregate concrete, autoclaved aerated concrete, manufactured stone and natural stone masonry units due to capillary action and the initial rate of water absorption of clay masonry units.

S.R. 325 – Recommendations for the design of masonry structures in Ireland to Eurocode 6

S.R. 16 – Guidance on the Use of IS EN 12620

S.R. 18 – Guidance on the use of IS EN 13139

xxxv) Road Works

IS EN 10060 - Hot rolled round steel bars for general purposes. Dimensions and tolerances on shape and dimensions.

IS EN 13877-2 Concrete pavements. Functional requirements for concrete pavements.

IS EN 13877-3 Concrete pavements. Specifications for dowels to be used in concrete pavements

IS EN 14188-1 - Joint fillers and sealants. Specifications for hot applied sealants.

BS 2499-2: - Hot-applied joint sealant systems for concrete pavements. Code of practice for the application and use of joint sealants.

IS EN 14023 Bitumen and bituminous binders. Specification framework for polymer modified bitumen's.

BS EN 1340:2003 - Concrete kerb units. Requirements and test methods

BS 7533-101:2021 - Pavements constructed with clay, concrete or natural stone paving units. Code of practice for the structural design of pavements using modular paving units

xxxvi) Aggregates

BS 812-124- Testing aggregates. Method for determination of frost heave.

xxxvii) Ducting

IS EN 61386-21- Conduit systems for cable management. Requirements. Rigid conduit systems.

BS 5252– Framework for colour co-ordination for building purposes

IS EN 933-1- Tests for geometrical properties of aggregates. Determination of particle size distribution. Sieving method.

IS EN 12620 Aggregates for concrete

xxxviii) Water Supply and Drainage

Drains and Sewers

BS 5911-1- Concrete pipes and ancillary concrete products. Specification for unreinforced and reinforced concrete pipes (including jacking pipes) and fittings with flexible joints (complementary to IS EN 1916: 2002).

BS 5911-3- Concrete pipes and ancillary concrete products. Specification for unreinforced and reinforced concrete manholes and soakaways (complementary to IS EN 1917: 2002).

BS 437- Specification for cast iron drainpipes, fittings and their joints for socketed and socket less systems.

IS EN 598- Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods.

IS EN 1401-1- Plastic piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system.

IS EN 752- Drain and sewer systems outside buildings.

IS EN 124-1- Gully tops and manhole tops for vehicular and pedestrian areas. Definitions, classification, general principles of design, performance requirements and test methods.

Land Drains

IS EN 295-1- Vitrified clay pipe systems for drains and sewers. Requirements for pipes, fittings and joints.

BS 3506- Specification for unplasticized PVC pipe for industrial uses.

Water Mains

IS EN ISO 9001, - Quality management systems. Requirements.

BS PAS 27- Unplasticized poly(vinyl chloride) alloy (PVC-A) pipes and bends for water under pressure.

IS EN 545- Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods.

IS EN 12201-2- Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Pipes.

IS EN 1074-1- Valves for water supply. Fitness for purpose requirements and appropriate verification tests. General requirements.

IS EN 1074-2- Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Isolating valves.

BS 750- Specification for underground fire hydrants and surface box frames and covers.

IS EN 14901 part 1 & 2 – Ductile iron pipes, fittings and accessories - Requirements and test methods for organic coatings of ductile iron fittings and accessories

IW-CDS-5020-01 – Water Infrastructure Standard Details

IW-CDS-5020-02 – Design Risk Assessment for Water Infrastructure Standard Details

IW-CDS-502-03 – Code of Practice for Water Infrastructure

Rainwater Goods

IS EN 612- Eaves gutters with bead stiffened fronts and rainwater pipes with seamed joints made of metal sheet.

BS 460- Cast iron rainwater goods. Specification.

IS EN 12200-1- Plastics rainwater piping systems for above ground external use. Unplasticized poly (vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system.

Oil Interceptors

IS EN 858-2- Separator systems for light liquids (e.g. oil and petrol). Selection of nominal size, installation, operation and maintenance.

xxxix) Palisade and Weldmesh Fencing & Gates

BS 1722-12- Fences. Specification for steel palisade fences.

IS EN 13438- Paints and varnishes. Powder organic coatings for hot dip galvanised or sherardised steel products for construction purposes.

xl) Floors

IS EN 12825- Raised access floors.

BS EN IEC 62485-2:2018 - Safety requirements for secondary batteries and battery installations. Stationary batteries)

IEC 61340-4-1:2003+AMD1:2015 - Electrostatics - Part 4-1: Standard test methods for specific applications - Electrical resistance of floor coverings and installed floors

xli) Radon Barrier

IS EN 12311-1- Flexible sheets for waterproofing. Determination of tensile properties. Bitumen sheets for roof waterproofing.

xlii) Plasterwork

IS EN 13914-1- Design, preparation and application of external rendering and internal plastering. External rendering.

IS EN 13914-2- Design, preparation and application of external rendering and internal plastering. Design considerations and essential principles for internal plastering.

BS 8481- Design, preparation and application of internal gypsum, cement, cement and lime plastering systems. Specification.

IS EN 13279-1- Gypsum binders and gypsum plasters. Definitions and requirements.

xlili) Joinery

IS EN 622-1- Fibreboards. Specifications. General requirements.

BS 1186-3 - Timber for and workmanship in joinery. Specification for wood trim and its fixing.

93/703417 DC – Revision of BS 1210:1963 Specification for wood screws.

BS 1202-1- Specification for nails. Steel nails.

BS 1186-2- Timber for and workmanship in joinery. Specification for workmanship.

BS 476 Fire Tests on building materials and structures.

BS 476-3- Fire tests on building materials and structures. Classification and method of test for external fire exposure to roofs.

xliv) Structural Timberwork

IS EN 1995-1-1– Design of Timber Structures.

IS EN 338- Structural timber. Strength classes

IS 435- Timber Post and Rail Roadside Fencing - Collection.

xlvi) Doors

IS EN 12433-1- Industrial, commercial and garage doors and gates - Terminology - Part 1: Types of doors.

IS EN 12433-2- Industrial, commercial and garage doors and gates - Terminology - Part 2: Parts of doors.

IS EN 12444- Industrial, commercial and garage doors and gates. Resistance to wind load. Testing and calculation.

IS EN 12425- Industrial, commercial and garage doors and gates. Resistance to water penetration. Classification.

IS EN 13241- Industrial, commercial and garage doors and gates - Product standard.

BS 6262-3- Glazing for buildings. Code of practice for fire, security and wind loading.

BS 6262-4:2018 - Glazing for buildings. Code of practice for safety related to human impact

BS 476-20- Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles).

BS 476-21- Fire tests on building materials and structures. Methods for determination of the fire resistance of loadbearing elements of construction.

BS 476-22- Fire tests on building materials and structures. Method for determination of the fire resistance of non-loadbearing elements of construction.

BS 476-23- Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure.

BS ISO 3864-1- Graphical symbols. Safety colours and safety signs. Design principles for safety signs and safety markings.

IS EN 12600- Glass in building. Pendulum test. Impact test method and classification for flat glass.

BS 6206- Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings.

IS EN 179- Building hardware. Emergency exit devices operated by a lever handle or push pad, for use on escape routes. Requirements and test methods.

EN 1627 Pedestrian doorsets, windows, curtain walling, grilles and shutters. Burglar resistance. Requirements and classification.

DIN 18251-1: Locks - Mortise locks - Part 1: Mortise locks for rebated doors.

DIN 18251-2: Locks - Mortise locks - Part 2: Mortise locks for tube frame doors.

DIN 18251-3: Locks - Mortise locks - Part 3: Mortise locks as multipoint locks.

xlvi) Tiling

BS 5385-3- Wall and floor tiling. Design and installation of internal and external ceramic and mosaic floor tiling in normal conditions. Code of practice.

xlvii) Metal Composite Panel Wall Cladding

BS 476-7- Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products.

BS 476-3- Fire tests on building materials and structures. Classification and method of test for external fire exposure to roofs.

Loss Prevention Standard LPS 1181: 2003: Part 1: Issue 1 Ceiling Lining Test published by the Loss Prevention Certification Board [LPCB].

BS 5427:2016+A1:2017 - Code of practice for the use of profiled sheet for roof and wall cladding on buildings

IS EN 1991-1-4- Wind actions.

IS EN ISO 13788- Hygrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation methods.

xlviii) Flat Roof Construction

BS 5250:2021 - Management of moisture in buildings. Code of practice.

IS EN 13707- Flexible sheets for waterproofing. Reinforced bitumen sheets for roof waterproofing. Definitions and characteristics.

IS EN 13304-Bitumen and bituminous binders. Framework for specification of oxidised bitumen.

Information Sheet 18 'Code of practice for safe handling of hot bitumen for roofing purposes', in the FRCAB Handbook, produced by the Flat Roofing Contractor's

BS 6229- Flat roofs with continuously supported coverings. Code of practice.

BS 8218- Code of practice for mastic asphalt roofing.

xlix) Plumbing and Sanitary Ware

IS EN 1057- Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications.

IS EN ISO 1452-2- Plastics Piping Systems for Water Supply and for Buried and Above-ground Drainage and Sewerage Under Pressure - Unplasticized Poly(vinyl Chloride) (pvc-u) - Part 2: Pipes.

IS EN ISO 1452-3- Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC-U). Fittings.

IS EN 12056-1: 2000 - Gravity drainage systems inside buildings. General and performance requirements.

IS EN 12056-2-Gravity drainage systems inside buildings. Sanitary pipework, layout and calculation.

BS 6465-1- Sanitary installations. Code of practice for the design of sanitary facilities and scales of provision of sanitary and associated appliances.

BS 6465-2- Sanitary installations. Code of practice for space requirements for sanitary appliances.

BS 6465-3- Sanitary installations. Code of practice for the selection, installation and maintenance of sanitary and associated appliances.

BS 6465-4- Sanitary installations. Code of practice for the provision of public toilets.

IS EN 1329-1- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Unplasticized poly(vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system.

IS EN 1451-1: 2017 & AC- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Polypropylene (PP). Specifications for pipes, fittings and the system.

BS 4514- Unplasticized PVC soil and ventilating pipes of 82.4 mm minimum mean outside diameter, and fittings and accessories of 82.4 mm and of other sizes. Specification.

BS 416-1- Discharge and ventilating pipes and fittings, sand-cast or spun in cast iron. Specification for spigot and socket systems.

BS 5627- Specification for plastics connectors for use with horizontal outlet vitreous China WC pans.

IS EN 274-1- Waste fittings for sanitary appliances. Requirements.

IS EN 12056-5- Gravity drainage systems inside buildings. Installation and testing, instructions for operation, maintenance and use.

l) Fire Detection & Fire Alarm Systems

IS 3218:2013 Fire detection and alarm systems for buildings - system design, installation, servicing and maintenance (+A1:2019)

li) Mechanical and Electrical Services

IS 3217:2013 Emergency lighting (+A1:2017)

lii) Cranes

BS EN 13001-1:2015 - Cranes. General design. General principles and requirements

BS EN 13001-2:2021 - Crane safety. General design. Load actions

BS EN 13001-3-1:2012+A2:2018 - Cranes. General Design. Limit States and proof of competence of steel structure

BS EN 13001-3-2:2014 - Cranes. General design. Limit states and proof of competence of wire ropes in reeving systems

BS EN 13001-3-3:2014 - Cranes. General design. Limit states and proof of competence of wheel/rail contacts

BS EN 13001-3-4:2018 - Cranes. General design. Limit states and proof of competence of machinery. Bearings

BS EN 13001-3-5:2016+A1:2021 - Cranes. General design. Limit states and proof of competence of forged and cast hooks

BS EN 13001-3-6:2018+A1:2021 - Cranes. General design. Limit states and proof of competence of machinery. Hydraulic cylinders

Appendix G - List of Drawings

DRAWING NUMBER			DRAWING TITLE
OFD	SSS	500	STANDARD 220KV AIS ONSHORE COMPENSATION COMPOUND SINGLE LINE DIAGRAM
OFD	SSS	501	STANDARD 220KV AIS ONSHORE COMPENSATION COMPOUND LAYOUT DRAWING - PLAN VIEW
OFD	SSS	502	STANDARD 220KV GIS ONSHORE COMPENSATION COMPOUND SINGLE LINE DIAGRAM
OFD	SSS	503	STANDARD 220KV GIS ONSHORE COMPENSATION COMPOUND. LAYOUT DRAWING - PLAN VIEW
OFD	SSS	504	STANDARD 220KV GIS OFFSHORE SUBSTATION PLATFORM SINGLE LINE DIAGRAM
OFD	SSS	505 TO 510 (inclusive)	NOT USED
OFD	SSS	511	STANDARD SIGNAGE FOR EIRGRID STATIONS
OFD	SSS	512	EARTHING OF CONTROL CABINETS
OFD	SSS	513	GENERAL ARRANGEMENT. EARTHING PRACTICE
OFD	SSS	514	STANDARD ONSHORE COMPENSATION COMPOUND. CONCRETE POST AND RAIL FENCE AND GATE DETAILS.
OFD	SSS	515#	STANDARD ONSHORE COMPENSATION COMPOUND. DETAILS OF PALISADE FENCING
OFD	SSS	516#	STANDARD ONSHORE COMPENSATION COMPOUND. DETAILS OF PALISADE DOUBLE GATE
OFD	SSS	517 -520 (inclusive)	NOT USED
OFD	SSS	521	STANDARD – AS-BUILT CABLE ROUTE
OFD	SSS	522	STANDARD – C2 CHAMBER
OFD	SSS	523	STANDARD – LINK BOX CHAMBER
OFD	SSS	524	STANDARD – TRANSITION CHAMBER
OFD	SSS	525	HV CABLE EARTHING PRACTICE JOINT BAYS
OFD	SSS	526	JB CLAMP BRACKET
OFD	SSS	527	STANDARD - 3RD PARTY CROSSING (300 MM ABOVE)
OFD	SSS	528	STANDARD - 3RD PARTY CROSSING (300 MM BELOW)
OFD	SSS	529	STANDARD - RIVERBED CROSSING
OFD	SSS	530	STANDARD - BRIDGE CROSSING
OFD	SSS	531	STANDARD - TRENCH THROUGH PEAT
OFD	SSS	532	STANDARD – TRENCH CROSS SECTION
OFD	SSS	533	STANDARD – PRE-CAST JOINT BAY 8 X 2.6 M (220 KV)