



registered office:

**OAKLANDS,
HEADFORD,
CO. GALWAY.**

Ph: 093-35641
Fax: 093-35050

Newell Consulting Engineers Ltd.

Chartered Engineers & Registered Building Surveyors

web: www.newelleng.ie email: info@newelleng.ie

**BALLYCLIDER,
PORTLAOISE,
CO. LAOIS.**

Mob.: 086-2106823
Ph: 093-35641

Your Ref:

Our Ref: 789524

Date: 31 August, 2026

(Please quote in all correspondence)

REQUEST FOR QUOTATIONS

TO WHOM IT MAY CONCERN

Works Specifications

Upgrades and Alterations at Scoil Ailbhe, Parnell Street, Thurles, Co. Tipperary.

Roll No.: 17634M

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SECTION 1 – GENERAL DESCRIPTION

The project consists of removal of existing damaged floors and supporting structures, fumigation of the entire school and installation of new floors at large sections of the school. Also include is internal modifications and upgrades to facilitate the installation of a new toilet and sensory room serving the ASD classroom at the school. All installed and upgraded services will be connected into the existing and revised facilities with upgrades where necessary. Service connections will be installed as necessary to connect to the existing school water, heating, electrical and ICT systems.

It will be the duty of the contractor and all sub-contractors, prior to commencing work on site, to survey and familiarise themselves with all the above and below ground services, runs, ducts, etc and carry out construction, including moving and protecting these services, in an appropriate and safe manner.

General

All works and materials must comply with the current building regulations and technical guidance documents, the latest relevant Irish and EU Standards (supplemented where necessary by BS Standards), Codes of Practice and Regulations, Health and Safety Regulations and all relevant planning permissions and fire safety certificates.

All construction products must comply with the Construction Products Regulations. Where covered by hEN standards all construction products used must bear the CE marking and have Certificates of Conformance. (The successful contract will be required to keep the conformance certificates on file and provide copies to the Engineer in Charge.) Where not covered by hEN standards any product used shall comply with the appropriate national standard or have an appropriate Irish Agreement Certificate, copy to be provided to Engineer in Charge.

Prior to commencing the works the contractor must carry out a full above and below ground site services and utilities survey to identify locations and runs of all services including electrical cables, communications infrastructure, sewers, soakaways, etc. The site specific safety plan for the construction works must be based on the results of this survey and the survey must be forward to the Engineer in Charge prior to the commencement of construction works.

SECTION 2 – SCOPE OF WORKS

Works to existing floors

The contractor must include in their costings to address these works on a “room by room” approach or a “whole school” approach depending on project timing:

1. Existing timber floors, floor covering and battens to be completely removed from the areas shown on the attached drawings.
 - a. All existing furniture, fixtures, etc. must be removed and stored whilst these works are ongoing.
2. Existing subfloors to be cleaned and prepared by removal of all debris, loose material.
3. Contractor to supply and install new treated timber battens of an appropriate size at max 400mm spacing across all the timber floors to be replaced (with the exception of the GP Hall and Stage area, see below)
 - a. Battens to be screw fixed at max 400mm spacings to underlying floor structure with stainless steel CE certified screws.
4. Contractor to supply and install new treated, foam backed, sprung batons to GP Hall and Stage area. Sprung batons must match the sports flooring to be used (Junckers Unobat or equal approved) and must be fixed down to manufacturer’s specifications, including fixings, adhesives and suitable membrane.
5. Four separate floor build ups are to be used in the rehabilitated areas as detailed below. All floors will require new painted red deal skirting board throughout:
 - a. In timber floored classroom areas a new floor is to be installed on top of the newly installed battens the floor must consist of:
 - i. 18mm CE Certified EN 636-2S F30/40 E60/70 Birch plywood to EN12369 screw fixed to the newly installed battens with CE Certified 5mm Grade 8.8 countersunk stainless steel woodscrews to BS1210 and EN14592
 - ii. 5.5mm SP101 flooring plywood to be mechanically fixed on top of the underlying structural plywood to manufacturer’s specifications including all suitable gluing and fixings.
 - iii. SP101 to be primed if necessary and then a proprietary flex smoothing compound to be installed in accordance with manufacturer's specifications. The flex smoothing compound must be compatible with

the flooring membrane listed below and installed in accordance with BS8203:2017

- iv. Floor finishing – Furbo Marmoleum Fresco or Sarlon to be installed in each room as shown on attached drawings. Indicative colours shown – exact colours to be agreed with client and design team in advance.
- b. In Sports Hall and on Stage:
 - i. New Junckers pre-finished solid maple sports flooring to be installed on the sprung battons as per manufacturers guidelines, with appropriate expansion joints.
 - ii. Contractor to include for 120m of agreed sports line marking in two separate colours on the new sports flooring. Protective matt coating to be installed if necessary to protect the line marking.
- c. In Library and Office area:
 - i. 18mm CE Certified EN 636-2S F30/40 E60/70 Birch plywood to EN12369 screw fixed to the newly installed battons with CE Certified 5mm Grade 8.8 countersunk stainless steel woodscrews to BS1210 and EN14592
 - ii. 5.5mm SP101 flooring plywood to be mechanically fixed on top of the underlying structural plywood to manufacturer's specifications including all suitable gluing and fixings.
 - iii. SP101 to be primed if necessary and then a proprietary flex smoothing compound to be installed in accordance with manufacturer's specifications. The flex smoothing compound must be compatible with the flooring membrane listed below and installed in accordance with BS8203:2017
 - iv. Floor finishing – Furbo Flotex colour carpet to be installed in each room as shown on attached drawings. Indicative colours shown – exact colours to be agreed with client and design team in advance.
- d. In concrete floored areas (e.g.: SET Rooms 15, 16, 17)
 - i. Existing floor covering to be removed and all debris cleaned/scraped off to leave suitable concrete surface.
 - ii. New proprietary smoothing/levelling compound to be installed to floor finish manufacturer's guidelines.
 - iii. Floor finishing – Furbo Marmoleum Fresco to be installed in each room as shown on attached drawings. Indicative colours shown – exact

colours to be agreed with client and design team in advance.

6. In all rooms where floors are to be rehabilitated the contractor is to include from removal and temporary storage of all furniture and fixtures to facilitate the works. Where existing furniture is found to be wood-worm infested an agreed schedule of disposal must be prepared with the client. All remaining items to be reinstalled after the works have been completed.
7. Note the new lightweight walls to be constructed in the ASD area. The necessary parts of these works, as shown on the attached drawings, and detailed below, must be carried out whilst the floors are removed.

School fumigation

The contractor must include for 2 No. Woodworm SPI fumigations of the entire building at least four weeks apart. (Exact treatment methodology to be agreed with Engineer in Charge in advance – e.g. ProFume Sulfuryl Flouride or similar) The fumigation must be carried out at times when the school is empty and will have sufficient time to recuperate before next occupation and the timing must be selected in conjunction with the school authorities, the Engineer in Charge and the supplier in order to allow for preparation and to target the time at which the solution will be most effective.

Ventilation

Contractor to install 20 number new passive wall vents (min 150mm diameter) in selected rooms across the school. (One per room). Locations will be agreed on site on a room by room basis. Stainless steel / galvanised external wall vent cover and non-closing internal room side vent cover along with vent sleeve to be included in each case.

Bicycle Stand

Contractor to install a new 150mm concrete base with pin rolled anti-slip anti-ice finish on new compacted sub-base at location shown on attached drawings. A new prefabricated

galvanised steel bike shelter with polycarbonate roof to be bolted to the newly installed concrete base. Kenilworth W2000 x D2150 or similar. Bike shelter to include 4 No. inverted U bike galvanised steel racks anchored to the concrete base.

Concrete base to have a 2% fall towards the rear and a gravel filled french drain at the rear perimeter for drainage.

ASD Conversion Works

The attached drawings show the works necessary to convert the existing classroom into a toilet, store and sensory room as well as works to the existing ASD classroom at the school. The existing fittings and furnishings in the classroom to be converted must be removed and disposed of at a suitably licensed facility. The construction of new walls, flooring, finishes, fittings, etc. must be completed as shown on the attached drawings and in line with the details below.

A new water supply to serve the toilet and sink must be taken from the existing water supply near the first floor toilet block. It will be the duty of the contractor to sufficiently pipe this supply along the existing ceilings and carry out the necessary floor penetrations and fire sealing.

A similar process must be employed to connect the electrical installations to the existing consumer unit near the stairs in the front hall. The existing fire alarm must be extended to cater for the newly created room including the installation of additional zones as necessary on the existing fire panel.

A new sewer connection must be installed along the footpath outside the converted room to connect to the existing sewer at the corner of the school. Note that the existing sewers are shallow so the newly installed 150mm sewer will be required to be encased in concrete for its entire length.

All new, upgraded and existing services, including civil, mechanical and electrical must be appropriately connected and interlinked with existing school systems in accordance with the Building Regulations, manufacturer's requirements and relevant legislation/regulations.

SECTION 3 – BUILDER’S WORKS – ARCHITECTURAL AND STRUCTURAL

Structural Works

All structural works to be as shown on attached drawings and to be constructed in compliance with current Building Regulations as well as IS EN 1990, 1991, 1992, 1993, 1994, 1995, 1996 and 1997 supplemented where necessary by SR325 and BS 5628. Detailed design calculations and certified performance criterion for all precast elements to be provided to this office prior to casting/construction of any elements. It will be the duty of the contractor to ensure that all precast elements meet the requirements of all relevant codes and standards to the satisfaction of the Engineer in Charge prior to installation. All structural blocks to be colour coded to agreed standards and coding. Where lightweight blocks are specified the blocks must be Quinlite B7 or similar with a minimum certified compressive strength of 7.5 N/mm² or higher. Unless otherwise specified all above ground structural concrete must be of grade C25/30 and all foundation and below ground concrete must be of grade C32/40 and all masonry units must be solid Class 1 units with a compressive strength of at least 7.5 N/mm².

Certification for fill material, including CE Certificate, Declarations of Performance and Grading Charts to be provided for verification before any material is brought to site. All delivery dockets for fill to be kept and supplied to this Firm at the end of the project. Fill delivery dockets to be in compliance with IS888.

All blockwork to be constructed using concrete blocks with a certified minimum strength of 7.5 N/mm² or higher. Where structural blocks are indicated these must be of a minimum strength of 20 N/mm² and colour coded as agreed with Engineer in advance. Where lightweight blocks are specified the blocks must be Mannok Aircrete B7 or similar with a minimum certified compressive strength of 7.5 N/mm² or higher. Grade M4 mortar in accordance with IS EN 1996 to be used in all blockwork construction unless otherwise specified. All masonry and other structures to be “wind-braced” in accordance with the requirements of SR325, BS5628 and IS EN 1991 and IS EN 1996. Wall ties to IS 845 (or equal approved) to be installed in all cavity walls with a 750mm maximum horizontal spacing and 450mm maximum staggered vertical spacing. Minimum 5 wall ties per square metre. Extra wall ties at openings and movement joints as per Diagram 9 of TGD A. Blocks used in the outer leaf of all external walls within 150mm of the DPC and footpath level must have a minimum certified compressive strength of 13.0 N/mm² or higher and Grade M12 mortar must be used to bed these blocks.

DPC to be installed at all window opes, door opes and potential moisture ingress points. Cavity trays to be installed as necessary in cavity walls. Details to be confirmed with Engineer in Charge prior to construction.

Mortar and pointing to be continuous on all horizontal and vertical joints throughout the blockwork. Areas with insufficient mortar work and pointing will have to be knocked and rebuilt at the contractor's expense. Air leakage through these joints will not be accepted. A certified air tightness test for the rooms will be required on completion to prove an air tightness of 3 m³/m²/hr or better. Note that particular care must be taken in construction of the rooflight shafts. Blocklaying site practice should following the guidelines of IS EN 1996 and of CBA Data Sheet 11. Attention should be paid to all ambient temperature requirements and appropriate wall ties must be installed in each 225mm course at all openings including the top of the cavity walls.

Solid concrete block construction to be used to block up any existing windows or doors where shown. Construction must provide minimum 60 minute fire resistance. Blocked up windows to be finished and finished to match existing and full room painted as per specification below.

10mm movement joints to be formed where shown using 13mm polyethylene foam strip with a bond breaker and finished in a suitable sealant such as 2 part polysulphide. Where joint extends through render or tiling a galvanised expanded metal uPVC finish stop bead should be used to cover the joint. Fire rated movement joints to be installed where shown.

Unless otherwise noted all structural steel to be grade S275 with a subgrade of JR for internal elements and J2 for steel not within the thermal envelope. All structural steelwork shall have an execution class of EXC2 in accordance with IS EN 1090 unless otherwise noted. All structural steel members to have a certified 60 min fire protection coating of intumescent paint and external steel members to have a protective coating suitable for corrosivity class C3 environments.

All internal walls to be fixed to underside of overlying concrete slabs or braced between ceiling joists as per the attached drawings.

Roofing Works

Ceilings to be of 30 minute fire resisting construction with joints to correspond with solid timber backing members. Underside of joist trusses to be cross-battened prior to installation of the half hour fire resisting slab. Ceilings to be skimmed appropriately and painted as specified below. Ceilings below roof level to be installed in accordance with Gyproc “The White Book” Manual Table 6b, including all necessary timber noggings between joists to support board edges and at room perimeter. **Note all timber backing members, including trusses to be minimum 38mm thick.**

Do not scale from drawings. All measurements are indicative and should be checked by the contractor. It will be the duty of the contractor to ensure that all truss and timber dimensions are correct at time of ordering and installation.

Any roofing joists for any new flat timber roof area to be certified, tanned and meet the structural requirements of IS 444, IS EN 1990, IS EN 1991 and IS EN 1995. Precast concrete slabbed flat roofs where specified to meet the specification for precast units detailed above. Where cast in-situ concrete roofs are proposed the contractor must agree a specification in advance of contract signing with Engineer in Charge.

Install cavity barriers as necessary in any attic spaces and as shown on attached drawings. Fire detectors to be installed in all attic spaces as shown on drawings. Where cavity barriers are cut or opened for access they must be repaired/replaced to as new condition.

Raised plywood walkways to be installed in attic areas from hatches to all serviceable items in the attic. Walkway not to compress insulation. Insulated, draught stripped attic hatch to be installed to each attic area.

Floor insulation to be sufficient to provide a U-Value of 0.16W/m²K using 100mm Xtratherm Thin-R XT or equal approved insulation.

Finishes, Painting & Insulation

Smooth hard wall plaster finish on all internal walls. Sand and cement nap plaster finish on external walls to match existing school colour and finishes as shown on attached drawings or as otherwise agreed. Suitably repair all damage to the existing external and internal finishes.

Where existing “dash” plaster walls become new internal walls the existing render finish must be removed from the walls and a new nap plaster sand and cement render added and finished with a skim finish as detailed below.

Unless otherwise specified on drawings all new walls to have 150mm cavity with 150mm of Agreement Certified Platinum Bonded Bead insulation with a thermal transmissivity of 0.033W/mK or agreed equal approved alternative. Type and specification of insulation to be agreed in advance with Engineer in Charge. All insulation throughout to comply with Part L of the current Building Regulations. A thermal image assessment of every new wall must be provided on completion. Certified air tightness of 3m³/h per m² (or better) at 50 Pa is required.

Top of all cavity walls and all window, door and opes to be certified fire stopped.

Concrete cover to meet the requirements of I.S. E.N. 1992 throughout. Design and reinforcement to be confirmed with Engineer in Charge prior to installation. Provide for specified external vents as shown on the plans.

All structural steel beams and columns to be provided with certified 60 minute fire resisting intumescent paint protection throughout.

Provide for the complete paint-out of both all internal and all external walls, ceilings and timber work throughout the new and renovated sections of the school in selected colours where alteration works are carried out. Painting to include for a sealing coat and two top coats of appropriate Dulux paints (external and internal) in selected colours to be agreed with the Consultant Engineer in Charge. Use eggshell/“easicare” washable finish on the inside painting. Architrave, door frames and skirtings to be finished in high gloss Dulux Cornfield yellow paint. All new timber doors (typically FD30S or FD60S where specified) to be

finished in selected primary colours, as agreed with the Engineer in Charge. Contractor to provide certification for fire rating of all installed **door sets**. Doors to be marked with metal plate indicators showing fire rating. Use push-pads and kick-plates on all doors. All walls to be finished in a washable “easicare” / “eggshell” type finish.

Existing windows to be blocked up with solid concrete block construction where shown.

Surface finish of sanitary fittings, grab-rails and doors, should contrast visually with their background in accordance with Section 1.6.4 of TGD M: 2010. There should also be a visual contrast between wall and floor finishes in accordance with Section 1.6.4 of TGD M: 2010.

Where visual contrast is provided the difference in the LRV of the surfaces should be 30 points or more when measured in accordance with BS8300:2009 Annex B or BS8493:2008. For large areas such as walls and floors a difference in LRV of 20 points or more is acceptable provided the illuminance on the surfaces is 200 lux or more. For door opening furniture a difference in the LRV of 15 points between the product and its background is acceptable. All walls, floors, ironmongery and grab-rails both inside and outside must meet these visual contrast requirements. Where visual contrast is provided shadow, glare and large repeating patterns should be avoided and the area should be adequately lit in all conditions.

Windows, Roofs, Floor Coverings, Tiling, Doors & Ironmongery

Use selected colour Forbo Marmoleum in all new and upgraded areas except in the wet areas where R11 Forbo Marmoleum or equal approved floor covering is to be used. Marmoleum to be cleaned and sealed with the recommended manufacturer’s sealing compound after installation. Non slip floor tiles or selected marmoleum both with at least R10 surface finish to be used for 2 metres inside the outer entrance doors and on the exposed covered external section of flooring. Marmoleum Safe-step R11 surface finish to all disabled en-suites/toilets and sluice rooms. Sure-Step Marmoleum at least R10 surface finish in agreed colour, size and pattern to be installed in all other toilet areas and serveries. Turn-up edging in all R10 and R11 areas to provide 150mm skirting. Marmoleum floor covering with at least R10 surface finish to be used on all slopes.

All new internal door openings throughout the building, old and new to be a minimum FD30S standard and FD60S where required and also to include for vision panels and self closing mechanisms with metal push-plates and kick-plates. **All doors must have proprietary finger guards.** Fire rating of each door to be indicated with a metal disk. Front entrance doors to the classroom en-suite toilets to be FD30S and be self closing. Store room doors must be FD30S with self closers on both opening sections. Vision Panels to be in accordance Diagram 10 of Technical Guidance Document M 2022. Heavy duty school standard ironmongery including matching push plates and kick plates to be used throughout. Type and make to be agreed with the Engineer in Charge before purchase or installation. New external entrance door units and panels, front, rear and sides to be heavy duty (agreed AMS section or equivalent – minimum 66mm thermally broken section) double swing full glazed industrial quality thermal break aluminium units with self closing mechanisms, fully protected wind bracing and with fire escape push-bar use combined with security locking mechanisms IS EN 1125:2008. All fire doors on the corridors to be double swing with vision panels and to have fire alarm electro-magnetic controlled closing mechanisms. All external doors from the classrooms to be full glazed industrial quality thermal break aluminium units (agreed AMS section or equivalent – minimum 66mm thermally broken section) with self closing mechanisms, fully protected wind bracing and with fire escape push-bar use combined with security locking mechanisms to IS EN 1125:2008 Ironmongery to be agreed with the Consulting Engineer in Charge before purchase or installation. All doors to be self closing with top frame mechanical closers suitable for child use. **Clear opes for all doors** must be in accordance with Technical Guidance Document M 2022 – Table 3 and Diagram 10. Toughened glass to be used for glass elements of all external doors.

Proprietary finger guards must be installed on all new or upgraded doors.

Fire and Smoke brush intumescent strips to be installed on all fire doors throughout the building as shown.

Moulded and painted red deal architrave and 150mm moulded and painted skirting to be used throughout. Use high gloss “Cornfield” yellow paint on all door frames, architrave and skirting throughout the building.

New windows to be installed as shown on attached drawings to be uPVC heavy duty section, double glazed, toughened, with low emissivity coating throughout. Construction, openings, design and colour to be agreed with the Consulting Engineer prior to manufacture. Glass units to have a certified u-value of 1.1 W/m²K or better and overall window units to have a certified u-value of 1.4 W/m²K or better. Construction, openings, design and colour to be agreed with the Consulting Engineer prior to manufacture. Window certification, signed by a representative of the window manufacturer, to be supplied as part of the school safety file and copied to the Consulting Engineer in Charge. All new windows to comply with TGD-021-1 Guidance on the Specification of Windows First Edition April 2010. **Safety restrictors** to be installed on all window openings. Closing mechanism for all high level openings to be operational from ground level. All external windows to be in toughened glass. Use warm edge sealing edging on all double glazed units.

Guardrails to be installed as per TGD K on all windows.

All “safety glass” should be marked in accordance with “Glass and Glazing Federation” guidelines and with the name of the manufacturer, identifier of the product standard that the safety glass conforms to and the classification according to BS EN 12600.

In addition to the above requirements all windows must be in compliance with Dept. of Education and Skills Technical Guidance Document 021-1a (Copy available on request.) All windows must meet the “Window Compliance Requirements” listed below.

Where solid panels are part of the window unit the U-Value of these panel must match or be better than the U-Value of the glazing units in the rest of the windows.

Note: Fire rated attic hatches with 30 minute fire resistance(FAKRO LSF fire-resistant scissor loft ladder or equal approved) are to be installed at agreed locations as per attached plans.

SECTION 4 – COORDINATED FIRE INFORMATION

Fire Door Schedule

Three number Fire Doors are to be installed (FD1, FD2 and FD3) and these door are scheduled, detailed and drawn on drawing number 789424_PS_006 and 789424_PS_302.

Fire Compartmentalisation

Existing fire compartmentalisation to be unaltered with the exception of the new openings and fire rated wall constructions shown on drawing 789424_PS_006.

Fire Resistance of Installations and Fire Stopping of Openings

Fire resistance of newly constructed elements and required fire-stopping including resistance periods to flame and smoke are shown on Fire Safety Drawing 789424_PS_006.

SECTION 5 – MOISTURE PREVENTION STRATEGY

General

The Contractor shall prepare, implement, maintain and continuously update a Moisture Protection Strategy for the duration of the Contract. The purpose of the strategy is to prevent damage arising from rainwater, groundwater, construction moisture, condensation, accidental water ingress and inappropriate storage or installation of moisture-sensitive materials.

The Contractor shall ensure that all materials incorporated into the Works are maintained in a dry condition suitable for their intended purpose and shall prevent deterioration of completed and partially completed work arising from moisture.

The Moisture Protection Strategy shall form part of the Contractor's Project Quality Plan and shall be submitted upon request to the Employer's Representative. Submission of the strategy shall not relieve the Contractor of any responsibility under the Contract.

Scope

The Moisture Protection Strategy shall apply to all works including, but not limited to:

- Removal and disposal of existing timber flooring affected by woodworm infestation.
- Fumigation works.
- Removal of floor build-ups.
- Installation of replacement floor construction.
- Construction of new lightweight masonry internal partitions.
- Formation of the new sensory room.
- Formation of the new toilet accommodation.
- Installation of finishes, joinery, doors, ironmongery, ceilings and decorations.
- Storage of all materials on Site.
- Protection of completed works until Practical Completion.

Contractor's Responsibilities

The Contractor shall:

- a. identify all potential sources of moisture affecting the Works;

- b. identify all moisture-sensitive materials;
- c. sequence the Works to minimise exposure to moisture;
- d. protect exposed building fabric during demolition;
- e. prevent rainwater entering the building during all phases of construction;
- f. ensure new materials are not installed until substrates are dry and suitable;
- g. continuously inspect moisture protection measures throughout the Contract;
- h. maintain records demonstrating compliance with this requirement.

Removal of Existing Timber Floors

During removal of existing timber flooring the Contractor shall:

- minimise the extent of exposed floor areas;
- prevent rainwater entering the building;
- provide temporary weatherproof protection where floors are removed adjacent to external walls or openings;
- immediately remove all water entering the Works;
- ensure exposed structural timbers remain protected from rainfall;
- remove all debris capable of retaining moisture.

Any timber identified as unsuitable due to moisture damage or fungal decay shall be reported immediately to the Employer's Representative.

Fumigation Works

The Contractor shall ensure that:

- fumigation works are undertaken strictly in accordance with the specialist contractor's recommendations;
- the building is adequately ventilated following completion of fumigation;
- no moisture-sensitive materials are introduced before the treated areas have been certified suitable for reoccupation;
- any temporary sealing measures do not result in long-term moisture entrapment within the building fabric.

Storage of Materials

The Contractor shall store all moisture-sensitive materials in accordance with the manufacturer's recommendations.

Without limitation this shall include:

- timber;
- engineered timber flooring;
- sheet flooring;
- plasterboard;
- insulation;
- suspended ceiling components;
- doors;
- joinery;
- adhesives;
- paints and decorative finishes.

Materials shall:

- be stored clear of the ground;
- remain in unopened packaging until required;
- be protected from rainfall;
- be protected from condensation;
- not be stored within damp areas of the building.

Any material becoming wet shall be immediately removed, inspected and replaced where deterioration has occurred.

New Floor Construction

Prior to installation of new floor finishes the Contractor shall demonstrate that:

- any concrete has adequately cured;
- screeds have achieved the moisture content specified by the manufacturer of the proposed floor finish;
- timber moisture content complies with the flooring manufacturer's recommendations;
- substrates are clean, dry and free from contamination.

The Contractor shall undertake moisture testing using calibrated equipment and shall submit test records to the Employer's Representative as part of the safety file. Installation may only proceed if test results are suitable.

Lightweight Masonry Partitions

The Contractor shall:

- minimise introduction of excess construction water;
- protect newly constructed partitions from saturation;
- allow mortar and plaster to adequately cure;

- provide suitable ventilation during drying;
- prevent finishes being applied to damp substrates.

Decorations shall not commence until the Contractor has confirmed that substrate moisture levels comply with the manufacturer's requirements.

Weather Protection

The Contractor shall maintain the building in a weather-tight condition throughout the Contract. Where temporary openings are created the Contractor shall immediately install suitable weatherproof protection. Temporary weather protection shall remain effective during periods of heavy rainfall and high winds. No work shall proceed where moisture ingress is likely to damage completed or partially completed construction.

Internal Environmental Control

Where natural drying is insufficient the Contractor shall provide temporary:

- ventilation;
- heating;
- dehumidification;

as necessary to maintain appropriate drying conditions.

The use of direct-fired gas heaters or other equipment producing excessive moisture shall not be permitted within enclosed areas unless otherwise approved.

Inspection and Monitoring

The Contractor shall implement a documented inspection regime including:

- daily inspections during demolition;
- inspections following rainfall;
- weekly moisture inspections;
- inspection before installation of moisture-sensitive finishes;
- photographic records;
- moisture test records;
- corrective action records.

Inspection records shall be available for inspection by the Employer's Representative at all times.

Water Ingress

Should water ingress occur the Contractor shall immediately:

- identify and eliminate the source;
- remove standing water;
- dry affected areas;
- inspect all affected materials;
- replace any material adversely affected;
- record the incident;
- notify the Employer's Representative within 24 hours.

The Contractor shall bear all costs associated with rectification of damage arising from inadequate moisture protection.

Completion Requirements

Before requesting Practical Completion the Contractor shall submit:

- the completed Moisture Protection Strategy;
- moisture testing records;
- inspection records;
- photographic records;
- confirmation that all floor finishes were installed on compliant substrates;
- confirmation that all moisture-damaged materials have been replaced.

Failure to provide satisfactory records may result in the Employer's Representative withholding certification until compliance has been demonstrated.

Measurement and Pricing

The Contractor shall be deemed to have included within the Contract Sum for all costs associated with preparation, implementation, inspection, testing, temporary protection, drying, monitoring, record keeping and compliance with this Moisture Protection Strategy. No additional payment shall be made for compliance with this requirement.

SECTION 6 – VENTILATION DETAILS AND STRATEGY

General

The Contractor shall prepare, implement and maintain a Coordinated Ventilation Strategy for the duration of the Contract. The purpose of the strategy is to ensure that, following completion of the Works, the building provides effective passive ventilation to all refurbished spaces, prevents moisture accumulation, minimises condensation risk, maintains adequate sub-floor ventilation and promotes a healthy indoor environment. The Coordinated Ventilation Strategy shall form part of the Contractor's Project Quality Plan and shall be submitted to the Employer's Representative on request. Submission of the strategy shall not relieve the Contractor of any obligation under the Contract.

Scope

This requirement applies to all areas affected by the Works including, but not limited to:

- Removal of existing timber floors.
- Replacement floor construction.
- Existing suspended timber floor voids.
- Existing external air vents.
- Classrooms.
- Sensory room.
- Toilet accommodation.
- Ancillary circulation spaces where affected by the Works.

Performance Requirements

The Contractor shall ensure that:

- adequate permanent ventilation is maintained throughout the construction period wherever reasonably practicable;
- completed works do not reduce the existing ventilation performance of the building unless specifically detailed elsewhere within the Contract Documents;
- all refurbished areas achieve effective permanent background ventilation (note requirements above regarding installation of new vents);
- sub-floor ventilation remains continuous throughout all suspended timber floor areas;
- completed works do not create conditions likely to promote condensation, mould growth or timber decay.

Existing Floor Ventilation

Prior to commencement of the Works the Contractor shall inspect all existing external sub-floor ventilation openings.

The Contractor shall:

- identify all existing air bricks and ventilation openings;
- record their location;
- verify that each ventilation opening is operational;
- remove vegetation, debris and obstructions restricting airflow;
- reopen any blocked ventilation openings;
- replace damaged air bricks with matching proprietary units;
- ensure new works do not obstruct existing ventilation paths.

No existing sub-floor ventilation opening shall be permanently closed, reduced or covered unless specifically instructed in writing by the Employer's Representative.

Where existing ventilation routes are interrupted by the Works the Contractor shall provide an alternative permanent ventilation route of equivalent or greater free air area.

Sub-floor Ventilation

Following completion of the replacement timber floor construction the Contractor shall ensure that any remaining structural timberwork beneath timber floors have:

- continuous cross ventilation beneath all suspended timber floors;
- unobstructed airflow between opposing ventilation openings;
- insulation, services and construction materials do not impede airflow;
- sleeper walls, if encountered, are provided with suitable ventilation openings where necessary to maintain continuous airflow.

Where defects in the existing sub-floor ventilation arrangement become apparent during construction the Contractor shall immediately notify the Employer's Representative.

Classroom Ventilation

Each classroom shall be provided with new permanent passive wall ventilation.

The Contractor shall provide:

- proprietary passive wall ventilators;

- controllable internal grilles;
- external weather louvres;
- insect mesh;
- insulated sleeves where passing through insulated construction.

Wall ventilators shall:

- be permanently openable;
- provide effective background ventilation;
- minimise rain penetration;
- minimise cold draughts;
- be suitable for educational buildings;
- comply with the Building Regulations and all relevant Irish Standards.

The exact size, number and location of wall ventilators shall be determined by the Contractor and submitted to the Employer's Representative for review prior to installation.

Ventilator locations shall avoid conflict with:

- structural elements;
- electrical installations;
- heating emitters;
- teaching equipment;
- fixed furniture.

Sensory Room

The Contractor shall give particular consideration to occupant comfort within the sensory room via the installation of a new continuous mechanical extract system as shown on the attached drawings.

Ventilation shall:

- provide adequate background fresh air;
- minimise draughts at occupant level;
- minimise external noise transmission;
- avoid direct airflow onto seating or activity areas.

Where necessary the Contractor shall propose proprietary acoustic passive ventilators.

Toilet Ventilation

The Contractor shall ensure the toilet accommodation is adequately ventilated. Where passive ventilation alone is insufficient to satisfy the Building Regulations, the Contractor shall provide supplementary mechanical extract ventilation complete with controls, ductwork, grilles and external weather terminals. Mechanical extract systems shall discharge directly to external air.

Protection During Construction

The Contractor shall ensure that ventilation openings remain unobstructed throughout the Contract.

Construction materials, debris, insulation and temporary works shall not obstruct:

- air bricks;
- wall ventilators;
- under-floor ventilation paths;
- permanent ventilation openings.

Temporary closures shall only be permitted where absolutely necessary and shall be removed immediately following completion of the relevant activity.

Commissioning and Verification

Prior to Practical Completion the Contractor shall:

- inspect every ventilation opening;
- verify that all passive vents are unobstructed;
- confirm all existing air bricks remain operational;
- clean all ventilation components;
- remove temporary coverings;
- demonstrate continuous airflow beneath suspended timber floors;
- submit a ventilation inspection report to the Employer's Representative.

Operation and Maintenance Information

The Contractor shall include within the Health and Safety File and Operation & Maintenance Manuals:

- manufacturer's literature;
- maintenance requirements;
- cleaning procedures;
- replacement parts information;
- recommended inspection intervals;
- as-installed drawings identifying every ventilation opening.

Measurement and Pricing

The Contractor shall be deemed to have allowed within the Contract Sum for:

- inspection of existing ventilation;
- reopening blocked air vents;
- replacement of damaged air bricks;
- provision of new passive wall ventilators;
- all making good;
- insulation and weatherproofing around penetrations;
- testing;
- commissioning;
- documentation;
- and all works necessary to provide a complete and fully operational ventilation system.

No additional payment shall be made for compliance with this requirement.

SECTION 7 – BUILDING SERVICES – MECHANICAL, ELECTRICAL, COMMUNICATIONS, ETC.

Telephone, Computers, Electrical and Emergency/Fire

All works must comply with the Electro Technical Council of Ireland revised current regulations, NSAI IS 10101, ET101, NSAI and CENELEC standards and all other relevant standards.

Lights to be installed at locations shown on attached drawings and to meet a minimum illuminant level of 300 lux at 700mm above the floor level to be provided in classrooms and 200 lux at floor level in all toilets. Switches to be fitted at agreed locations and in accordance with the Building Regulations. Height of switches, sockets, controls, etc. to be in accordance with Diagram 32 of TGD M 2022. Light switches to be used by the general public should have large pushpads and align horizontally with door handles within the range 900mm to 1200mm. All controls should visually contrast from their background. Occupancy sensor operation to be used for all classrooms, toilets and en-suites, with a manual override on/off switch for each location. Occupancy sensors in toilet areas to cover both cubicle and non-cubicle areas.

Emergency lighting to be designed and installed along all escape routes and to tie in with existing emergency lighting. Emergency lighting will be in accordance with TGD B 2006 and I.S. 3217:2023 “Code of Practice for emergency lighting”. At least five LED bulk-head maintained fittings to be installed in the corridor. Two LED bulk-head maintained fittings to be installed in the Toilet for Assisted Users.

The complete emergency lighting system and fire detection system to be interconnected and appropriately alarmed and linked into the existing emergency lighting and fire alarm system in the existing school and to any existing intruder alarm dial-out complex. Certification on the whole alarm system to be provided on completion. Use an addressable fire alarm system on all new installations.

All alarms, alarm strips, chords, etc. to be installed as per attached drawings, including “Toilet for Assisted Users” drawing.

Maintained exit signs to be located over the exit doors as shown on the plans with maintained external LED units over the exit doors. (Thorn Piazza II LED, emergency 25W fitting or equal approved).

Where required use suitably earthed switched twin double sockets with pilot lights on individual circuits to comply with the accepted load factor norm for each room. All wiring to be in concealed grounded steel conduits and trunking. Sockets/outlets should be located consistently in relation to doorways and room corners but in any case no closer than 350mm from room corners in accordance with 1.5.7 of TGD M 2022. All switches and light controls to have a pilot light.

All other electrical fittings to be installed as shown on the layout plan including all light fittings as shown on attached plan.

All electrical wiring and new sub-boards to be connected into the existing mains supply using new sub-boards in accordance with the ESB, IS 10101, ET101 and Safe Electric / Electro Technical Council of Ireland Regulations.

The distribution box for the new extension is to be enclosed in 60 minute fire resisting construction. The exact location for the distribution box for the new extension to be agreed with engineer in charge.

A maximum of 4 double sockets allowed on each circuit. Heavy duty usage to be on a single circuit.

Install a fully addressable L3M fire detection system where shown, linked to the existing school system, designed and installed in accordance with I.S.3218:2024 “Code of Practice for fire detection and alarm systems for Buildings” in all new and altered areas throughout the school (including attic areas) with a minimum automatic type L3M detection system, linked into the existing alarm system.

Drop-down alarm activation units (resettable call points) to be installed at all exits with automatic detection in all habitable rooms. Integrated alarm sounders and beacons to be

located in all habitable rooms and along the exit corridor and at least two such integrated units to be located in any GP Room and on the corridors. Combined detection, flashing beacon and sounder alarm units are preferred. Alternative proposals to be outlined in the quotation supplied.

Fire extinguishers to E.N.3 to be installed within the building in accordance with I.S.291. Include for a dial-out PIR intruder alarm system to all new and refurbished areas, linked into the existing alarm system if present. Clarify proposals on the quotation details.

The contractor will be required to provide commissioning certificates in compliance with the relevant guidelines for all electrical works, fire alarms and all mechanical plant.

CO₂ Monitors

All teaching spaces shall be fitted with a CO₂ monitor that shall include a LED display. The single wall mounted self-contained unit shall consist of a CO₂ sensor enclosure and a large LED display and all associated electronics.

The unit shall be screwed to the teaching wall facing the body of the classroom. The display colour will be capable of changing from Green to Amber and Red to indicate CO₂ levels, thus providing easy visual indication as well as specific readings.

The LED colour indicator should be capable of being easily identifiable from the rear of the classroom with a minimum illuminated area of 25 cm². It should be either self powering from the ambient light in the classroom using an integrated PV panel or be connected to the mains distribution system.

The system will enable the teaching space users to be aware when the desired levels are breached so that the necessary intervention via opening windows for ventilation can take place to maintain the comfort levels and air quality.

A laminated A4 size label (screwed at the four corners to the wall) incorporating clear and

simple advice and instructions on how the teaching space can be operated efficiently with regard to heating, lighting and ventilation during school hours shall be located in a suitable location near the door of each teaching space. It is paramount that all school staff are provided with full user training and demonstration of these systems as part of the handover requirements.

Carbon Dioxide (CO ₂) Traffic Light Display Indicator Ranges		
Optimum Range <1500ppm		
Green	Amber	Red
<1500ppm	1500 to 2000ppm	>2000ppm

Heating, Hot Water and Sanitary Requirements.

All heating and plumbing to be carried out in accordance with “Plumbing Engineering Services Design Guide”, The Institute of Plumbing, England.

Sink units made from solid timber framing and routed selected MDF external finishes with selected kitchen work-top finish to be installed as shown on the plans. 760mm high by 600mm deep by 3200mm long wet area unit (closed off with sliding unit doors) with 1500mm x 500mm stainless steel double bowl, double drainer sink and single swivel on/off mixer tap with 3200mm x 300mm high tiled splashback above unit and agreed sliding doors under.

The contractor must connect the new central heating zones to the existing school system as detailed below and with heating circuits to heat the new areas as shown on the attached drawings. The contractor must carry out the necessary alterations to any existing pipework as well as hot and cold water supplies to meet the central heating and water supply requirements of the new extension. Provide new radiators in all new rooms and where shown in renovated rooms.

The entire heating system must be “power flushed” thoroughly using an approved cleansing agent such as Fernox to remove all debris from the system. A commissioning certificate confirming that the correct treatment has been applied will be required prior to handover. Proprietary frictionless connections to be provided for all structural pipe supports.

Central heating system must be capable of heating the new rooms to a temperature of 25°C in 30 minutes.

Provide new thermostatically controlled individual heating circuits for each new/upgraded classroom, resource room, wc, corridor area, etc. from new connections in the new boiler house. New radiators must be capable of heating the new sections of the school to temperature of 25°C within 30 minutes.

Contractor to confirm the design of the heating and hot water systems to carry the additional loadings before the contract is signed. Install separate zoned heating areas for each classroom, resource room, office and corridor. Contractors must familiarise themselves concerning the alterations required in any existing heating system (including floor chases) to achieve the necessary background internal heating requirement of 25°C throughout the whole school. **Heating design to be checked and agreed in writing with the Engineer in Charge before installation.** Only radiators meeting the most stringent health and safety standards (**no unprotected sharp edges**) for use in areas where children normally play will be accepted, i.e. include protective covers for all radiators. Balancing and flow control mechanisms must be provided for each radiator. All radiators and pipes must be securely fastened onto solid walls and floors. Radiators must be installed in all en-suites and stores.

In sanitary facilities, heat emitters should either be screened or have their exposed surfaces kept below a temperature of 43°C. All piping in sanitary areas to be in protected copper.

New individual room thermostats to be provided and linked to the existing school heating control panel. Existing heating control panel must be upgraded if necessary to cater for the new and upgraded rooms and controls.

Unless otherwise stated radiator pipes in all non-sanitary/wet areas to be in medium grade black MS tube unless alternative agreed in advance with Engineer in Charge. If gun barrel/steel piping is being used it must be exposed where possible. Where gun barrel/steel

piping is enclosed it must be protected with suitable insulation and water proofing so as to prevent degradation or rust damage. Where gun barrel/steel pipe loop is to be embedded in the concrete floor, copper pipe of a similar size should be installed with brass interface connectors. If copper piping is used, it will be necessary to embed the pipes in concrete and provide sleeved structural protection in the exposed areas.

All central heating pipes passing through floors, attics and other uninsulated internal areas must be insulated with 15mm thick “armaflex” insulation. All central heating pipes passing through external areas must be insulated correctly and the level/type of insulation and piping to be agreed with Engineer in Charge prior to signing of contract.

Domestic hot (15mm thick armafex insulated pumped circuit) and cold water supply to be supplied to all the sink units as shown on the plans from new electrically powered, insulated undersink water heater. (Make and model to be confirmed in advance with Engineer in Charge) Cold water to all classroom sink units to be provided from mains. Provide a suitable (insulated) non metallic piped drinking fountain externally and a separate drinking water tap from a non metallic distribution system in each classroom. Provide for a central and separately adjusted temperature control on an insulated hot water loop to the sinks and for anti-scald thermostatic mixing valves (e.g. “Horne H15-11B 1/2” Thermostatic Mixing Valve) and single low pressure push button spray taps on all en-suite and toilet sinks/wash hand basins (e.g. “Delabie type Tempostop Ref 745250 Automatic Shut Off Taps”). Contractor to check with the Consultant Engineer in Charge concerning the heating and hot water layout before signing contract. Hot water to be supplied by a new electric “above sink” water heater in a lockable cabinet. 20mm copper supply pipes to be used for all domestic connections. All hot water lines to be insulated with 15mm thick armafex insulation. A minimum Pressure Head 0.5 bar must be available at the taps, by gravity if possible. It is envisaged that this hot-water domestic circuit will be a pumped circuit which should be control by the boilers but with a manual over ride. Allow for a separate drinking water tap, direct from the rising main, in each room.

Note: An Electric shower(Mira Advance ATL Flex Low Pressure with thermostatic temperature control or equal approved) is to be installed in the Toilet for Assisted Users.

Appropriate fire restraint systems to be installed where necessary in any boiler house or oil store.

All sink and wash hand basin waste to discharge via a localised u-trap into an open discharge gully or hopper.

As per Dept of Education and Skills TGD-030.1:

The selection of pipe work, fittings, valves, meters, and taps must take into account the material used in manufacture, and the potential for Lead, Copper, Nickel and other metals, to leach into the drinking water, particular during periods of stagnation. This potential for leaching is influenced by the quality of mains water supply feeding a school in particular its pH and Hardness.

In order to reduce the risk of metallic exceedances in a mains water supply feeding drinking water outlets, in particular Lead and Copper, a complete non-metallic pipe work solution should be provided on a Mains Water Distribution System only in schools.

Drinking taps which do not have any metal in contact with mains water should be considered on the Mains Water Distribution System in schools. They must also be selected with care. In particular having regard to their potential to leach metals after periods of stagnation. Bronze or brass taps may contain up to 8% Lead and there is therefore a risk of an exceedance of the maximum allowed level for Lead. Taps selected should be of Low Lead make up, with no more than 0.25% Lead. If Nickel is used in tap manufacture or make up it may also lead to a risk of an exceedances of this parameter.

All drinking water taps must be labelled permanently and unambiguously with an engraved label in order to distinguish them from hot and cold water services

The Mains Water Distribution System distribution pipe work must be labelled appropriately to ensure that it is not inadvertently connected to other Water Services e.g. drinking water taps will be provided in vicinity of hot and cold water supplies serving blended taps in the sink units.

All drinking water outlets shall be fed from the Mains Water Distribution System in a school.

The pipe work should serve each drinking water tap sequentially from the boiler house to the final connection to the mains water storage tank in the roof space. This in order to promote water turnover and reduce stagnation in the distribution system.

The design of the distribution system shall ensure that no drinking water tap is located at the end of a long pipe run.

Final connection to each drinking water tap via the shortest “dead leg”.

Drinking water taps in classrooms and in the Staff Room should be located over the sink units and labelled as outlined above.

All sanitary fittings and wash hand basins in the toilet areas to be child size fittings in accordance with the respective class ages in each room. All fixtures, fittings, alarms and other items in the classroom en-suites and disabled toilets to be in accordance with attached drawings and with Figure 8 of SDG 02-06 -(Department of Education and Skills) and Diagrams 15a, 16 and 17 of TGD M 2022. Standard fittings to be installed in the other toilet areas. Water conservation devices to be installed on all w.c. fittings. Use a dual flush system such as the Delabie/Douglas type WC Cistern Duoflush, Ref: TB880. Final details to be agreed on site.

All toilet areas to include for automatic lighting and mechanical extraction with an independent 10 minute time overrun.

New covered insulated cold-water storage tank to serve the new classroom and toilet areas must be installed to meet a total volumetric requirement of 20 litres per student/staff member and a minimum volume of 800 litres. A frost stat and associated electric blow heater must be installed in the attic area to prevent this tank from freezing.

Where new water mains are to be installed use Class C Wavin Watermain, installed in accordance with the national standards and at a minimum depth of 1 metre to be used for the external mains supply.

New fire hydrants to be installed as shown on attached drawings.

New foul water piping from the altered existing buildings and the extended new school areas to be installed throughout in 150mm uPVC pipe at appropriate slopes and connected to the new effluent treatment system. Final layout details to be agreed with the Engineer in Charge before the contract is signed.

SECTION 8 – EXTERNAL WORKS – CIVIL ENGINEERING, TRAFFIC MANAGEMENT, ARCHITECTURAL ETC..

Grounds

Concrete footways as per the attached specification drawings should be installed as shown on the attached drawings. Provide level access to external doors as shown in accordance with Technical Guidance Document M 2010 with heel safe, appropriately load rated, Aco Drains (piped to surface water drainage systems). Gently sloped and level tarmac areas to be installed as shown on the attached drawings including those to serve as access to the front door from the new disabled parking area and rear and side doors from the adjacent hard and soft surface areas. Safety railing in galvanised steel or appropriate aluminium section to be installed at all locations where there is a disparity in height between finished surfaces and also at **open edges of any flat roof sections**. Design to be agreed with the Engineer in Charge.

Any macadam areas to be finished as shown on attached cross-sectional drawings and in line with “Recommendations for Site Development Works” published by Dept. of Environment and Local Government. Tarmac to have a minimum fall of 2% towards adjacent drainage soakaway. Soakaway to be appropriately sized and gravel filled with geotextile lining. Tarmac and base layer specifications as per attached drawing.

All road markings in white unless otherwise indicated (e.g. Double Yellow Lines) and to be laid in accordance with Dept. of Transport “Traffic Signs Manual 2010” including 2013 and all other updates. All road markings to be reflective thermoplastic markings with materials conforming to IS EN 1871 and shall meet the requirements of the relevant classes of IS EN 1436 as set out in Table 12/6 of “NRA Specification for Road Works – Volume 1. Series 1200 – Traffic Signs and Road Markings”

New tarmacadam as shown on attached drawing to be installed including relocated play area with macadam, kerbing, gullies, etc.

Ramp and steps as shown on attached drawings and in accordance with Technical Guidance Document M 2022 including necessary safety rails. (No horizontal bars.)

All surface water to be connected to purpose built on-site soakpits as shown on attached drawings. Ground surfaces above pipes and soakpits to be reinstated to pre-construction state including if necessary, consolidation of backfill, levelling and seeding or installation of hard surface as appropriate.

Cleaning gullies required at all connection points of downpipes into the surface water system and at all change points, gullies and at 30m intervals.

Foul sewers and/or surface water sewers running under the location of any new works to be rerouted using new 150mm uPVC Wavin Sewer pipes laid at appropriate falls. Exact layout of rerouted sewers to be agreed on site with Engineer in Charge. All foul and storm sewers to have appropriately benched manholes (GEN3) grade concrete at all changes in direction. All manholes to have hinged, locked, circular, ductile iron, 700mm manhole covers with D400 load rating such as Cavanagh Brio 700 or similar. All new and altered foul sewers to be connected into a new foul sewer drainage system draining to the existing foul sewer system. All WAJs and sewer infrastructure to have Cast Iron covers such as Cavanagh B0022 or similar. All sewer connections to be 150mm uPVC Wavin sewer pipes laid to the appropriate falls. All connections, piping, etc. to existing foul water collection system to be connected to the effluent treatment system and made good. All new manholes and sewers to be installed in accordance with “Irish Water Standard Details for Wastewater Infrastructure”. Any internal manholes to be double-sealed, proprietary units in accordance with the building regulations.

Existing manholes and connecting sewers to be re-routed if necessary to install new extensions, ramps, etc. as shown on attached drawings.

Install top soil, level and seed in the designated grassed area.

Re-level, remove all stones and re-seed all damaged green areas and leave these areas

suitable for play grounds and pitches. Reinststate all damaged steps, paths, etc. around the existing school. Remove all extraneous materials from the site to an authorised waste facility.

SECTION 9 – ADDITIONAL

The contractor must provide for full reinstatement to pre-construction quality and layout of any access, play or other external areas affected by the proposed works. This includes but is not limited to re-levelling, stone-removal and re-seeding all damaged green areas to leave these areas suitable for play grounds and pitches. Also included is the appropriate grading, compacting and installation of heavy duty tarmac areas or appropriate concrete footpath areas where these areas have been disturbed including where rutting, consolidation or other damage has been caused to hard surfaces by movement of machinery or supplies as per the attached specification drawing.

All waste material must be segregated for removal off-site by registered disposal contractors with final disposal to a registered disposal facility. Complete records of all materials removed from the site, including a full description and volume/weight data, must be maintained for inspection at any reasonable time in the site office.

The project must be fully completed by the date indicated in the attached particulars and the school vacated at this time. Liquidated damages may be recouped for any works which extend beyond this closing date.

Please note that any internal, noisy or disruptive works on the existing school must be carried out during school holiday periods, out of school hours or at weekends as agreed with School Authorities and must not interfere with the normal operation of the School.

Contractor to include for a professional cleaning service to clean the whole school after completion of building works.

Asbestos

Please refer to the asbestos report which is contained in the school for information on any existing known sources of asbestos. Any works relating to asbestos must be carried out by specialist contractors with disposal off-site to a registered disposal facility. Great care must be exercised when dealing with asbestos and best practice compliant with the current statutory regulations must be implemented.

SECTION 10 – WINDOW COMPLIANCE REQUIREMENTS

6.1.1 General

- (a) All windows proposed for use in educational facilities must conform to this specification. It will be the responsibility of the window manufacturer to provide independent accredited test report conforming to this specification to the project supervisor prior to the selection of any proposed window system. The minimum requirements are set out in Table 2 below.
- (b) Where an independent test report cannot be produced or validated for the criteria in this specification the proposed window system will not be deemed acceptable for use in schools by the Department of Education and Skills and will not qualify for grant assistance.
- (c) Building materials and products - IS EN ISO 10456:2007 - Hygrothermal properties for determining declared and design thermal values (includes corrigendum 2009) – All individual materials used in the fabrication and manufacture of windows are to be compliant with this standard regarding the rounding up or down of the declared thermal values.

6.1.2 Independent Accreditation

- (a) The contractor is required to submit independent accredited approval from the manufacturer of the selected/proposed window system tested on a specimen size of 1500mm high x 1200mm wide full Top Hung opening sash to comply with the following Department of Education and Science product requirements:

Table 2 – Submittal / Design Statements

Reference	DOES Requirements
EN 12207:2000 Air Permeability	Class 3 at 600Pa. or better.
BS EN 12208:2000 Water tightness	Test Class 9A at 600Pa. or better.
IS EN 12211: 2000 Wind Resistance	P1= 1600Pa., P2 = 800Pa., P3 = 2400Pa.
BS 8200 Design of non-loadbearing external vertical enclosures of buildings	All windows and doors to comply with requirements of this standard.
BS EN ISO 140 Acoustic Performance	The Rw sound reduction index for the Glazing should not be less than 27db.

Thermal Transmittance ISO/NP 10077-1 and ISO 10077-2:2011	Table F.4 — Thermal transmittances for vertical windows with fraction of the frame area 20 % of the whole window area, glazing spacer bars with improved thermal performance 1.4W/m ² K. Design size: 1.2wide x 1.5m high top hung opening sash full size. Manufacturer to provide documentary evidence that the above sized window has a thermal performance of 1.4W/m ² K or better.
Glazing to BS 6262-1:2005	Glazing to conform to the guidelines set out in this standard. Thermal transmittance for standard glazing shall be no greater than - 1.15W/m²K = Centre pane U value. All units to be 28mm minimum overall thickness. Typical centre pane make up: 4mm glazing – 20mm argon filled cavity (90%) – 4mm soft coat thermal glazing with glass having an emissivity value of 0.01. Where safety glazing is required the supplier shall submit calculations to show an overall U-value of 1.15 W/m²K. The spacer used to separate the glazing should be a warm edge spacer bar and the space between the panes filled with Argon gas. A minimum requirement for the U-value of the glazing for a window Design size: 1.2wide x 1.5m high top hung opening sash full size shall be 1.6W/m²K
EN12206-1 2004	Polyester Powder coating Interpon D or Syntapulvin applied by Qualicoat approved applicator using a standard RAL colour in matt finish.
BS EN 1670:2007 Building Hardware. Corrosion resistance. Requirement and test method	All Ironmongery to comply with the requirements this standard. Multipoint single lever locking system is to be incorporated in all opening sashes.

Note: All thermally modified window frames are to be fully tested in accordance with Table 2 in order to be considered for use in school buildings

6.1.3 Product Data

- (a) The contractor is required to submit to the project supervisor manufacturer's product data for all materials in this specification.

6.1.4 Shop Drawings

- (a) The contractor is required to submit to the project supervisor profiles, accessories, location, and dimensions.

6.1.5 Site Dimensions

- (a) The dimensions provided on the tender documents are indicative and should only be used for pricing. It is the Contractor's responsibility to measure each window and produce the dimensions to which the windows will be manufactured.

6.1.6 Samples

- (a) Manufacturer to provide sample upon request; sized to represent material adequately.

6.1.7 Contract Closeout

- (a) The contractor is required to submit to the project supervisor the window manufacturer's warranty prior to the contract closeout.

6.1.8 Handing

- (a) NOTE 1: Window types and examples of handing are shown in Figure C.1 and Figure C.2 of BS4873:2009. These handing illustrations show the traditional British designations. The forthcoming European designations (pr EN 125194)) are significantly different and shall be applied on its' release.
- (b) NOTE 2: The handing of a multi-light or a horizontally sliding window is related to the position of the largest opening light.
- (c) NOTE 3: The handing of a vertically pivoted window is described by the position of the pivots in relation to the opening out portion.
- (d) The handing shall be in accordance with the tender drawings provided.
- (e) In specifying the handing all windows shall be viewed from the outside unless otherwise stated.
- (f) For a multi-light window, the arrangement of the multi-light shall be shown on a diagram.
- (g) The handing of side-hung, top-hung and bottom-hung casements is related to the position of the hinges.
- (h) The proportion opening outwards of a vertically pivoted window shall be stated.

6.2 MATERIALS

6.2.1 Aluminium

- (a) Extruded aluminium profiles shall be fabricated from designated treated alloy 6060 or 6063 in tempers T4, T5 or T6 conforming to BS EN 755-9:2008.
- (b) When ancillary components such as sills, couplings etc. are formed from sheet materials they shall be fabricated from designated alloys 1200, 3103, 5005 or 5251 conforming to BS EN 485-2:2013 in temper suitable for the particular type of application and degree of forming to be adopted.
- (c) The aluminium profiles used in the construction of the frames excluding glazing beads, nibs, interlocks and similar features shall be, at minimum tolerance, not less than 1.2 mm thick.
- (d) Powder Coated Finish
 - (i) The aluminium shall be finished with the following:
 - (ii) A powder coating conforming to BS EN 12206-1:2004: 'Paints and varnishes - Coating of aluminium and aluminium alloys for architectural purposes'
- (e) Polyester Powder Coating
 - (i) A Polyester Powder coating Interpon D or Syntapulvin (Not a mixture of both) applied by Qualicoat approved applicator using a standard RAL colour in matt finish to BS EN 12206-1:2004. Prior to the application of the polyester power coating the aluminium profiles are to be pre-treated using an 8-stage process of acid etching, Chrome or Chrome Free process to Qualicoat approval and water rinsing. A guarantee of 25 years must be applied for in advance of starting the project on site. It is noted that this period of time is subject to the location or proximity of the school to marine environment. Therefore 'Architectural powder coating to Qualicoat 'Seaside' standard from approved supplier' is required.

6.2.2 Timber

(a) All of the timber used in the manufacture of windows for Educational Facilities should be sourced from an approved sustainable source.

(b) Quality

(i) Timber shall be of a species classified as suitable for its purpose in accordance with BS EN 942:2007, National Annex NA. The timber for window frames, casements and sashes shall be of the classes defined for the UK in BS EN 14220:2006, or better.

(ii) NOTE: Where for reasons of design or appearance a higher quality of timber is required, the specifier should discuss these special requirements with the manufacturer in respect of timber species and availability.

(c) Preservation - the wood or wood-based components of a window shall either have sufficient natural durability, or be preservative treated.

(d) NOTE 1: The sapwood of any species will require preservative treatment.

(i) The natural durability of wood or wood-based components of a window to be used without preservative treatment shall be at least durability class 3 as defined in BS EN 350-2:1994.

(e) NOTE 2: If it is desired to use a species not listed in BS EN 350-2, its durability can be established in accordance with BS EN 350-1.

(i) Where the natural durability of the wood is class 4 or class 5 as defined in BS EN 350-2:1994, or where sapwood is present

(ii) For preservatives assessed under BS EN 599-1:2009+A1:2013 for penetrating processes and other preservatives listed in BS 8417:2011+A1:2014 as suitable for Use Class 3 (as defined in BS EN 335:2013), the wood shall be preservative treated in accordance with BS 8417:2011+A1:2014 (Use Class 6.1, 30-year life);

(iii) For preservatives assessed under BS EN 599-1:2009+A1:2013 for superficial processes, the wood shall be preservative treated using a preservative with a critical value (CV) derived from BS EN 599-1:2009+A1:2013), Use Class 3 (with coating), including testing to BS EN 330:2014, in which the preservative shall be applied using the manufacturer's proposed method of application and the reference preservative shall be applied by double vacuum. The treatment shall achieve penetration class P1 (BS EN 351-1:2007) and a retention of CV (factor $\times 1.5$).

- (iv) Any component or part of a component that is machined in a manner that exposes untreated timber shall receive further treatment to ensure continuity of the preservative envelope.
- (f) NOTE 3: The long-term performance of a window depends not only on the maintenance of the preservative envelope but on the maintenance of the window as a whole.

6.2.3 Unplasticized Polyvinyl Chloride (PVC-U)

- (a) White PVC-U extruded hollow profiles used in plastic windows and door sets shall conform to BS EN 12608:2003.
- (b) Surface covered PVC-U extruded hollow profiles used in plastic windows and door sets shall conform to BS 7722:2010.
- (c) PVC-U profiles manufactured in accordance with BS EN 12608:2003 only require an occasional wipe down for appearance purposes. A gradual loss of gloss might occur over time which has no effect on the functional performance of the window. As PVC-U profiles have been successfully used for windows and door sets for the last 40 years, PVC-U windows and door sets manufactured in accordance with this British Standard are expected to last in excess of 40 years.

6.2.4 Reinforcement

- (a) The use of reinforcement in plastic windows and door sets shall conform to the recommendations in British Plastics Federation publication 323/1.
- (b) NOTE 1: Reinforcement should be non-hygroscopic and should have no adverse effect on the performance of the window or door. Where metal reinforcement is used it shall be manufactured from one of the following metals:
 - (i) Mild steel sheet, hot-dip zinc coated, conforming to BS EN 10346:2009, coating designation Z275. This type of reinforcement shall only be used in profiles or systems designed and sealed so that no exterior moisture can come into contact with the reinforcement;

- (ii) Mild steel sections which are subsequently given a corrosion resistant coating in order to conform to the requirements in (i). This type of reinforcement shall only be used in profiles or systems designed and sealed so that no exterior moisture can come into contact with the reinforcement;
 - (iii) Austenitic stainless steel sheet or strip conforming to BS EN 10088-2:2014;
 - (iv) Extruded aluminium alloy conforming to BS EN 485-2:2013, BS EN 515:1993, or BS EN 755-9:2008. This type of reinforcement can be used in any type of profile or system.
- (c) Where non-metallic components are incorporated, the material and specification for these should be selected according to the required function.

6.2.9 Hinges, stays and pivots

- (a) Friction hinges, variable geometry stays and friction pivots are expected to maintain friction without adjustment or, when adjustment devices are provided, with adjustment. All hinges, stays and pivots shall be manufactured from stainless steel which is suitable for use in a marine environment. Corrosion test reports to be submitted.

6.2.10 Balances for vertically sliding windows

- (a) Balance mechanisms are available in too many types and styles for this standard to specify materials, finishes and means of attachment to frames and sashes. However, it is most important that the window design, including the provision of stops where required, is such that the balances can be fitted in a manner approved by the balance supplier. Balances should be ordered to the correct length and weight for the glazed-sash including an allowance for friction.

6.2.11 Weatherstripping

- (a) Weatherstripping shall be one of the following:
- (i) Ethylene propylene diene monomer (epdm); or
 - (ii) Plasticized PVC (PVC-P); or
 - (iii) Polychloroprene (CR); or
 - (iv) Polypropylene pile; or

- (v) Sheathed cellular elastomeric polymer; or
 - (vi) Silicone (Si); or
 - (vii) Thermoplastic elastomer (TPE).
- (b) NOTE 1: Non-cellular forms of materials i), ii) and iii) are specified in BS 4255-1:1986.
- (c) NOTE 2: Guidance on weatherstripping products is given in BPF WG 345/1 [1].

6.2.12 Glazing gaskets

- (a) To minimise gaps in joints and shrinkage internal gaskets are to be serrated to allow for the gasket to be continuous and not requiring mitre jointing at corners. The internal gaskets are to have one joint only which is to be sealed and located at a low critical area. Use a warm-edge gasket.
- (b) Glazing gaskets shall be one of the following:
 - (i) Chloroprene rubber, solid (cellular); or
 - (ii) Chloroprene rubber, solid (non-cellular) conforming to BS 4255-1:1986; or
 - (iii) Cured ethylene propylene diene monomer (epdm); or
 - (iv) Plasticized PVC; or
 - (v) NOTE: Plasticized PVC gaskets should not be used with polycarbonate glazing materials.
 - (vi) PVC nitrile; or
 - (vii) Thermoplastic elastomer (TPE); or
 - (viii) Uncured ethylene propylene diene monomer (epdm).
- (c) Glazing compounds shall be non-setting compounds, preformed mastic tapes, gun grade solvent release type sealants, one-part or two-part curing sealants or two-part rubberizing compounds. Gun grade sealants shall conform to BS EN ISO 11600:2003+A1:2011.

6.2.13 Fixings

- (a) All straps, clips, brackets, lugs, screws, nuts, bolts, rivets, metal washers, shims and other fixings shall be manufactured from one of the following: stainless steel grade A2, A4 or F1 conforming to BS EN ISO 3506-1:2009 or BS EN ISO 3506-2:2009; steel which has been finished by one of the following methods: zinc plating in accordance with BS EN ISO 2081:2008, code Fe/Zn 12 or Fe/Zn 25, and chromate passivation in accordance with BS 6338:1982, ISO 4520-1981, class 2C or 2D; hot dip galvanizing in accordance with BS

EN ISO 1461:2009 to a minimum coating mass of 460 g/m²; spraying with a zinc coating in accordance with BS EN ISO 2063:2005, symbol Zn4; any other protective treatment of equivalent performance to those specified in 4.1 Aluminium (a) to (c), of an alloy having mechanical strength properties at least equal to that of the frame. All straps, clips, brackets, lugs, screws, nuts, bolts, rivets, metal washers, shims and other fixings shall be manufactured from materials which is suitable for use in a marine environment.

- (b) NOTE: Spacer shims used at fixings, which serve only as packing and do not influence the structural integrity of the fixing, may be of extruded or moulded plastics material.
- (c) Fixing devices should be capable of withstanding the design wind load (see BS EN 1991-1-4:2005+A1:2010) and any operating forces of the windows. Provision should also be made to prevent water penetrating any holes provided for the fixings.

6.2.14 Glazing materials

- (a) Glazing type and thickness shall be selected, using the recommendations given in BS 6262, to withstand the design wind pressure calculated in accordance with BS 6375-1:2015 or BS EN 1991-1-4:2005+A1:2010. The type and quality of glass shall conform to BS 952-1:1995.
- (b) The exposed edges of glass adjustable louver blades shall be arrised, ground or polished.
- (c) Insulating glass units shall conform to BS 5713
- (d) NOTE: A series of standards specifying requirements and test methods for glass, prEN 1279, is currently in preparation.
- (e) **All glazed units must be CE Marked and composed of toughened glass throughout suitably stamped. All glazing units will be expected to be marked as follows in accordance with BS 6262-4:2005:**

Glass Co.
EN 12150
1

6.3 DESIGN AND CONSTRUCTION

6.3.1 Work Sizes and Manufacturing Tolerances

- (a) The work sizes for overall length and height shall be documented. The site survey of the windows will be the responsibility of the window contractor and comply with BS 8213-4:2007, Windows, doors and roof lights – Part 4: Code of practice for the survey and installation of windows and external doorsteps.
- (b) The size of an assembled frame shall be within ± 1.5 mm of the documented work size in any dimension, and the difference between the diagonals of the assembled frame shall be not more than 4 mm.

6.3.2 Operation

- (a) The completed window shall conform to the performance requirements for operation and strength specified in BS 6375-2:2009.

3.3.3 Marking

- (a) Pre manufactured window components shall be marked or labelled with: The name or trade mark of the manufacturer; the number and date of the British Standard, i.e. the relevant standard for the appropriate material used to construct the window.

6.3.4 Weather-tightness

- (a) The following weather-tightness requirements apply to all types of window.
 - (i) The completed window shall meet the weather-tightness requirements for the appropriate classification specified in BS 6375-1:2015, when tested in accordance with BS 6375-1:2015 and, for double windows, with the appropriate additional procedure given below.
 - (ii) For air permeability, double windows shall be tested with both windows closed, the length of opening joint being that which is visible on the inner surface of the inner window only.

- (iii) For water-tightness, double windows shall be tested with both windows closed and the performance class shall be that obtained by the outer windows.
- (iv) For wind resistance, double windows shall be tested with the inner window open and the outer window closed. The test shall then be repeated with the inner window closed and, if the outer window contains opening light(s), this (they) shall be opened.

6.3.6 Ventilation of room direct to external air

- (a) Each window assembly must be manufactured in accordance with Part F Table 1
Ventilation of room direct to external air of the current Building Regulations and achieve a minimum rapid ventilation area of 1/20th of the floor area of the room. The selected fabricator must demonstrate compliance through calculations mentioned earlier.
- (b) The following criteria should be used for background ventilation:
 - (i) Floor area up to 10 m² - 6500 mm² -
 - (ii) Floor area over 10 m² - 650 mm²/m² of floor area
- (c) Window ventilators are to be provided where no alternative means of passive ventilation can be provided.
- (d) Where indicated on the window schedule, each window shall incorporate a Ventilator and shall be polyester powder coated offering a single colour facility to match the window profiles. They should be fitted with an external, aluminium hood. Each Ventilator should be fitted with rod control.
- (e) Each vent must be capable of providing a minimum free airflow in accordance with Part F of the current Building Regulations. Vents shall be tested to BS6375-1:2015, and achieve the same requirements of the window unit for purposes of Air permeability, water tightness and wind resistance.

6.3.7 Natural Ventilation & Overheating

- (a) The final window design should ensure that a minimum target ventilation rate of 8 litres per second per pupil is provided in the space. This rate will probably need to be higher to achieve the objectives outlined above and to prevent overheating in the space. The resultant dry bulb temperature shall not exceed 25°C for more than 5% of the school year in all habitable rooms and teaching spaces.
- (b) The optimum working solution will require window openings at both high and low level distributed at regular intervals across the full structural width of the window. High level openings at one end of the window and low level openings at the other end will not achieve the desired level of ventilation.
- (c) The lower opening window should have its free area positioned above minimum sill height of 700mm and below 1.5 metres above finished floor level (or the lowest part of window)
- (d) The upper part of the window should have its free area above the level of the normal occupancy zone i.e. 2.0 metres above finished floor level (or the highest part of window)
- (e) The upper and lower opening sections must be independent of each other. Side hung opening sections are to be avoided due to draught issues.
- (f) Permanent vent openings should be provided at high level in a draught free manner.
- (g) A laminated label as outlined in 6.3.16 Labelling below that describes how natural ventilation should be addressed in teaching spaces should be provided in each classroom.

6.3.8 Design for glazing

- (a) The frame design shall be such that:
 - (i) The glazing shall comply with current Building Regulations;
 - (ii) The window can be glazed in accordance with BS 6262;
 - (iii) Re-glazing is possible without the need to remove the outer frame from the structure of the building;
 - (iv) It is possible to renew the weather-stripping without removing the outer frame from the structure of the building;
 - (v) It is possible to replace the hardware without removing the outer frame from the structure of the building.

6.3.9 Openable windows

- (a) For windows that are intended to be openable, the opening sashes however designed shall move freely and smoothly without hindrance throughout their intended range of movement.
- (b) The range shall be restricted to an opening for child safety and to ensure adequate free openable area.
- (c) In horizontally and vertically sliding windows, adjacent aluminium members shall not slide upon each other.
- (d) In horizontally sliding windows, the sashes shall be supported on bearing devices that facilitate movement and prevent direct contact between the sashes and the aluminium tracks.
- (e) In vertically sliding windows, the mechanism or balancing device shall be accessible for adjustment, repair or replacement, after the windows have been installed.

6.3.10 Remote window opening devices

- (a) Where opening window that are considered to be unreachable they shall be fitted with manual winding window gearing. Each set of windows shall be controlled by 1 No. operator; windows shall be opened using 250mm chain openers with conduit, winder

cables and saddle fixings to wall. All components shall be finished in a selected polyester powder coated paint finish as per window schedule.

6.3.11 Frame joints

- (a) Joints in frames shall be made either by welding or by mechanical means (e.g. cleating and screwing) and shall have flush, stepped or lapped surfaces. For flush joints formed by mechanical means, any deviation from the same plane shall be within the limits set by the use of extrusion tolerances given in BS EN 755-9:2008.
- (b) Welded joints shall be cleaned off smooth on surfaces that are exposed when the window is in the closed position and where the joints would otherwise project into the glazing space.
- (c) Sealing of joints
- (d) Any frame joints, including those of the thermal barrier or cladding, which would otherwise cause loss of watertightness and/or increase of air permeability, should be sealed with sealant or by other means to achieve the performance required.
- (e) Deviations in the plane of flush joints
- (f) No allowance is given for assembly and machining tolerances. Therefore, to achieve the requirements specified it can be necessary to use extrusions with closer tolerances than those given in BS EN 755-9:2008. In practice, to avoid sharp exposed edges etc., manufacturers might need to agree tolerances with the extrusion supplier. It can be necessary to fit “L” shaping backing plates (chevrons) to flanges of mitred cornered frames to correct misalignment due to angular tolerances.

6.3.12 Glazing light transmittance factor

- (a) The total solar transmittance of the window shall comply with the requirements of BS 6262-2:2005 Glazing for buildings —Part 2: Code of practice for energy, light and sound.

- (b) The glazing light transmittance factor shall comply with the requirements of BS 8206-2:2008 Lighting for buildings –Part 2: Code of practice for day lighting.
- (c) NOTE: The accessible parts of finished windows should as far as reasonably practicable be free from all sharp edges, burrs etc.

6.3.13 Glass and Glazing

- (a) Windows shall be glazed in accordance with the recommendations given in BS 6262.
- (b) NOTE: Attention is drawn to the glazing safety recommendations of BS 6262-4:2005.
- (c) 28mm double glazed units, low “E” argon filled (90%) glazing units. Safety glass to be 6 mm laminated to BS 6262 & BS 6201- Glass in Buildings. All glazing must be installed in accordance with BS 6262 and the double glazed unit manufacturer’s and system supplier’s instructions.
- (d) To comply with BS 5713, hermetically sealed and Kite mark certified.
- (e) All windows shall contain sealed units, which shall be manufactured in accordance with EN1279 Parts 2 and 3 and carry the necessary and appropriate guarantee.
- (f) The glazing light transmittance factor shall not be less than 70%
- (g) Clerestory high-level windows to have sandblasted finish to Face 2 of double-glazed units to reduce glare (GP Halls).
- (h) U-value: Design size: 1.2m wide x 1.5m high top hung opening sash full size. Manufacturer to provide documentary evidence that the above sized window has a thermal performance of 1.6 W/m²K or better. The centre pane “U” Value of each sealed unit when combined with the window frame should achieve a target figure of 1.6 Wm²/K when treated as a single element. Each fabricator/installer must demonstrate compliant glass choice with tender return. All glazing shall conform to BS 6262. Use thermally broken warm edge spacer in the double glazed units to increase thermal efficiencies. All glazing to be Low E

Hermetically Argon Filled double glazed Clear sealed units 4/20/4mm to BS 5713:1979 with a U value ≤ 1.15 W/M²K

- (i) Any perimeter taping must be transparent to permit inspection of unit edge condition.
- (j) Glazing System: All double-glazed units, panels and inserts shall be supported continuously along all four edges by specialised glazing support blocks. All windows shall be dry glazed using external 'snap in' extruded aluminium beads with captive 'E' gaskets externally and wedge gasket internally. The corners of the gaskets shall be accurately mitred together and sealed to ensure an effective joint. Setting blocks and location pieces shall be fitted in accordance with BS 6262 in order to ensure the windows are maintained square and rigid.
- (k) All glass must be toughened glass.

6.3.14 Security

- (a) When the completed window is tested in accordance with PAS 24:2012, it shall not be possible to gain entry.
- (b) NOTE 1: The manufacturer should establish whether any of the security devices listed in PAS 24:2012 is to be provided.
- (c) NOTE 2: A glazing system that prevents the removal of the glass by dismantling the system entirely from the outside is available as an optional feature PAS 24:2012.
- (d) NOTE 3: Guidance for security against crime is given in BS 8220.
- (e) Handles shall suit single lever wrap around multipoint locking type. The opening is to be restricted for child safety and to ensure adequate free openable area. To meet the required security level and safety standard all lower opening vent frames shall be fitted with one non releasable locking restrictor. These will restrict the window opening in line with the rapid ventilation calculations. These should be fitted in accordance with manufacturer's recommendations and as detailed in their technical literature.

6.3.16 Labelling

(a) A laminated label incorporating simple instructions for operating the following elements if present in the room shall be located in a suitable location near the door in each teaching space:

- (i) Natural Ventilation: Advice on how the space can be naturally ventilated effectively and efficiently via the windows during schools hours
- (ii) Blinds: Include the following “Raise blinds when not required in order to reduce lighting energy used”.

6.4 Doors Generally

- Double doors to have outside access and part M compliant door closer.
- Double doors to have touch bar type panic hardware in accordance with IS EN 1125:2008.
- The main leaf of the double door to have a flat pad type pull handle on the inside of the door.
- Single doors to have outside access and part M compliant door closer.
- Single doors to have touch bar type panic hardware in accordance with IS EN 1125:2008.
- Single door to have flat pad type pull handle on the inside of the door.
- All door opening furniture should contrast visually with the surface of the door in accordance with section 1.6.4 of T.G.D.M 2010.
- Recess the threshold flush with the floor for the double doors. The threshold shall be level, i.e.with a maximum threshold height of 15 mm with exposed edges chamfered or pencil rounded.
- Recess the threshold flush with the floor for single doors. The threshold shall be level, i.e.with a maximum threshold height of 15 mm with exposed edges chamfered or pencil rounded.
- The single door needs to have a flat pad type pull handle on the inside as shown on picture.
- The double doors to have flat pad type pull handle on the inside also as per picture.
- The windows to be split into even thirds top opening and bottom opening

- Flat type push bars on the double doors as per pictures.
- 400mm panel on bottom of doors as per pictures.
- Single door to have thumb lock on inside.
- All Fire Doors to be a fully certified fire door set.

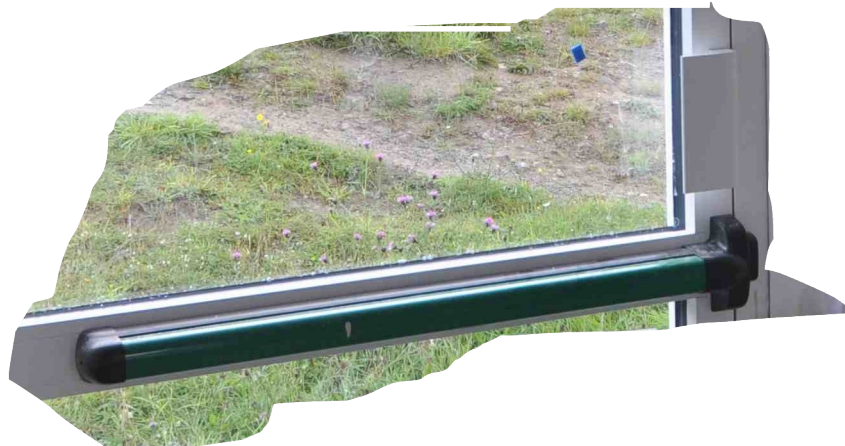


Figure 1. – Single Door Inside



Figure 2. – Double Door Inside

SECTION 11 – PIPEWORK AND RADIATORS - GENERAL

If radiators and pipes are being altered they must be securely fastened onto solid walls and floors. If MS piping is being used it must medium grade black pipe, exposed where possible. Where MS piping is enclosed it must be protected with suitable insulation and water proofing so as to prevent degradation or rust damage. Proposals for the use of copper piping must be agreed in advance with Engineer in Charge.

Where modified or newly installed supply and install all heating system pipework and fittings within the building. Connect all pipework to heat emitters and plant. Supply and install all heat emitters. Ensure that adequate access is provided for maintaining the system. All water pipework and fittings shall be suitable for the distribution of low pressure hot water, containing the various water treatment chemicals used in the system and at the various temperatures found within the system.

All new MS heating distribution pipework MUST be provided with one coat of red oxide paintwork prior to fitting insulation. Failure to provide this paintwork prior to insulation will result in the removal of insulation for painting. All exposed (visible) pipework shall be painted with one undercoat and an overcoat to the colour agreed with the Employer's Representative. All exposed Pipework within rooms shall be painted with a finishing paint coat to a colour selected by Engineer in Charge.

Arrange all pipe runs neatly, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting. Ensure all vertical pipes are plumb or follow building line.

Spacing of pipework

Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.

Use the following minimum clearances in spacing of pipe runs:-

Between	And	Clearance (mm)
Pipeline -	Wall finish	25
Insulated or	Ceiling finish or soffit	50
Un-insulated	Floor finish	150
Insulated pipeline	Adjacent service runs	25
Un-insulated pipeline	Adjacent service runs	50
Adjacent pipelines	Both un-insulated	150
	One un-insulated	75
	Both insulated	25

Grade pipework to allow system to be drained. Provide a means of draining the system at all low points. Use eccentric reducers, and tees to allow full system draining.

Provide test plugs on pipelines either side of all pipes and in any other location required to fully commission the system. Plugs to be of type Binder, Mechseal or approved equivalent and shall include water tight caps.

Arrange cushioned supports and fixings to accommodate pipe movement caused by the thermal changes. Generally allow the flexure at changes in direction. Allow for movement at branch connections. Select pipe rings and clips appropriately to allow axial movement due to expansion.

Provide expansion loops in all straight heating pipework runs with a length of greater than 20m. Use expansion bellows where the installation of loops is not possible due to space constraints.

Arrange supports and accessories for equipment, appliances or ancillary fitments in pipe runs, so that no undue strain is imposed upon pipes. Ensure that materials used for supports are compatible with pipeline materials and contain a cushion or movement axle.

Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and

venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use bends and swept tees where practical.

Provide 4 No. keys for drain valves or any other valves that have not been fitted with levers or hand wheels. Hand these keys to the client at handover stage and obtain a signature of receipt.

Do not use any fabricated junctions or fittings, except with the receipt of written approval from the Employers Representative.

Enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made fire-compliant sleeves. Fit masking plates where visible pipes pass through building elements. Where mild steel pipe loop is to be embedded in the concrete floor, copper pipe of a similar size should be installed with brass interface connectors.

Seal all services where they exit through an external wall with an air tight sealer. Expandable foam must not be used in isolation to seal any pipework through external walls as it does not provide an air tight seal.

Where pipe insulation is not carried through pipe sleeve, cut sleeves one or two sizes larger than pipe from the same material to allow adequate clearance. Do not use sleeves as pipe supports. Install sleeves flush with building finish. In areas where floors are washed down, install sleeves with a 100mm protrusion above floor finish.

Pack annular space between pipe and sleeve or insulation and sleeve with nonflammable and fire resistant material to form a fire/smoke stop of required rating. Apply 12mm deep cold mastic seal at both ends within sleeve.

Terminate headers in removable flanged connections with bolt fixings.

Seal all open ends as installation proceeds by plugs, caps or blank flanges, to prevent ingress of foreign matter. Use plugs of metal, plastic or wood to suit pipework material. In the event of such precautions not being taken, strip out pipework adjacent to open ends to demonstrate that fouling of bores has not occurred.

All pipework stored on site must be raised a minimum of 300 mm above floor level. Any pipework stored outside a sealed compartment must also be capped at both ends. Drill holes squarely. Use drills of requisite size and depth, and appropriate to the fabric. Do not flame-cut holes in metal work.

Inspect components carefully before fixing and reject any which are defective. Ensure cut ends of pipes to be clean and square with all burrs removed. Allow for thermal and building movement when jointing and fixing. Form junctions using fittings intended for the purpose, ensuring that jointing material does not project into bore of pipes, fittings and appliances. Avoid contact between dissimilar metals and other materials which would result in electrolytic corrosion. Take appropriate means to prevent galvanic action where dissimilar metals are connected together. Provide access covers and cleaning eyes as necessary in convenient locations, to permit adequate testing and cleaning of pipework. Prevent entry of foreign matter into any part of system by sealing openings during construction. Fit all access covers and cleaning eyes as work proceeds.

Plastic Pipe Connections

Connect plastics pipework to pipework of other materials using approved connectors and methods in accordance with plastics pipework manufacturer's recommendations, to form a watertight joint.

Copper Pipework Connections

Connect copper pipework to clay/concrete sockets using a caulking bush (brazed on), bitumenised yarn and 1:3 cement:sand mortar, neatly finished, to form a watertight joint.

Connect copper pipework to cast iron sockets using a caulking bush (brazed on), bitumenised yarn and an approved caulking compound, neatly finished, to form a watertight joint.

Connect copper pipework to cast iron using purpose made copper to iron connectors.

Fixing to the Building

Take the following precautions when fixing to the elements shown below:

Reinforced concrete

Take precautions to avoid fixing through reinforcement.

Brickwork

Do not fix to unsound material or mortar between brickwork courses.

Timber rails

Fix equipment, brackets and supports by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

Hollow stud/tile/block walls

Fix equipment, brackets and supports where there is access at the rear of the wall, by drilling a hole through the wall and fixing with bolt, back-plate, washer and loose nut. To fix equipment, brackets and supports where there is no access at rear of wall, drill a hole and use screw anchor type fixings or gravity type toggle fixings.

Concrete, brickwork or blockwork

Fix equipment, brackets and supports using wood screws in plugs. Drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing.

Metalwork

Fix equipment, brackets and supports by drilling holes and fixing using set screws or bolts complete with washers, shakeproof washers and loose nuts.

Steelwork and concrete structures

Provide manufacturer's information on recommended fixing. Obtain approval for any fixing

to structure steel work and concrete structures. Generally use proprietary fixings to structural steelwork and concrete structures. Obtain approval to cut holes in structural steelwork or concrete structures or to weld to structural steelwork.

Painting

All coatings to be applied by the Mechanical Services Specialist (or purchased pre-applied).

Heating Pipework Location	Coating Of Pipes And Fittings
Un-insulated Pipework - Visible	Paint with undercoat (Zinc chromate primer) and overcoat in paint. All paint to be neat, drip and ripple free and to be suitable for the temperature of the pipe to which it is applied.
Insulated Pipework	Paint with undercoat (Zinc chromate primer). Recoat fittings and welds within four weeks of their installation. Wire brush welds before painting.

Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased. Clean steel surfaces in accordance with IS EN ISO 8503 and prepare surfaces for painting in accordance with IS EN ISO 4618-3.

Use the following materials as appropriate

Solvent borne priming paint to BS 7956 for bare woodwork. Red Oxide priming paint for bare iron and steelwork. Zinc Chromate priming paint for bare ferrous and non-ferrous metals. Calcium Plumbate priming paint to BS 3698 for galvanized steel or composite wood/metal components. Undercoating paint for previously primed or painted surfaces before the application of finishing coats. Gloss finishing paint for previously primed or painted/undercoated surfaces. Epoxy resin paint for Specialist coatings requiring resistance to acids, alkalis, oils, solvents, abrasion or high humidity. Aluminium paint to BS 388 for structural steelwork, storage vessels, heated metallic surfaces and similar applications where moisture and heat resistant properties are required. Cold galvanizing paint for making good

damage to previously galvanized surfaces and protection to galvanized materials modified during installation. Zinc-rich metallic paint to BS 4652 for bare iron and steelwork where electrical conductivity has to be assured. Black tar-based paint to BS 1070 for moisture resistant protection to metal surfaces where decorating appearance is not important. Bitumen based coatings for cold application to BS 3416 protection to iron and steel, particularly pipelines and fittings for use in contact with potable water. Bitumen based coatings for cold application to BS 6949 are not to be used in contact with potable water.

Paint Quality

Ensure paints used are of a quality and type to suit the application and that:-

Primers have good adhesion, covering power, rust-inhibiting and grain filling properties.

Gloss finishing paints are of machine finish grade having high adhesion and high resistance to solvents, mineral oils, cutting oils, detergents, chipping and impact damage.

Heat Resistant Paint

Use heat resistant paints for applications to surfaces over 70 °C.

Workmanship

Ensure paints are applied in accordance with manufacturer's instructions and to BS 6150.

Weather Conditions

Do not apply paints where weather, temperature, humidity or other conditions may have a damaging effect upon finish or paint.

Cleaning and Preparation

Cleaning and preparing for painting steel surfaces:

Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased. Clean steel surfaces in accordance with IS EN ISO 8503 and prepare surfaces for painting in accordance with IS EN ISO 4618-3.

For steel pipework, remove scale, rust or temporary protective coating by chipping, wire brushing or use of approved solvents and paint with one coat of red oxide primer, as work proceeds.

Application Off Site

Wherever possible ensure paint finishes applied by component manufacturers are spray applied.

Apply paint evenly and ensure finish shows no excessive brush marks, grinning, runs, sagging, ropiness or other application defects.

Cold Galvanizing

Repair damage to galvanized components due to installation process, i.e. following cutting, drilling or welding, by applying 2 no. substantial coats of cold galvanizing paint.

Identification

Pipework

Clearly label all pipework using colour bands to BS 1710

Apply colour bands, 300mm wide, to each pipe at least

- Once in every room or enclosed area.
- At intervals not exceeding fifteen metres.
- At every junction.
- At every valve.
- At every inspection and access position into service shafts, false ceilings, bulkheads etc.

Secondary Identification

Apply colour bands, 50 mm wide, and superimpose a legend identifying circuit, direction of fluid or gas flow, and nominal pipe bore. Apply colour bands using transfers of an approved

type. Ensure that all labels are securely fixed in a manner that will not allow them to peel off over time. Orient all labels so that they can be clearly viewed from a normal position of observation.

Air Venting

Provide a means of venting the pipework systems at all high points. Provide automatic air vent valves at all high points and at locations agreed with the Employer's Representative. Provide drain points at all low points in the system and at locations agreed with the Employers Representative. Inform the Contractor in writing of all access requirements to air vents and drains prior to commencing work.

Isolation and Regulation

Supply and install isolation valves in the following locations:

- At the base of all main risers and drops except where only one fitting is served
- Before connections to equipment
- At main system branches.

All valves shall be placed in locations where they are unlikely to be tampered with.

Align valves in groups and perfectly in line (or staggered with equal spaces where locating valves inline will prevent ease of use). Align all valves with handles or adjusters facing the normal user position.

Cleaning

Thoroughly clean and degrease all pipework, joints, and fittings. Remove all dirt, plaster and other construction materials before concealment or handover.

Manufacturer's Instructions

Follow manufacturer's instructions for the storage, preparation, and installation of all equipment, fittings, and materials.

Site Dimensions

Check dimensions on site prior to ordering any equipment or emitters. Any equipment or emitters delivered to site which do not fit or do not have adequate maintenance provision must be replaced without cost to the project unless the Employers Representative has been notified in writing of the dimensional difficulties, prior to ordering.

Pipework Insulation

Internal Pipework

Pipework exposed at low level within rooms, or dropping within rooms shall be uninsulated. All other pipework to be insulated with foil faced mineral wool insulation. Insulation shall be carried over all valves and fittings smaller than 65Dia. For valves with a diameter of 65 mm or larger, provide insulated jackets with Velcro seals for ease of maintenance.

All insulated pipework that is visible within the building shall be fitted with aluminium cladding protection, with the exception of pipework within the plant room which shall be left with an aluminium foil finish. Profiled aluminium cladding shall have a thickness of 0.56mm. It shall be fitted with reinforcement bands at 300mm centres, and shall be left in an undented condition at practical completion. All damaged protection shall be replaced before practical completion, irrespective of the source of the damage.

It is the duty of the Contractor to determine the extent of visible pipework in the building at tender stage, as no allowance will be made if it is incorrectly assumed that pipework is contained within voids. If in doubt, the Contractor should contact the Employers Representative during the tender period to determine pipe locations.

All insulation materials shall be supplied by a manufacturer assessed and registered in accordance with IS ISO 9000-2.

Insulation shall be finished with a neat and undamaged appearance. All insulation or insulation protection damage shall be repaired prior to handover, irrespective of the cause of damage.

Insulation type shall be foil faced mineral wool with a density of 80 to 120 kg/m³ and a

thermal conductivity of no more than $0.038 \text{ W/m}^{\circ}\text{C}$ at a mean temperature of 50°C .

Mineral wool insulation thickness shall be as follows:

Pipe Size	LPHW Pipework (mm)	External Pipework (mm)
15	30	50
20	30	50
25	35	50
32	35	50
40	40	50
50	40	50
65	40	50
80	40	50
100	45	80

External Pipework

On all exposed external insulation, provide polyisobutylene (PIB) protection as follows:

Wrap pipework, fittings, and vessels with PIB sheeting lapped at every joint by at least 50 mm. Solvent weld joints and support with banding in accordance with the manufacturer's instructions. Arrange joints to shed water and prevent the ingress of water. Minimum thickness of polyisobutylene shall be 0.8mm.

Integrity of Vapour Barriers

Where a vapour barrier is used ensure its integrity throughout. Repair immediately any damage to vapour barriers and where such barriers have been applied off site, repair to manufacturer's instructions.

Do not exceed a permeance value of 0.05g/sMN for vapour barriers.

Insulation Materials

Ensure all thermal insulants for use in the building services are made using materials with

zero ozone depletion potential (CFC and HCFC free).

The following materials must not be used to insulate mechanical services:

Urethane foams. Extruded polystyrene. Polyisocyanurate foam. Polyethylene foam.

Ensure the insulation will maintain its thermal performance for a minimum of twenty five years

Ensure all materials are kept dry. Insulate each pipe separately. Do not enclose adjacent units together. Ensure all pipework surfaces are dry before the installation of thermal insulation. Neatly finish joints, corners, edges and overlaps and, where possible, arrange overlaps to fall on blind side. Ensure overlaps are neat and even and parallel to circumferential and longitudinal joints. Ensure joints are close butted together. Secure overlaps with adhesive or matching class 'O' tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above.

Where a vapour seal or fibre containment is required tape exposed insulation membrane and return to pipe surface.

Where insulation abuts pipe support inserts that have integral vapour barriers, seal using class 'O' foil tape to continue vapour barrier or containment.

Where insulation carries through pipe supports, provide phenolic foam pipe supports and ensure that vapour barriers are maintained.

Insulate all valves, flanges and other fittings that are installed on runs of insulated pipework with materials to provide insulation and vapour barrier performance equivalent to that which is provided on the run of pipework in question.

Fire Protection

All insulation shall comply with Euroclass A1. When completed, ensure surface-finish complies with BS 476-7 Class 1 spread of flame. Supply materials classified as less than 5% smoke obscuration rating when tested in accordance with IS EN ISO 5659-2.

Thermal insulation of plant

Pumps and other irregular shapes:

Where access is required to pumps and other irregular shapes submit proposals for materials and methods of applying a demountable finish, for approval by the Employer's Representative.

Electrical Bonding Terminal

Ensure an electrical bonding terminal suitable for connection of a 6 sq mm maximum conductor is provided. Make this connection where required to allow earth bonding of pipework and cladding.

Pipework Joints

All pipework joints shall be welded. All connections to valves or equipment shall be screwed for ease of maintenance.

Use skilled craftsman in possession of a current certificate of competence appropriate to type and class of work, issued by an approved authority. Provide certificates for all welders on request.

Preparation, Making and Sealing

Oxy-acetylene welding, conforming to BS 1821 or BS 2640 appropriate to system temperature and pressure. Arc welding, conforming to BS 2633 or BS 2971 appropriate to system temperature and pressure. Use arc welding process on piping greater than 100mm.

Screwed Joints

Ensure that plain ends are cut square. Reamer out bore at plain ends. Screw plain ends, taper

thread. Coat male pipe threads with jointing compound and hemp, or PTFE tape on small sizes. Immediately after applying coating connect with female end of socket or fitting and tighten, ensuring that coating does not intrude into pipe. Leave joint clean.

Expansion Devices

Fit expansion devices in the form of expansion loops or bellows in any straight runs with a total length of greater than 20m. Preference should be given to the use of expansion loops over bellows where space allows.

Expansion loop

Provide expansion loop in material and finish of associated pipeline. Size to limit stress set up in material of pipe wall to 69 MPa. Forge bend from a single length of pipe or join by welding fittings if expansion loops are too large to manufacture in one piece.

Expansion compensators Axial bellows Ends : Flanged Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves. Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

Support spacing

Space supports as shown in the following table:

	Steel	
PIPE BORE (mm)	Horizontal (m)	Vertical (m)
Up to 15	1.8	2.4
20	2.4	3.0
25	2.4	3.0
32	2.7	3.0
40	3.0	3.6

50	3.0	3.6
65	2.7	3.0
80	3.7	4.6
100	3.7	4.6
125	3.7	5.4
150	4.5	5.4

	Copper	
PIPE BORE (mm)	Horizontal (m)	Vertical (m)
Up to 15	1.2	1.8
22	1.4	2.1
28	1.8	2.4
32	2.4	3.0
35	2.4	3.0
42	2.4	3.0
54	2.7	3.0
67	3.0	3.0

Where multiple pipe runs of differing bores are supported from a common point, use the support spacing of the pipe type requiring the closest spacing. Provide for appropriate cushion/axle support points.

Anchors

Construct to resist axial stress transmitted by flexure of horizontal and vertical pipe runs or loading on vertical pipes assuming that unbalanced forces exist at all anchor points, even when these are situated in intermediate positions between two expansion loops or bellows. Use similar or compatible materials to the attached pipe.

Provide and fix all associated backing plates, nuts, washers and bolts for attachment to or building into building structure; ensure structure is suitable for transmitted stress. Set out and line up anchors accurately in position. Inspect final grouting into building structure.

Provide anchors constructed using mild steel overstraps or heavy U-bolts. Secure to channel section, adequately attached to or grouted into building structure; weld longitudinal edges of strap to pipe.

Flexible Connection Installation

Fit rubber bellows as close to source of vibration as practicable. Ensure the pipe at other end of bellows is a fixed point. Install flexible connections strictly in accordance with manufacturer's instructions.

Ensure flexible connections are tied when the plant is on vibration isolation mountings.

Terminal Unit Connections

Install hose connections strictly in accordance with manufacturer's instructions.

Fittings

Headers

Terminate ends with blank, bolted flanges.

Screwed Flanges

Apply jointing materials - Screw on flange and expand tube into flange with roller expander where necessary.

Preparation - Ensure that flange mating faces are parallel; flange peripheries are flush with each other; and bolt holes are correctly aligned.

Making and Sealing - Insert jointing between flange mating faces. Pull up joint equally all round.

Flexible Couplings and Flange Adapters

Preparation - Ensure that cut ends are square and free of bumps, dents and score marks and are within manufacturer's tolerances.

Making and sealing - Ensure gasket is suitable for service. Thoroughly lubricate gasket using manufacturer's recommended lubricant. Assemble coupling in accordance with manufacturer's instructions.

For non-end load capable couplings, ensure that adequate pipe anchorage is provided to prevent pipe disengagement.

Valves

All valves are to be pressure tested at the manufacturer's works. All valves shall be CE and kitemark certified. All valves shall be attached to pipework with screwed fittings. All valves shall be manufactured from a copper alloy.

Stop Valves

For isolation of pipework up to 65 Dia. Type : Lever operated Manufacturer: BS BOSS Fig 966S, brass full bore ball valve, WRC approved Materials: to suit steel tube: Bronze or DZRR copper alloy body. Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seals and stem seals. Anti-blowout stem. Ends: Threaded

For isolation of pipework over 65 Dia. Type : Lever operated Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit IS EN 1092-2. Provide lever and gear operated valves with long body neck for lagging clearance. Seat - Bonded. Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat. Operation - Lever and graduated notch plate.

Regulating Valves

Type: Screwed regulating valves up to 65Dia. Flanged for 65 Dia and above.

Manufacturer: Up to 50 mm NHN Ltd. Fig. 1432, Fig. 1473.

Over 50mm: HNH Ltd. Fig. M733DR to PN16 or equivalent and approved. WRAS approved

Materials: To suit steel tube

Double Regulating Valves

Type: Screwed double regulating valves up to 65Dia. Flanged for 65 Dia and above.

Manufacturer: HNH Ltd. Fig. CV 2432. Fig CV 2373 (low flow) WRAS approved Material:

To suit steel tube. Material - Cast iron to IS EN 13789. Oblique or Y pattern; copper alloy, nickel alloy or resilient valve face; rising stem outside screw or non-rising stem inside screw; manufacturer's standard materials. Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter.

Test Plugs

Measurement of temperature and pressure, to be provided as required allowing the system to be fully commissioned. Manufacturer and reference: Mechseal or approved equivalent

Self sealing test points Provide DZR copper alloy self sealing test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.

Radiator Valves

Material - Bronze or brass copper alloy body. Pattern - Angle or straight to suit application.

Straight - Threaded to BS 21 or compression to IS EN 1254-2 (BS 864-2) to suit pipework as indicated.

Angle - Threaded to BS 21 with one end internal and other end external with union nut and tail pipe; or compression joint to IS EN 1254-2(BS 864-2) one end and other end externally

threaded to BS 21 with union nut and tail pipe to suit pipework as indicated.

Options - Fit wheel valves on flow connections to radiators, and other heat emitters, without thermostatic radiator valves. Fit lockshield valves on return connections.

Pipe Strainers

Type: Screwed up to 50mm, flanged for 65mm and above.

Manufacturer: Up to 50mm HNH Ltd. Fig. 87

65 and above: HNH Ltd. Fig 810 PN16

Material - Bronze to IS EN 1982 up to 50mm

Cast iron 65mm and above

Ends - Threaded to BS 21 up to 50mm and flanged to IS EN 10982 for 65mm and over.

Pattern - Y pattern body.

Screen free area - Not less than 250% of pipe bore.

Screen perforations 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter. 65mm and over nominal size, within range 1.5 - 1.8mm diameter. Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to BS 21.

Gauges

Provide gauges in the following locations:

- On common flow and return header to boilers.
- On main variable temperature flow and return connections.
- In additional locations as indicated on the drawings.

Manufacturer: BSS Ltd.

Use dial type gauges of robust construction, enclosed in dust tight metal cases. Retain dial glass with bezels screwed to case. Finish with chromium plating. Use white dial scales indelibly and clearly marked with black lettering to indicate measured values. Select scale ranges which indicate 'Normal' when pointer is vertical or central on scale.

Dial case - 100mm diameter for flush mounting to steel panel. Mount gauges with dial face in

vertical plane flush to panel and conceal casing within a steel metal cubicle

Control Valves

BALL VALVES: Valve - Two way control valve. Rotary Actuator - Modulating. Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle;

EPDM spindle seal. Connections - Threaded to BS 21. Ancillaries - Lever for manual operation.

THREE WAY: Valve - Three way control valve. Rotary Actuator - Modulating. Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle;

EPDM spindle seal. Connections - Threaded to BS 21. Ancillaries - Lever for manual operation.

Check valves:

Type Swing check, screwed. WRAS approved. Pipe material - to suit steel tube. Screwed Connection. Manufacturer HNH

Drain Cocks

Fit at all low points in the system that can not be drained through outlets. Manufacturer: HNH Ref 371 Operation: Lockshield connection to accept key Materials: Bronze body Ends: Threaded Outlet: Fit outlet with hosepipe connector

Automatic Air Vents

Type : Ball float Manufacturer : Chas. Winn Ltd. type B

Combined air and dirt separators:

Microbubble air and dirt separator

Construction : Vertical steel housing with internal large surface area mechanism to remove

microbubbles via coalescence effect. Fitted with dirt drain at its lowest point for removing dirt that sinks and fitted with a dirt drain valve on the side of the housing for removing dirt that floats on the water. Provide automatic air release mechanism.

Ends : Line size with flange Maximum temperature, 110°C. Maximum pressure 10 bar.

Direct Acting Safety Valves

Confirm all safety valves are set to appropriate pressures. Provide test Certificates for all safety valves prior to practical completion.

Manufacturer: NVEIG Ltd. NABIC Fig. 42 (screwed / flanged) PN rating 10

Type: Double spring loaded, high lift type.

Up to and including 65 Dia.:

Copper alloy - Bronze or DZR copper alloy body. Ends - Threaded

Over 65 Dia.:

Material - Cast iron body. Ends - Flanged. Spring type - Double spring loaded, high lift type.

Pumps

Select pumps at or near the most efficient part of the performance curve for the duty required. Pumps delivered to site that do not meet this requirement must be replaced.

Pump type and materials supplied shall be appropriate for their application and the conditions of the fluid served.

Position and orientate pump in accordance with manufactures guidance.

Support pumps independently of pipework, except by agreement with the Employer's Representative. Locate pumps with adequate access for maintenance without the need to stand on other plant or pipework.

Fit flanged or screwed connections with associated isolating valves to all pumps.

Pump Electrics

Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by manufacturer.

Supply transient suppressors in the form of resistor and capacitor networks across the starter contactor coils. Fitted by manufacturer

Ensure motors, starters and ancillary equipment are suitable for operation at full capacity at heights above sea level not exceeding 1000m, with air cooling at an average temperature over 24 hours not exceeding 35 °C dry bulb with maximum conditions of 40 °C dry bulb and 50 per cent RH.

Use motors which conform to BS 2048-1, BS 4999, BS 5000:Index, IS EN 50347 and IS EN 60034, as applicable, which operate at the lowest possible speed, compatible with performance requirements.

Select maximum continuous rating (MCR) such that Driven machine operates at correct speed or speeds at design duty.

When running continuously at design rated duty, the temperature of the motor parts is within limits defined in IS EN 60034-1. When provided with excess motor current (over-load) protection of thermal overcurrent release type, ensure operation is within tolerances of tripping as defined in IS EN 60947-4-Insulation Use motors with Class 130 or 155 insulation, with temperature rise as defined in IS EN 62114.

Conduit entry Fit motor bodies with conduit entry terminal box or cable gland as required, and to suit type and size of cable being terminated.

Supply a Class Eff 1 High Efficiency Motor (HEM) with a stated efficiency as European Motor efficiency classes table below.

Power	Min Eff Class 1 (%)	
kW	2 Pole	4 Pole
1.1	82.2	83.8
1.5	84.1	85.0
2.2	85.6	86.4
3.0	86.7	87.4

Motors -over temperature protection use thermistors as follows:

Fit positive temperature coefficient thermistors to BS 4999-111. Provide a minimum of 3 PTC thermistors in each motor with 2 ends terminated in motor terminal box clearly and permanently marked.

Motor starters - motors of 0.37kW and above:

Provide starters incorporating overcurrent protection for motors of 0.37kW and above.

Provide starter with manual reset, adjustable, inverse time delay, and ambient temperature compensated thermal overcurrent release to IS EN 60947-4-1. Ensure overcurrent release is compatible with starting, accelerating and running characteristics of motor, starter and driven machine combination. Use phase unbalance protection on three phase equipment.

CURRENT LIMITING MOTOR STARTERS: Use static type thyristor voltage control starter to provide reduced current starting. Provide adjustable ramp times. Provide contactor for switching and disconnect for isolation. Provide details of harmonic distortion content prior to ordering.

DIRECT-ON-LINE MOTOR STARTERS: Use direct-on-line starter to IS EN 60947-4-1, with single phase motors and three phase motors.

STAR DELTA MOTOR STARTERS: Use star delta starter to IS EN 60947-4-1 with three phase motors. Incorporate adjustable time delay contactor relays, to control star delta changeover, ensuring electrical endurance compatible with starter contactors. Ensure starting

sequence activated on voltage restoration.

AUTO-TRANSFORMER MOTOR STARTERS: Use auto-transformer starter to IS EN 60947-4-1 with three phase motors. Provide 2 step closed transition auto transformers suitable for 3 operating cycles per hour. Provide auto transformers with three tapings for selection of motor starting voltage.

Arrange tapings to limit motor starting current to 80 per cent, 65 per cent and 50 per cent of full voltage starting current. Incorporate adjustable time delay contactor relays, to control automatic changeover from selected reduced voltage to full voltage, having an electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

STATOR ROTOR MOTOR STARTERS: Use stator rotor starter to IS EN 60947-4-1 with three phase motors. Provide starter resistors suitable for indicated operating cycles per hour. Incorporate adjustable time delay contactor relays, to control starter resistor short circuiting contactors, having electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

ACCESS TO PUMPS Locate pumps with adequate access for maintenance. Comply with manufacturer's maintenance guidance.

Location of valves

Install and locate valves to manufacturer's instructions

Install double regulating variable orifice valve to ensure equivalent of 10 diameters of straight pipe upstream and 5 diameters downstream of double regulating valve.

Supports - Arrange supports for control components to ensure no strain is imposed on components. **Access** - Arrange control components to ensure adequate access for operation and maintenance.

Provide outlets of vent cocks with discharge pipes.

Vibration isolation mountings

Provide vibration isolation and mountings as recommended by equipment manufacturers and as required to prevent excessive noise or vibrations.

Pressure equipment directive/pressure equipment regulations:

All equipment and assemblies which fall within the scope of the Pressure Equipment Directive (PED) 97/23/EC, implemented in the UK through the Pressure Equipment Regulations 1999, must be tested by the manufacturers, and be certified as compliant with the Directive. Such compliance shall be evidenced by displaying the appropriate CE Mark on the equipment and assemblies.

Only relevant equipment and assemblies certified as compliant will be permitted under this specification, and any substitution put forward must also be compliant with the Directive.

Installation of heat emitters

Install in accordance with manufacturers instructions. Ensure that all radiators are mounted at equal heights and are fully level. Radiators must be securely fixed. Where floor mounted or non standard fixings are proposed, a sample must be constructed on site and commented on by the Employers Representative prior to ordering supports.

Heating design, number and size of all new radiators and modified radiators to be checked and agreed in writing with the Engineer in Charge before installation. Only radiators meeting the most stringent health and safety standards (no unprotected sharp edges) for use in areas where children normally play will be accepted, i.e. include for protective covers for all radiators. Balancing and flow control mechanisms must be provided for each radiator. All radiators and pipes must be securely fastened onto solid walls and floors.

The position of radiator supports shall be clearly marked on site and checked with Engineer in Charge prior to installation.

Radiators shall be pressed steel to IS EN442

Provide brackets suitable for wall mounting

Connections shall be BOE type

Outputs are at room temperature of 20°C and MWT of 76.5°C

Allow for demounting radiators once for painting

Radiators to be powder coated to standard white or selected colour.

Testing, Cleaning And Commissioning

Cleaning and chemical treatment Specialist

Use a Specialist for analysis and for design, supply, installation and operation of any system cleaning and chemical treatment process.

Conditions for cleaning and chemical treatment:

Ensure treatment complies with statutory authority and health and safety regulations. Notify manufacturers and suppliers of equipment of proposed system cleaning and chemical treatment processes. Establish if any manufacturer or supplier of equipment requires any particular cleaning and chemical treatment process due to size of waterways or materials used.

All chemicals used are to be compatible with the metallurgy of the systems and equipment used.

Where any equipment installed can be damaged by common treatments, install a laminated

notice in the boiler house indicating the treatments that can damage the system or reduce the system life.

Preliminary checks

Prior to carrying out cleaning or chemical treatment process, ensure that:

All foreign matter is removed. Certified pressure tests have been carried out in the parts of the system to be cleaned. Carry out further pressure tests on the isolated sections of the system independently. All water used for pressure testing is inhibited. Leave remaining pipework sections full after testing. Where there is a risk of freezing inhibited mono-ethyleneglycol is used. Circulation has been demonstrated and approval obtained on all parts of the system.

Manipulate and leave fully open all valves other than those used to isolate sections. Carry out balancing and certification after the flushing, cleaning and passivation operations.

No damage can occur to any item of plant or equipment due to cleaning and chemical processes.

Chemicals used are compatible with system materials. All items of plant and equipment subject to damage or blockage due to cleaning and chemical treatment processes are isolated or removed.

Dirt pockets are installed at low points to facilitate solids removal. Supply dirt pockets with drain valves sized to pipework size. All drains provided have been tested and approved and that any pumping equipment associated with the drainage system is fully commissioned. Dead legs that are more than 3 pipe diameters in length are looped to allow effective cleaning. Strainer baskets and filter media, incorporated within systems, are removed; and where necessary spool or stool pieces are installed.

Temporary strainers and filters are installed as required for removal of solids during cleaning and chemical treatment processes. Strainers are clean prior to the start of the cleaning process, throughout the cleaning and on completion.

Suitable supply and drainage points are provided with 50mm minimum connections, properly sited and installed, either valved or plugged.

All automatic/manual air vents are fully commissioned. All requirements of COSHH regulations are complied with during the chemical cleaning and chemical treatment of the system.

Where required by local water authority, provide effluent tanks for storage of all waste products of cleaning and chemical treatment processes. Following local water authority approval, either neutralize and dispose to drain of all waste products; or ensure authorised disposal at registered sites.

Comply with Waste Management Duty of Care: A Code of Practice and Control of Pollution (Special Waste) Regulations 1980 where appropriate.

Testing

Pressure test all water services pipework

Operating gauge pressure less than 3.5 bar, test gauge one and a half times operating pressure. Operating gauge pressure 3.5 - 7.0 bar, test gauge pressure twice operating pressure. For below ground pipework test to 7 bar or twice the working pressure (whichever is the greater) for 4 hours.

Comply with procedures given in HVCA Guide to Good Practice for Site Pressure Testing of Pipework. Ensure safety precautions detailed in HSE Guidance Note GS4 Safety in Pressure Testing are adopted.

Test concealed or buried pipework before any permanent covering is applied. Advise appropriate personnel, in advance, of the time pressure tests may be witnessed.

Carry out Hydraulic Pressure Testing as described in HVCA Guide to good Practice for Site Pressure Testing of Pipework. Test section by section for one hour, as the work proceeds and prior to application of thermal insulation. Keep record of pressure tests and issue them to the Employers Representative, and include them within the handover documentation.

Commissioning

Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

Carry out checks and procedures as detailed in CIBSE Commissioning Code W, Section W1. Ensure system is statically complete as defined in section B4 of BSRIA Application Guide 2/89 Commissioning of water systems in buildings.

Use pre-commissioning checklist from BSRIA Application guide 2/89.

Setting to work and regulation Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W, Sections W2 and W3, and sections C3 and C4 in BSRIA Application Guide 2/89.

Use instruments for measurement detailed in BSRIA Application Guide 2/89.

Test all outlets in groups to determine that appropriate flow rates and temperatures are achieved.

Performance test records

Keep a systematic record of all tests. Include the test record with the O & M's.

Flushing

Carry out flushing of water systems in accordance with BSRIA Application Guide 1/2001 Pre-commission cleaning of pipework systems.

All water used for pressure testing, flushing and system filling is of good quality. Leave remaining pipework sections full and treated after pressure testing.

Install all necessary pipework ancillaries to enable a Specialist to carry out flushing,

inspection and witnessing of water systems in accordance with BSRIA Application Guide AG 1/2001. Pre-commission cleaning of water systems.

Temporary connection from the mains must be in compliance with the Water Supply Regulations, or by installation of a temporary tank and pump arrangement. Domestic water systems are to be flushed and disinfected in accordance with the requirements of BS 6700, and to the satisfaction of the local water supply authority. Flush systems using mains water until the water is clear.

Witnessing

When the system has been cleaned, obtain written confirmation from the Employers Representative that the system, including water storage tanks has been inspected. If the system is found to be dirty at any stage after the cleaning has taken place, then the Contractor shall re-clean and sterilise the system unless a signed witnessing certificate is produced.

Chemical cleaning and solids removal

Carry out chemical cleaning procedure in accordance with BSRIA Application Guide 1/2001 Pre-commission cleaning of pipework systems.

Sterilization – General

After flushing process, carry out sterilization in accordance with BS 6700. Prior to sterilization ensure each system is flushed, cleaned and drained. Provide temporary connections to system terminal points suitable for introduction of sterilization chemicals and fluids and 22mm minimum valved drain connection on incoming main immediately downstream of mains isolating valve. Fill system with clean, fresh water.

Chemical dosing – LPHW systems

Provide biocides effective against Legionella Pnueumophilia, algae, fungi, moulds and slime

forming bacteria including pseudomonas and sulphate reducing bacteria.

Supply biocides as recommended by water treatment Specialist. Incorporate a bio dispersant in the programme to break up and disperse any slime masses, where required.

The water treatment Specialist shall select the appropriate corrosion inhibitors, to minimise corrosion, and biocides to prevent any proliferation of any growth on mild steel, copper and copper alloys.

Provide a specific inhibitor to protect aluminium when it is present in the system. The cleaning agent must be specified by the water treatment Specialist.

Documentation:

Within handover documentation include the following:

- Certificate confirming that the water systems have been cleaned, sterilised and tested
- Details of routine cleaning and sterilisation required that will be required by the end user
- Provide number of copies as indicated of hard cover binders containing details of
 - Programme outlines.
 - Purpose of chemical treatment.
 - Chemicals used and quantity.
 - On site testing procedures.
 - Control limits of tests.
 - Equipment data and drawings.

- Product notes and material safety data sheets for all chemicals used.

Chemical provision:

Provide consumables for a period of 12 months.

Fully balance all systems. Make a full record of all commissioning point flow rates and provide a comparison of flow rates achieved with design flow rates. Send results to the Employer's Representative for comment.

Instrument and Gauges

Ensure instruments are correctly calibrated. Record details of all instruments on record sheets. Submit evidence of correct calibration of instruments to be used in connection with the commissioning and testing.

Thermostats and temperature sensors

Test all thermostat and temperature sensor readings against calibration equipment that is provided with a calibration cert that is dated within six months of the test period.

Performance testing

Test the full system, under various conditions. Check the operation of run and standby plant. Check all controls settings and the operation of every function of the controls system before requesting that the Employers Representative witness the correct operation of the system.

Venting of heat emitters

Vent all air from heat emitters prior to testing, and again at practical completion.

Standards and Regulations

Comply with all of the requirements within following standards:

IS EN 10255	Steel pipework	09/2011
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IS 21:1985	Steel fittings - Screwed	09/2011
BS EN 102551, PN 16	Pipe flanges	09/2011
IS EN 1092-1	Pipe flanges	09/2011
BS 7786	PTFE tape	09/2011
IS EN 751-2	Pipe jointing materials	09/2011
BS 21	Screwed joints with PTFE tape	09/2011
BS 1453	Welding rods gas welding	09/2011
BS 2633 BS 2971	Electric arc welding	09/2011
BS 2640 BS 2971 HVACA Code of Practice TR/5	Welding of steel pipework	09/2011
IS EN 12266	Testing of valves at manufacturers works	09/2011
IS EN 618005-1	Variable speed drives on pumps	09/2011
IS EN 13828	Ball valves	09/2011
IS EN 593	Butterfly valves	09/2011
BS 7350	Globe valves	09/2011
BS 2767	Radiator valves	09/2011
IS EN 215	Thermostatic radiator valves	09/2011
BS 5154	Check Valves	09/2011
IS EN 442	Radiator manufacture	09/2011

Note: Use latest edition of each standard, containing all revisions available at the time that the project was issued for tender. Also include compliance with all other relevant standards and codes of practice which apply at the time that the project was issued for tender.

Valves, Actuators, Etc.

The Contractor shall ensure that the valves are appropriate to allow the control routines specified to be achieved, including the “valve closed” detection routines. The secondary circulation pump shall be provided with an integral pressure controlled variable speed drive that reduces pump flow as the room valves close. The Contractor shall provide commissioning certificates proving the correct operation of the variable speed drives on handover of the building.

It will be necessary for the successful contractor to integrate the installed system with the new associated control system.

Actuators

- Ensure that actuators and linkages for valves and dampers operate smoothly from fully open to fully closed without binding and with adequate torque to overcome the resistance of the actuator mechanism and the flow and to provide the specified close off ratings.
- Ensure that linkages are clearly marked with the clamping position such that after maintenance or replacement the mechanism is able to operate correctly.
- Fit actuators with visual position indication.
- Ensure that there is sufficient space above the actuator so that it may be removed for testing or maintenance.
- Include position feedback devices suitable for connection to the BMS.
- Ensure that actuators incorporate a disconnection device to allow manual operation of the valve or damper in the event of actuator failure.
- Ensure that actuators are electrically and mechanically protected from the effects of valve or damper seizure.
- Use 24v actuators wherever possible. Where line voltage actuators are used, provide local means of isolation by manual isolator or plug and socket connection.
- Ensure that, during commissioning, valve actuators are fitted in a fully closed/bypass position where they are being fitted to valves which push against a spring.
- Ensure that all actuators are fitted with isolation valves on both sides.

Valves

General

- Ensure that valves have the correct authority without excessive pressure drop.
- Ensure that valve bodies are suitable for the medium, the temperature and the pressure of the fluid system.
- Ensure that valves will pass the required flow at a pressure drop within the maximum differential pressure rating of the valve.
- Check for out-of-balance forces, particularly during operation of a three-port valve.
- Where possible ensure that valves are not installed with their spindles in the horizontal position. If valves cannot be installed with their spindles in the vertical position ensure that they are as near as possible to the vertical.
- Ensure that valves are not installed with the actuator at the bottom.

Modulating valves

- The following additional considerations apply for modulating valves:
- Ensure system operating pressures, test pressures, pump heads and pressure drops through heat exchangers and associated pipework are known before control valves are selected.
- Select valves to provide an authority of 0.3 to 0.5 for diverting applications and 0.5 for mixing applications.
- Select valves with port characteristics appropriate for the intended function.

- Ensure that all modulating control valves are selected for equal percentage or linear characteristics according to system type, to provide near linear characteristics between the valve position and the heating/cooling power as delivered to the air or water-based system.
- Ensure that the rangeability of the selected valves is large enough to provide stable control under low load conditions.

Valve Sizing Requirement

Select control valves for required working pressures

Valve close off pressure to be appropriate for the application

Maximum valve leakage co-efficient shall not exceed 0.05% kv

Dampers

Provide visual position indicators on all damper actuators installed so that they can be seen from the plantroom floor.

Ensure that damper characteristics are as linear as possible.

Products/Materials

MOTORISED VALVES: IS EN 60730-2-8

MOTORISED DAMPERS: Use motorised control dampers manufactured and installed in accordance with DW 144

ACTUATORS: SOLENOID TYPE IS EN 60730-2-8.

ACTUATORS: ELECTRONIC TYPE: IS EN 60730-2-8

TEMPERATURE SENSORS: IS EN 60730-2-9.

HUMIDITY SENSORS: IS EN 60730-2-13

FLOW SENSORS: IS EN 60730-2-18

AIR THERMOSTATS- ROOM TYPE: IS EN 60730-2-9.

AIR THERMOSTATS- FROST PROTECTION TYPE: IS EN 60730-2-9.

For space mounting, use frost protection thermostats with temperature range of 0 - 20[°] C and with SPST switching action and an electrical rating of 20 amps resistive.

SECTION 12 – WIRE SERVICES - GENERAL

Labelling

Labelling shall be provided on all Switchgear, Dist. Boards, electrical plant. All labels must be neat, lined up with other labels, orientated for easy view, and securely fixed. Any labelling installed which does not fit this description shall be removed and replaced as required.

ELECTRICAL SUPPLY AND ELECTRICITY CENTRE

The design parameters are defined by “IS 10101”, ‘BS 60439’, the ‘ETCI National Rules for Electrical Installation’ and ESB ‘National Code Of Practice For Customer Interface’. Any new external ESB meter enclosure shall be a four compartment IP44, 3mm Galvanised Steel, flame-retardant Class 0, waterproof enclosure contained within the Meter Store on the outter wall by Starway 1. This enclosure shall be ESB compliant, capable of taking a ESB Cut-Out, ESB Whole Current meter or ESB CT’s and come with four doors with ESB key safe built in. Minimum dimensions for this enclosure shall be 1760mm (H) x 1100mm (W) x 320mm (D). Any new Main Switchboard shall be ‘BS 60439’ compliant, Type Tested Assembly (TTA) or Partially Type Tested Assembly (PTTA), floor mounted, ‘Form 4A Type 2’, metal clad type with standard metal 8mm triangular locks fitted and come with a Electronic Moulded case circuit breaker incomer. Electronic Lightning/Surge protection shall be provided on the incoming mains along with shunt trip facility via the Fireman Switch.

PRIMARY & LOCAL ELECTRICAL DISTRIBUTION

Primary Distribution

Sub-mains circuits shall supply local General Service, Power and Lighting boards from the Main distribution board. Sub mains distribution within the building shall be via XLPE insulated, steel wire armoured, LSF sheathed cable on galvanised steel cable tray mounted directly to the soffit. A separate CPC shall be installed with every sub-mains feed and should be of the size detailed in the distribution drawings. The amour of the cable should also be bonded at both ends to the distribution equipment by means of a nut and bolt through a tab linked to the earth bar.

The Main runs of Information and communication technology cables shall be run within a separate Mesh cable tray system generally following the same Main service routes and shall

be separated from power distribution cables. Where crossovers are required, they shall be at 90° to the power cable route. On leaving the main run containment system these cables shall be run in a separate compartment of the 3- compartment steel trunking or within steel conduit. Local general services, lighting and power boards (SDB's) shall be metal clad type MCB cubicles fitted with standard metal 8mm triangular locks. Each SDB shall have load break isolator incomers and MCCB sub section breakers. Type B, C or D MCB's shall feed final lighting and power circuits, with RCD protection on socket circuits. 25% spare capacity for future expansion shall be included on the main and subdistribution switchboards. Fire barriers shall be installed where trunking/tray passes through fire walls and compartments. The main switchboard shall contain the final circuit distribution for the common spaces, and classrooms. A system of medium duty, galvanised steel cable tray in accordance with BS 61537:2007 and trunking in accordance with BS EN 10346:2009 shall be installed to distribute sub mains, general and emergency lighting, power, fire alarm, public address and mechanical services control wiring throughout the building. Separate tray/trunking shall be provided for data. Separate systems shall be segregated in accordance with the NSAI IS 10101 and ETCI National Rules for Electrical Installations.

Local Sub-distribution and final circuit distribution

Each local sub-distribution board shall have separate general services, power and lighting sections. Local sub-distribution boards shall be 'Form 2' metal clad MCB cubicles with load break isolator incomer and MCCB sub section breakers. MCB's shall feed final lighting and power circuits, with RCD protection on each individual socket circuit. Local consumer units to 'Form 1' construction shall be provided where indicated on the drawings. 25% spare capacity for future expansion shall be included on the main and subdistribution switchboards. A system of medium duty, galvanised steel cable tray in accordance with BS 61537:2007 and trunking in accordance with BS EN 10346:2009 shall be installed to distribute sub mains, general and emergency lighting, power, fire alarm, public address and mechanical services control wiring throughout the building. Separate systems shall be segregated in accordance with the NSAI IS 10101 and ETCI National Rules for Electrical Installations. Information and communication technology cables shall be run within on a separate cable tray system generally following the same service routes and they shall be separated from power distribution cables. Where crossovers are required, they shall be at 90° to the power cable route. Fire barriers shall be installed where trunking/tray passes through fire walls and compartments.

EARTHING

The objective of the system is to provide an effective system to minimise danger to life and equipment arising from:

Faults between line conductors and non-current carrying metal work.

Atmospheric discharges.

Accumulation of static charges.

The design parameters are defined within NSAI IS 10101 the ETCI National Rules for Electrical Installations. Earthing connectors to pipes etc. shall be done in a neat manner and shall be visible and aesthetically acceptable, preferably in an area where student access is restricted. Earthing connectors shall be located where visual inspection and easy access is available. In doing so the contractor shall take account of other services or disciplines which can influence earthing connector locations.

POWER DISTRIBUTION SERVICES

General Services

The objective of the system is to provide an efficient and effective system for the distribution and support of small power requirements. The design parameters are defined within NSAI IS 10101 and the ETCI National Rules for Electrical Installations. The system requirements are as shown on the system drawings. Final circuits shall be fed from local sub-distribution boards, as indicated on the system drawings. Socket outlets shall be of the 13 Amp switched type surface mounted (unless indicated elsewhere) and shall be wired in 20 Amp radial circuits using 4mm² XL/LSF cable enclosed in galvanised steel conduit and/or trunking. A 2.5mm² XL/LSF CPC shall be installed with each circuit and connected to the main earth bar in the distribution board. In classrooms and offices no more than 4 twin socket outlets shall be supplied from one 20A circuit. Socket surface plates shall be of metal clad finish only and be engineered to fit flush with the back box. All circuits supplying socket outlets shall be individually protected by a 30 mA RCD. Sockets in classrooms (excluding the teacher's wall) shall be un-switched type and these along with common spaces shall be supplied with 3-pin socket cover / socket protector inserts to prevent children from inserting foreign objects into the socket. The removal of socket cover / socket protector inserts shall require the use of the flat side of a second protector.

Mechanical Plant and Controls Wiring

The connections to mechanical plant shall consist of supplies to all mechanical services being installed under this contract which operate at 230V or 400V, as well as low voltage for control cabling. The wiring in connection with mechanical services shall be in accordance with the system drawings, and the requirements of the installation. The connections to controls shall consist of supplies and connections to all mechanical services, door automation and hatch shutters being installed under this contract which operate at ELV, 230V or 400V, as well as extra low voltage for control cabling. The Contractor is required to co-ordinate all services packages in order to determine and ensure that the required wiring is provided to provide the functions required from the systems.

7 COMMUNICATION SERVICES

Information Communication Technology A networked Local Area Network (LAN) cabling system shall be installed for all habitable rooms in the building in accordance with the Department's brief documentation. The system shall comply with Category 6a enhanced UTP (CAT6a)/Class EA, ISO 11801 (fast Ethernet) with outlets as indicated on the drawings. A central Data Communications Centre (DCC) shall be provided where all data cabling shall be terminated. A fully fitted 2222mm(h) x 1000mm(w) x 800mm(d) cabinet shall be provided at this location for housing patch panels and active equipment. This cabinet shall come with all relevant equipment for supporting and terminating cables as standard along. Extract fans and power socket strips shall also be included. Data cabling shall be terminated in RJ45 outlets at both ends. Power supply to each cabinet shall be via a separate MCB from the DCC to an industrial type 'Commando' plug and socket to IS/EN 60309, so as to eliminate the risk of nuisance tripping. A trailing lead from the plug shall be terminated in a switched spur in the cabinet which in turn connects to socket outlets. The number of socket outlets within the cabinets can be calculated by dividing the number of network points by twenty-four with a min of an 8-way outlet installed. At least two additional socket outlets shall be provided for expansion. The Contractor shall be responsible for the provision of all cabling, outlets, RJ45 patch frames, device leads and patch leads. A Data Services Specialist shall be employed by the Contractor in order to install the cables, carry out all the final connections and commissioning of the system. Separate telephone lines from the service provider's main incoming termination frame to the DCC frame shall be provided for Internet (WAN) & phone connection. All data cabling shall be installed in a separate ELV mesh cable tray of the main containment distribution system and classroom points shall be installed in the dado trunking in the computer section. Active computer network equipment (hubs, routers, switches, servers, UPS's) is outside the scope of the building contract. The

number of patch leads and device leads shall be 100% of the number of wired points.

All data products shall be randomly tested through the year by 3rd party test houses, as opposed to product that is selected specifically for test. The following parameters shall also be met with regard to the data system installation:

- Guarantee from manufacturer to end-user for 20 years
- Lifetime of applications
- Warranty must cover both copper and fibre
- Warranty must cover IEC fire ratings
- Full cost of replacement (**labour** and parts)
- Transferable warranty
- Extended distances (see technical specification)
- Fully compliant with latest International and European standards
- Fully Technical support from manufacturer in event of an accident
- Manufacturer must audit site during installation
- Proof of training of installer (not older than 2 years) must be supplied.
- All products must cover 3rd party compliance documents. 3rd party compliance must be **random** tested, **not sample** testing.

The contractor shall also allow for 2 site visits from the proposed supplier's cable manufacturer to inspect the site and work in progress.

Public Address (PA) where specified

The contractor shall ensure a specialist PA supplier provides a PA system in strict accordance with this specification. The specialist supplier shall also be required to carry out the final connections to the main panel and to carry out the final commissioning of the system. The PA system shall consist of wall mounted speakers in the classrooms, corridors and the sports hall. External speakers shall be provided around the school as outlined on the drawings. The PA system shall be a two way system with the facility for the teachers to talk to the caller. The speakers will be served by a central console located in the Administration or Principal's office with all wiring originating from this location. The PA system shall be provided with a separate microphone socket, hand held microphone and microphone stand for use in the GP / Sports hall as outlined later in this specification.

Cabling: The cabling to speakers shall be wired in a four core LSF CATV screened cable (PROCAB - CAT50HF) wired to each classroom speaker. The corridor speakers shall be wired in parallel on a floor by floor basis using a 2 x1.5 (PROCAB LSF LS07HF) LSF

Speaker cable. The external speakers should also be wired in parallel using a 2 x 1.5 (PROCAB-LSF LS07HF). The speakers in the GP / Sports hall shall be wired in parallel and wired in a four core LSF CATV screened cable (PROCAB - CAT50HF). The speakers in the GP hall will require a mains power supply to each speaker. The microphone input plate in the GP / Sports hall shall be wired with two no 2 core screened cables. One of these cables will be wired back to the main console and the other directly to one of the speakers in the GP hall and then on to the other speaker in the GP hall. The speakers shall be terminated at the main console into a wall mounted KRONE termination box. This termination box must be fitted within two meters of the console in a position assessable by the engineer for commissioning and maintenance.

Speakers: Speakers throughout the school shall be as per that detailed in the equipment schedule. Mounting heights for Classroom and Corridor speakers shall be 1600mm AFFL. External speakers shall be mounted between 2500mm (Min) and 3600mm (Max) ground floor level. The GP /Sports hall shall have a pair of speakers (see equipment schedule) fitted to facilitate assembly / plays and other used that may be required in this space. Under normal working conditions the speakers will be connected to the main school panel (on their own zone select switch). The hall will be fitted with a dual microphone input plate which will allow the microphone in the hall to be broadcast through the hall speakers, the school speakers or both as required. The speakers will be wall mounted and will be protected with a wire cage supplied by the contractor. As part of the GP/ Sports hall system a hand held microphone with a floor stand shall be provided. The microphone shall have the minimum specification as detailed in the equipment schedule. The floor stand shall be telescopic type with a round flat base. The stand shall be fitted with a suitable microphone grip to facilitate the microphone detailed. The microphone input plate shall be metal brushed aluminium type fitted with two XLR input sockets. The PA control console shall be located in the administration or Principals office and shall consist of the following:

Amplifier: The Amplifier shall be a 100volt type integrated amplifier. The amplifier shall have at least six universal inputs and shall utilise inputs one and two for “Talk Out” and “Talk Back”. Input three shall be utilised for the GP Hall microphone input and input four shall be utilised for the external chime board. Inputs five and six may be used for program inputs or remote microphone inputs if required. The minimum amplifier wattage shall be determined by the following table. A pre-announcement chime will sound on operation of the paging microphone.

Gooseneck microphone. The microphone shall be a dynamic type 12” gooseneck microphone and shall be integrated on the top of the main console. This microphone shall be operated by a push to talk switch located on the main switch panel. This microphone shall be mounted via an XLR type socket for ease of maintenance.

Switch Panel: A Speaker Switch panel shall form an integral part of the system and shall provide a separate switch for each of the following;

- ☐ Each teaching space as a separate zone
- ☐ All Corridors as one zone
- ☐ All external speakers as one zone
- ☐ The GP / Sports hall as one zone

An “ALL CALL” switch shall also be provided as well as a “Push to Talk” switch.

24 Hour master clock: A 24hour dual channel time clock shall be supplied as an integral part of the control equipment. This will be used to signal class changes as well as start and end of day signals. The clock shall be dual channel with each channel having the following specification as a minimum.

- ☐ 56 Program times
- ☐ 1sec to 30min pulse

Classroom speakers 3 Watts each

Corridor Speakers 3 Watts each

External speakers 15 Watts each

GP room speakers 3 Watts each

- ☐ Auto daylight saving
- ☐ Permanent On /Off override switch
- ☐ USB Program key
- ☐ Permanent current time and date display
- ☐ Program for day or group of days
- ☐ Holiday mode
- ☐ Backlit display
- ☐ Keypad lock facility

Chime board: A minimum of three chimes shall be available for use. One of these chimes

will be used as a pre- announcement chime and the other two for Class Change / End of day signals. The exact chime sounds shall be agreed with the consultants before installation.

Reproductions Facilities: The console shall have the facility to provide a 0dB output for recording facilities and also a universal input for reproduction of material.

Commissioning: The system shall be commissioned by the specialist supplier and the following procedures shall be performed as a minimum.

- ☐ All field wiring tested before connection
- ☐ All field wiring terminated to console
- ☐ All speakers tested for operation
- ☐ All speakers checked for correct tapping
- ☐ All switching tested and recorded (Issue record sheet)
- ☐ All SP levels checked.
- ☐ All times programmed into clock and recorded onto USB.
- ☐ GP Sports hall speakers connected to main system
- ☐ GP Sports hall microphone plates terminated and tested.
- ☐ Demonstration to contractor.
- ☐ Present contractor and Employer's Representative with certificate of demonstration.
- ☐ Separate demonstration to Employer's Representative.
- ☐ Present Employer's Representative with certificate of demonstration once system proved to be fully complaint.
- ☐ Write commissioning certificate, User Instruction sheet with pictures and Switch ID drawing chart using building plan.
- ☐ All documents & certificates to form part of the hand over documents.

Client Handover and demonstration

After the final commissioning by the specialist supplier the system shall be demonstrated to the school. This demonstration shall take place on a separate day from any other PA commissioning. After demonstration a certificate of demonstration shall be signed by the school principal and this document will form part of the hand over documents.

The hand over documents must include the following:

- ☐ Certificate of demonstration to Contractor.
- ☐ Certificate of demonstration to Employer's Representative.

- ☐ Certificate of demonstration to Client.
- ☐ Instruction sheet with pictures.
- ☐ Switch allocation drawing sheet with a column left for the school to label the room numbers with names.
- ☐ Operation manuals.
- ☐ Commission Certificate.

Provision for the Hearing Impaired.

Provisions for deaf aid Induction loops shall be provided by the Contractor under the floor of any sports hall and in any Administration Office under the desk/counter located by the lobby viewing hatch. The Sports hall system shall also be linked to the building PA system. The contractor shall also supply 3 no. free issue mobile units for use throughout the school and 1 no. loop calibrated receiver for end user testing and use. The contractor shall test and certify the system ensuring measured responses are +/- 3dB between 100Hz and 5 Hz. Loop Systems shall confirm with EN60118-4 2006.

PROTECTIVE SERVICES

Door Entry System – Where Specified

A two-way speech intercom unit with integrated buzzer shall be located inside the lobby of the main entrance doorway to communicate with the administration/reception office and that of the staff room. The intercom receiver units shall be capable of releasing the individual electromagnetic door locks of the relevant door. The Contractor shall supply and installation the electromagnetic door locks on the relevant entrance lobby doors which shall be released from the administration/reception office or that of the staff room. The required electromagnetic door locks shall be mortise or surface magnetic locks as per that detailed on the drawings. Keypad access shall be provided for staff. The system shall come with a multi function user access program and shall be installed on the LAN network so that persons with the correct access can program the system and also view and release doors as required from any computer on the network. The Main doors will be installed with automated entrance doorways to facilitate Disability Access. The Contractor shall allow for all the wiring installation of the automated door system such as control cabling, power cabling, push pads and H/O/A key switches located in the administration/reception office. Control requirements to access controlled automated doors shall be as follows:

- Inner door will need Mortis Locks as per 'Abloy 351 U80'.
- Install Off/Auto key switches in Admin office to turn off the electro magnetic locks on the Inner Door to allow open access when required.
- Admin intercom unit to ONLY release relevant door Magnetic locks on doors.
- Separate Push Button required in Admin office to release & automate the locked door.
- Corridor 'Press to Exit' button is only to unlock the inner door.
- Corridor Release & Automation only to be instated when Disabled access push button is pressed.
- System to be co-ordinated with automated door supplier.
- The Key to the system controls is that the doors are **only** to be automated for Disabled persons.

A door bell/call system located outside the main entrance door shall be provided for out of hours use with the sounder located in the corridor areas adjacent to the administration/reception office.

Intruder Alarm – where specified

The Contractor Specialist shall be responsible for supply and installation the Grade 3 Intruder alarm systems in each building. The intruder alarm systems shall comply with IS EN 50131-1:2008 and the current Irish Standard IS. 228. All intruder alarm cabling shall be run in a separate galvanised steel conduit system and be a min of 6 core cable. Device quantities and locations are indicated on the system drawings. The systems shall operate on a sequential verification basis as required by the Garda Síochána and false alarms shall be limited as outlined in British Standard DD243:2004. Operation of the system shall meet the requirements of the "An Garda Síochána Policy On Monitored Intruder Alarms". A separate phone line shall be provided for the alarm system to allow the line status to be monitored. Panic attack pushbuttons shall be provided in the principal's and the administration/reception offices or where shown. A wireless panic attack system covering the whole site shall be provided to ensure protection to all external play areas. Activation of the wireless panic attack system shall cause the intruder alarm system to active in an internal panic mode different to the hard wired panic mode. Activation of the intruder alarm system shall activate the building perimeter lights. The intruder alarm system shall be linked to the

Fire alarm system and CCTV system. The intruder alarm system shall have a dedicated Fire alarm input and fire alarm indication. Where an Oil tank is installed this shall be supplied with an 'Oil Fuel Theft Detection System'. This system shall be hard wired linked to the intruder alarm system which shall go into alarm mode if theft detected or if power is interrupted to the Detection System. The intruder alarm system shall in turn notify the monitoring station of this alarm. The intruder alarm system shall be linked to a remote monitoring station (in conjunction with the fire alarm system). It shall be the Contractors responsibility to set up and maintain the monitoring station account for the first year of operation.

The intruder alarm system installer/commissioner must be a member of the Private Security Authority of Certified Intruder Alarm Installers. Clinet Handover and demonstration: After the final commissioning the system shall be demonstrated to the school. This demonstration shall take place on a seperate day from any other Security commissioning. After demonstration a certificate of demonstration shall be signed by the school principal and this document will form part of the hand over documents. The hand over documents must include the following:

- ☐ Certificate of demonstration to Contractor.
- ☐ Certificate of demonstration to Employer's Representative.
- ☐ Certificate of demonstration to Client.
- ☐ Operation manuals.
- ☐ Commission Certificate.

CCTV System

The contractor shall ensure a specialist security supplier provides a CCTV system in strict accordance with this specification and equipment schedule. The specialist supplier shall also be required to carry out the final connections to the system and to carry out the final commissioning of the system. A fully digital closed circuit television system via CAT6 cabling for video signalling only and twisted pair balams shall be provided to convert video signals; this shall be done as per ISEN50132. The system shall comprise of analogue CCTV cameras, with a minimum of a fixed internal dome CCTV camera in the main entrance lobby and 1 external fixed CCTV camera outside the main entrance viewing the main approach to the building. Any additional CCTV cameras shall be indicated on the relevant drawings. Dome cameras are not to be installed outside. All external cameras shall be supplied with IP66 Aluminum Housing with included heater and blowers as standard. The monitoring and

recording equipment shall consist of a digital video recorder capable of storing on a supplied minimum 2TB hard drive, 400 FPS, 16Channels @ 4CIF real-time, H.264, 16 outputs, DVD Burner, Fully Networkable for remote viewing, coaxial telemetry control, DVR telemetry front panel control, support for Smart Phone viewing and Monitor outputs for VGA, HDMI & BNC. Two 22" monitors shall also be provided. These monitors shall support up to 1920 x 1080 resolutions, high contrast ratio 1000:1, 120Hz motion technology, BNC input, HDMI input and a remote control that can be used on both monitor and DVR. The recording/control equipment and one monitor shall be located in the first floor DCC/ Comms room with a video feed to the second monitor in the administration office. The recording/control equipment shall be connected to the schools 'IT' network and a CCTV network access program provided and installed on the Principals computer.

The control/recording equipment shall be capable of receiving alarm signals from the intruder alarm system to provide future functionality should the school wish to upgrade the CCTV system. *Commissioning:* The entire system shall be tested and commissioned in accordance with ISEN 50132. The system shall be commissioned by the specialist supplier and the following procedures shall be performed as a minimum.

- ☐ All field wiring tested before connection
- ☐ All field wiring terminated to console
- ☐ All cameras tested for operation
- ☐ Demonstration to contractor.
- ☐ Present contractor and Employer's Representative with certificate of demonstration.
- ☐ Separate demonstration to Employer's Representative.
- ☐ Present Employer's Representative with certificate of demonstration once system proved to be fully compliant.
- ☐ Write commissioning certificate.
- ☐ All documents & certificates to form part of the hand over documents.

Clinet Handover and demonstration:

After the final commissioning by the specialist supplier the system shall be demonstrated to the school. This demonstration shall take place on a separate day from any other CCTV commissioning. After demonstration a certificate of demonstration shall be signed by the school principal and this document will form part of the hand over documents.

The hand over documents must include the following:

- ☐ Certificate of demonstration to Contractor.

- ☐ Certificate of demonstration to Employer's Representative.
- ☐ Certificate of demonstration to Client.
- ☐ Operation manuals.
- ☐ Commission Certificate.

Emergency Lighting

The objective of the system is to provide an efficient and effective emergency lighting system meeting the requirements of IS 3217. The emergency lighting shall consist of self-contained, non-maintained luminaires, inverter packs and maintained LED exit signs, as indicated on the system drawings. In the event of circuit power failure to the building the relevant switching circuits shall illuminate one lamp in each emergency fitting for a minimum period of 3 hours. Exit signs shall stay maintained for a minimum period of 3 hours during power failure. All lighting circuits shall have a switched live supply and an un-switched Emergency supply with test facility emanating from the relevant distribution board concerned. Maintained Exit luminaires shall be supplied via an un-switched Emergency supply with test facility emanating from the relevant distribution board concerned. Each emergency luminaire shall have a switching unit which shall automatically switch the luminaire to the emergency circuit in the event of local or mains power failure.

Clenet Handover and demonstration:

After the final commissioning the system shall be demonstrated to the school. This demonstration shall take place on a separate day from any other Lighting commissioning. After demonstration a certificate of demonstration shall be signed by the school principal and this document will form part of the hand over documents.

The hand over documents must include the following:

- ☐ Certificate of demonstration to Contractor.
- ☐ Certificate of demonstration to Employer's Representative.
- ☐ Certificate of demonstration to Client.
- ☐ Operation manuals.
- ☐ Commission Certificate.

Fire Detection and Alarm Systems

The objective of the system is to provide L2/L3M protection system in accordance with IS 3218. The design parameters for the equipment and cabling are those defined within IS 3218. The areas requiring cover and type of cover required are defined on the system drawings. An alarm system diagram shall be provided next to the installed system FAP. The contractor shall ensure a specialist fire alarm supplier provides a complaint Detection system. The fire alarm system shall be of the open protocol analogue addressable type where manufacturers of field devices and/or CIE make the communication and data transfer protocol of their equipment available to other equipment manufacturers. The sensors and manual call points shall be in the same loop circuit. All wiring shall be carried out in a min of 2 core Enhanced fire cable (PH120) in HGSW conduit/trunking. There shall be 2 No separate sounder radial circuits. Should any device go into alarm or fault the precise zone and state of that device shall be displayed in alphanumeric form on the liquid crystal display (with a minimum capability of 32 characters) of the master fire alarm panel. Interface units shall be provided as indicated on the system drawings. These shall have separate 230 volt supply provided to them. Short circuit isolators shall be installed where the loop wiring crosses a fire compartment wall and where the wiring enters another fire zone. The Fire alarm system shall be linked to the Intruder alarm system. The Contractor shall provide a 4-way digital dialler for remote monitoring for Security and Fire Alarm systems. Fireman switch(s) shall be provided and installed by the Contractor in the main entrance lobby. These shall be clearly labelled as to their function. The Contractor shall provide signage for all 'Call units'; 'Refuge areas', external 'Fire assembly points' and any signage required under the current regulations. The Contractor shall provide protective covers for all Manual call points.

Clinet Handover and demonstration:

After the final commissioning the system shall be demonstrated to the school. This demonstration shall take place on a sepearte day from any other Fire Alarm commissioning. After demonstration a certificate of demonstration shall be signed by the school principal and this document will form part of the hand over documents. The hand over documents must include the following:

- ☐ Certificate of demonstration to Contractor.
- ☐ Certificate of demonstration to Employer's Representative.
- ☐ Certificate of demonstration to Client.
- ☐ Operation manuals.

- ☐ Commission Certificates.

Disabled Refuse Systems – If Specified

A Disabled refuse system with call points shall be installed where shown on the drawings in accordance with BS 5839 Part 9:2003, BS9999:2008 & BS8300:2009 and consist of Type B outstations which communicate with a master station. The entire system shall be controlled next to the master fire alarm panel located in the main entrance area. This system shall provide two-way communication with the disabled refuse outstation points. The system shall be wired in enhanced 4-core fire rated screened cable in a loop configuration and the loop monitored by the system. The system shall have a min battery backup for 24hr standby and 3hr use. To prevent hoax activations the system be linked to fire detection system which shall disable the refuge calls. Outstation call points shall provide visual indication or voice annotation of disabled status. On fire alarm activation the disabled status shall be removed and refuse system fully operational. Each control panel shall be surface wall mounted fully enclosed in stainless steel enclosure with Lockable glazed door. All outstation call points shall be surface mounted Steel Green IP66 rated enclosures. Control panel mounting height shall be 1400mmm - 1500mm to panel centre. Outstation mounting height shall be 900mmm - 1200mm to panel centre. Permanent, Self-Adhesive Vinyl labels indicating premises fitted with refuge system and refuge point labels for each remote station shall be supplied with system. Clinet Handover and demonstration: After the final commissioning the system shall be demonstrated to the school. This demonstration shall take place on a seperate day from any other Disabled refuse commissioning. After demonstration a certificate of demonstration shall be signed by the school principal and this document will form part of the hand over documents. The hand over documents must include the following:

- ☐ Certificate of demonstration to Contractor.
- ☐ Certificate of demonstration to Employer's Representative.
- ☐ Certificate of demonstration to Client.
- ☐ Operation manuals.
- ☐ Commission Certificate.

Lightning Protection

Lightning protection shall be provided in accordance with IS EN 62305 consisting of roof top air terminal network, down conductors and earth pits. Where appropriate, use shall be made of metal elements of the roof and structural steel. Where structural steel cannot be used

for down conductors, all tape down conductors shall be installed and secured within the wall cavity. The contractor shall ensure a specialist Lightning supplier provides a complaint system. All extraneous metal parts on or above roof level shall be bonded to the lightning protection system. Internally all metal parts including cable tray and trunking, heating and ventilation pipework and ductwork, radiators, sinks, etc. shall be bonded to the building's main earth terminal. All metal incoming services shall also be bonded to the main earthing terminal. Under no circumstance once passed the building's main earth terminal bar, should the internal building earthing system or internal metal parts be connected to the outer lightning protection system. The installation must take into account the elimination of parallel paths and separation distances must be observed as described in the standard. The Contractor shall allow for PVC coating on the roof termination network and on the down conductors to any RAL colour of the Project Architects choice. The specialist shall also allow for all Support/Pads/adhesive etc and making good to ensure the system is set to work properly. Where drops are installed in the cavity wall the Contractor shall allow for and provide channel runs in the building insulation to ensure the two materials (insulation & PVC drop) do not come into contact with each other. The use of isolated air termination systems should be used to achieve the required separation from electrical systems. This shall be especially important with regard to any Roof Mounted equipment or antennas. The LPS system should be cross bonded near the main incoming electrical panel zone 1. The Contractor shall provide 1 No earth pit per down conductor (Type A). The down conductors shall comprise a min of 3mm x 25mm sheathed copper concealed within cavities of the building and fixed at 500mm intervals. Each down conductor on reaching the ground shall run under the ground and terminate in a Concrete Inspection pit containing an earth rod with in the pit. The earth rod shall be driven into the ground to a minimum depth of 3.1m below the finish surface level. The Contractor shall on completion issue Test results and Certification from a Lightning Specialist.

Streaming devices and associated antennae, such as those described by the Helita system or equivalent shall not be acceptable. The lightning protection system must comply completely with the above mentioned standards.

Surge Protection

All incoming and outgoing cables (of all types) shall be provided with Lighting/Surge Protection devices to IS EN 62305. The electrical contractor shall ensure allowance for surge protection at all panels within his scope and those provided by others.

Lightning Protection Zone 1 Main Incoming Switchboards

- * SPD's for power supplies must be capable of diverting both Direct Lightning impulses 25kA 10/350µs per pole and Surge currents 40kA 8/20µs per pole eg. Combined arrester type 1/2/3.
- * The arrester must be a 3 stage combined arrester eg Type 1, 2 and 3 to protection level 1 100kA 10/350µs per device or 25kA 10/350µs per pole. The arrester must be fully co-ordinated between Lightning and Surge currents. * The let through voltage should not exceed 1kV even in the event of 100kA 10/350µs Lightning impulse. The arrester will also limit follow currents.
- * Only hermetically sealed gas filled spark gap arresters should be used. The arrester must comply with BSEN62305-4 and EN61643-11.
- * Arresters to be equipped with a fault alarm contact to remotely signal if the device fails

Lightning Protection Zone 2 Sub Distribution Boards

- * SPD's to have a maximum discharge current 40kA 8/20µs waveform per pole 160kA 8/20µs TP+N systems type 2.
- * The arresters must have visual indication of status LED's.
- * The arrester must be constructed so as to have no earth leakage currents.
- * The arrester must comply to BSEN62305-4 and EN61643-11
- * Arresters to be equipped with a built-in thermal fault alarm contact to remotely signal if the device fails.

Lightning Protection Zone 3 Final Sub Circuits

All fire / burglar alarm panels and any sensitive electronic equipment installed shall be protected as follows...

- * Maximum discharge current of SPD's 5kA 8/20µs type 3.
- * Protection devices must have indication of status.
- * The arresters must comply to BSEN62305-4 and EN61643-11.

Lightning/Surge Protection for Data/Signal and Telecommunication Cables Incoming data links and telecoms lines and lines between buildings must be protected against Direct Lightning and Surge impulses on each core and at both ends.

- * Arresters used for protection of data signal lines must be capable of handling Lightning impulse currents and Surges of at least 20kA 8/20µs
- * The protection circuit for signal transmission <600kHz must have an EMI filter

function (resonance circuit by inductance and capacitance) to protect also against harmonics caused by high frequency influences

- * Arresters must comply to IEC61643-21

- * Screens of cables to be earthed directly or indirectly via shield earthing

SITE SERVICES

Site Survey

The Contractor shall carry out a full electrical survey of the site prior to the commencement of any works.

ELECTRICAL SUPPLY AND MAIN DISTRIBUTION

General

This document shall be strictly adhered to. It shall be the responsibility of the panel manufacturer to indicate all components relating to the manufacture of the distribution centres/panels. It shall be the responsibility of the panel manufacturer to ensure for a safe and satisfactory switchboard/distribution centre. There shall be at least 25% spare capacity available in any item of switchgear. This shall consist of a number of different sized spare compartments. Generally all Main distribution boards shall be Form 4A Type2 unless otherwise indicated on the drawings. Sub Distribution boards shall all be Form 3B.

Drawings

Before manufacture of any item of switchgear commences, the Employer's Representative shall be furnished with a complete set of manufacturer's proposed layout and schematic drawings. Only on approval of these drawings shall actual production begin. On dispatch and before Final Commissioning the Contractor shall supply two sets of completed as manufactured Drawings, terminal lists, etc., to the Employer's Representative.

Standards & Regulations.

NSAI 10101, ETCI Regulations; IS EN 60439; IS EN 60947; IS EN 60529

Equipment

Main Distribution Board

Low-voltage switchgear shall be of sheet-steel cubicle-type construction. They shall be factory-built assemblies (FBA) in strict accordance with IS EN 60439 and as laid down by the ETCI's Code of Practice for Switchgear Assemblies. Form of construction is indicated on the drawings.

Sub Distribution Boards.

Low-voltage switchgear assemblies board shall be of sheet-steel cubicle-type construction. They shall be factory-built assemblies (FBA) in strict accordance with IS EN 60439 and as

laid down by the ETCI's Code of Practice for Switchgear Assemblies. However custom-built assemblies (CBA) are also acceptable provided the stringent requirements of the ETCI's document (i.e., calculations and clearance distances etc) are adhered to. Form of construction is indicated on the drawings.

Minipillar specification

Standard.

Comply with requirements of Electricity Supply Industry Specification ESI 37 and IS EN 60439-5. Provide housing with a degree of protection to IS EN 60529 IP 64.

Material: Glass reinforced plastic.

Terminations.

Make provision for termination and connection of cables and spare ways as indicated on drawings.

Access.

Supply front access pattern fuse pillars with insulated barriers or screens over all live metal and labelled for identification.

Access doors

Fit fuse pillar access doors with internal hinges. Secure doors with quick acting barlock and high security padlock.

Components:

Isolating switches.

Busbars (phases, neutral & earth).

Fuse carriers.

Bases.

Cartridge fuse links in accordance with BS 88 (IS EN 60269).

Drop off contactor for mains failure. Configured [N/C]

Ancillaries

Mount the following inside each fuse pillar:

set of isolator operating and locking off tools.

spare fuse tray, equipped with spare fuses.

Finish

Treat metal fuse pillars prior to final painting to prevent rust.

Apply final paint finish of stove gloss enamel to BS 381C, colour to manufacturer's standard finish.

After final painting treat interior with a cork based paint to reduce level of condensation by providing a thermal barrier between enclosure metalwork and internal air.

Heater.

Equip fuse pillar with an anti-condensation heater rated at 65 watts complete with a switch, fuse, switching thermostat, high limit cut-off thermostat and all necessary wiring.

Base unit

Supply purpose made base unit for cable entry.

Cubicle construction

The protection rating of the enclosure shall be minimum IP54 in accordance with IEC144. The enclosure framework shall be of sheet steel construction, minimum of 2.5mm thickness, sprayed and stove enamelled. Doors and panels shall also be of sheet steel construction and be 1.5mm minimum thickness. All insulated enclosures shall be constructed from impact-resistant glass fibre reinforced polyester. When the enclosures are assembled to form a composite switchboard they shall be assembled in a symmetrical form and shall maintain a protection of at least IP55 in accordance with IEC144. Also when grouped they shall be mounted onto an angle iron framework, rust proofed and painted, suitable for wall or floor mounting as specified. The internal protection rating of boards against contact with live or moving parts and against ingress of solid foreign bodies shall be not less than IP20 in accordance with IEC144. The Contractor shall not make site alterations unless authorised by the Employer's Representative. Where site modifications to assemblies are authorised, they are to be carried out in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

Fuses

Fuses shall be NH type in accordance with IEC 269-2-1

Current	Type
Up to 25 amp	DZII type to VDE0635 or BS88
From 25amp to 35 amp	DZII type to VDE0635 or BS88
35 amp and above	NH type to VDE0636 or BS88

Miniature Circuit Breaker (MCBs)

MCBS shall be type B,C,D to ISEN60898 to the following table

Type	Instantaneous Trip Current	Application
B	$5 \times I_N$	Resistive Loads
C	$10 \times I_N$	Discharge Lighting, Small Motors etc,
D	$20 \times I_N$	Large Inductive Loads, Large Motors, Welding Plant etc,

Where the prospective short circuit current exceeds the breaking capacity of the MCB, back up protection by means of fuses shall be provided in accordance with Manufacturer's Recommendations.

Where possible MCB's shall be of plug-in type, to allow replacement without undue difficulty.

Air Circuit Breakers (ACBs)

Air Circuit Breakers shall comply fully with IS EN 60947-2:2006 or equal and approved. When used as a main incoming device, ACB's shall have a rated prospective short circuit current of not less than 40 kA at a power factor of 0.2, the internal trip unit for the Main

Incomer shall be electronic and shall be tested to P2 category IEC157-1. When used in conjunction with another ACB (e.g., for incoming generator supply), both ACB's shall be mechanically and electrically inter-locked so that only 1 No. ACB may be switched in at any given time.

Moulded Case Circuit Breakers (MCCBs)

MCCBs shall comply fully with IS EN 60947-2:2006 or equal and approved. The internal trip unit for the Main Incomer shall be electronic. Their contacts shall be capable of inspection. When used as a main incoming device, MCCB's shall have a rated prospective short circuit current of not less than 40 kA at a power factor of 0.2, the internal trip unit for the Main Incomer shall be electronic and shall be tested to P2 category IEC157-1.

Earth Leakage Circuit Breakers (ELCB's)

ELCB's shall be of the current operated type complying with IS EN 61008-1:1995, IS IEC 1008-2-2:1990, IS EN 61008-1:2006 and IS IEC 1008-2-2:1990. They shall have a trip current rating of 30mA unless specified otherwise, and shall have a short circuit current rating of not less than (25 Amp - 1.5kA) (40 Amp - 1.5kA) (63 Amp - 2.0kA).

Load Break Switches

Load break switches shall be of the Rotary Air Break type and shall comply fully with IEC 408 or equal and approved. Their prospective short circuit current rating shall be adequate for their duty. (For guidance see below) They shall have on/off indication and be complete with door interlock to prevent inadvertent contact with live parts and must be lockable in the off position.

Switch Current Rating (Rated Current)	Symmetrical Withstand Current (RMS – 1s)
Up to 63 Amp	2.5kA
Up to 100 Amp	4.0kA
Up to 160 Amp	9.0kA
Up to 250 Amp	13.0kA

Up to 400 Amp	13.0kA
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Busbars

Busbars shall be HDHC copper of uniform cross section and shall comply fully with BS 159:1992. The busbar system shall be type tested in accordance with ISEB 60439 and be capable of carrying the continuous load current as specified elsewhere in the Document. Neutral busbars shall be the same cross-section as phase bus-bars unless agreed otherwise with the Engineer and the earth bus-bars shall be a minimum of half size. Busbar connections up to 63 Amp may be effected by means of cable, braced and supported as necessary, whereas connections above 63 Amp shall be made by means of HDHC rectangular section copper busbar, insulated and supported as necessary.

They shall be fully enclosed in their own sealable compartment extending the full length of the switchboard and shall be fully shrouded internally on all sides to prevent accidental contact. Where busbars are drilled care should be taken to maintain ample cross sectional area in order to effect a proper joint.

Contactors

Contactors shall comply fully with IEC158-1 or equal and approved. They shall be rated for AC3 Category and shall have at least 1 N/O and 1 N/C spare auxiliary contacts.

Motor Starters

Starters shall comply fully with IEC292-1 or equal and approved.

They shall incorporate the following protection features:-

Thermally delayed over-current release on all poles set to trip at 120% full load in two hours and incorporating temperature compensation

Positive protection against single phasing in the form of an extra differential tripping bar or similar approved device

Manual reset with protection against premature re-closing.

Push Buttons and Control Switches

Push buttons shall be in accordance with IEC337 and IEC144 and have a protection rating of IP65.

They shall be colour coded as follows:-

Start/On -Green

Stop/Off -Red

Reset -Yellow/Black

Pilot Lights & Indicators

Pilot lights shall be LED Type and in accordance with IEC337 and IEC144 and have a protection rating of IP65.

Their maximum Voltage shall be 230V Volt but where possible they shall be of either 110 Volt or 24Volt, as specified.

Neon indicators shall not be used. Pilot lights shall either be of LED, Transformer type or Series Resistor type.

Time Switches

Time switches shall be digital 7 day, 24 hour type, complete with day omission and 36 hour spring reserve.

Instrumentation

Instruments shall be provided where indicated and shall comply with IEC473 in all respects. They shall be of minimum 96mm x 96mm unless agreed otherwise with the Engineer and contain a modbus communication modular.

Instrument Transformers shall comply in terms of rated Current, rated Voltage, limits of error etc., with VDE 0414 and IEC 185.

Terminals

Terminals shall be provided at top or bottom of cubicle as specified and shall comply with IEC 61032:1997. All items of equipment shall be wired to these terminals and they shall be capable of accepting the incoming cable sizes as specified. They shall be of PVC grade and be identified by means of terminal numbers. The Manufacturer shall provide a terminal list, or numbered Drawing.

Push-in type terminals are not acceptable.

Wiring

Wiring shall be by means of PVC cables; of a minimum size 1.5sq.mm cross-section, unless agreed otherwise with the Engineer.

Cable shall be supported or enclosed in PVC trunking. Where enclosed in trunking their spacing factor shall not exceed 30% shall be grouped and labelled at intervals of 300mm maximum.

Cables to any moving parts (i.e., doors etc) shall be flexible and housed in PVC spiral wrap or some other equal and approved means of protection.

Earthing

A main earth busbar shall run the full length of the switchboard and all metalwork shall be bonded to this. Doors shall be bonded by 1.5 sq.mm cross section minimum size flexible cable.

Labelling

Labels shall be provided on all chambers inside and outside the panel, indicating the function of every item. Labels shall be 'Traffolyte', black on white, screw on type, and shall be subject to the Engineer's approval.

Every control centre sub-circuit shall be labelled to indicate its function and rating and shall be suitably indicated on heat sealed chart.

Testing and Commissioning.

All switchboards shall be subjected to the following tests before despatch:-

An Insulation-Resistance Test at 1,000 Volt D.C. (Megger Test) between phases, phases to neutral, phases and neutral to earth.

A High-Voltage 50Hz Test to 2,500 Volt for one-minute (flash test) between phases, phase to neutral, phases and neutral to earth.

A Continuity Test designed to measure the conductivity of each circuit between incoming and main outgoing terminals.

Simulation Test to test selected circuits on overload and short circuit. Function Test to Test operation of control system.

Test on mechanical operation of switching devices, inter-locks, locks, sequence controls, connections, etc.

The values obtained from the above Tests shall be recorded and a Full Copy in the form of a Test Record shall be supplied to the Engineer before delivery is made.

After erection on Site all switchboards shall be subjected to the following tests in the presence of the Engineer or his Representatives.

An Insulation-Resistance Test at 1,000 Volt D.C. (Megger Test) between phases, phases to

neutral, phases and neutral to earth.

A High-Voltage 50Hz Test to 2,500 Volt for one minute (flash test) between phases, phase to neutral, phases and neutral to earth.

A Continuity Test designed to measure the conductivity of each circuit between incoming and main outgoing terminals.

Electrical Containment

General

The Contractor shall supply install and test the entire electrical containment installation as indicated on the drawings as specified herein. The specification of the containment systems to be used and the standards associated with these systems are described hereafter.

Generally, hot-dipped galvanised steel wire (HGSW) containment shall be used verywhere for the primary distribution. Galvanised steel trunking shall be used for the containment of power and ELV services with galvanised steel conduit to be used for final circuitry distribution (power and data services) to outlet positions. For the distribution of ICT and power services within the class spaces and other specialist rooms, white plastic, 195x50mm dado trunking shall generally be used.

Standards & Regulations

Provide conduit and cable trunking in accordance with the relevant British Standards and in particular the requirements of ET101, National Rules for Electrical Installations.

Materials and Workmanship

Rigid Class 2 and Class 4 Conduit System

For conduit systems of metal rigid class 2 the Contractor shall provide conduit systems to IS EN 50086. Use conduit of each type from one manufacturer. Rigid class 2 conduit systems shall be used in the majority of areas throughout the school. However rigid class 4 conduit systems shall be used in areas where impacts or ingress to the systems are more likely. These areas shall include plantrooms, any externally located conduit and GP/PE halls.

The conduit system shall be of steel material, with threadable connections. The conduit system shall be suitable for bending to IS EN 50086-2-1 standard but be of a rigid structure. It shall have electrically continuous characteristics with resistance against corrosive or polluting substances. The protection offered by the conduit system shall be the same inside

as well as outside. Medium protection shall be offered by this conduit system and the finish of the system shall be stove enamel paint or air drying paint.

The rigid metallic conduit system shall use solid couplers to match the conduit grade/finish and to lengths of conduit. Conduit fittings and adaptable boxes shall also be joined using these couplers. The adaptable boxes shall be of a malleable iron adaptable box type.

Factory made bends, inspection bends or inspection couplers unless shown on drawings or schedules shall not be used. The Contractor shall ensure fittings are of the same class and finish as the associated conduit system. Covers for circular or adaptable boxes in the same material and finish as boxes shall be supplied by the Contractor. Steel dome or cheese headed screws to secure covers for Class 2 finish shall be used. The number of entry holes within loop-in boxes shall be limited to four. The adaptable box shall have a minimum size of 100mm x 100mm x 50mm. The Contractor shall use couplers and externally screwed brass bushes to connect conduit to loop-in circular conduit boxes, switchgear, distribution boards, and adaptable boxes. Spacer bar conduit fixing saddles shall be used by the Contractor. Hexagonal malleable iron plugs shall be used. Hexagonal steel locknuts shall be used.

For conduit systems of metal rigid class 4 the same technical specification as described above for the Class 2 rigid conduit system shall apply. However, the protection offered by class 4 systems shall be high and be of a hot dip zinc coating finish. Brass dome or cheese headed screws to secure covers for Class 4 finish will be used instead of steel.

The supports and fixings for a Class 4 conduit system shall be provided by a proprietary suspension system comprising channel sections with return lips and compatible fixing accessories made of material to IS EN 10162, IS EN 10210 and/or slotted angles to BS 4345.

The Contractor shall ensure support components have the same finishing method as the conduit carried out after manufacture. The Contractor shall ensure components in direct contact with the conduit match profile of conduit.

The Contractor shall ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 3382 after manufacture. Do not use metal fixing components likely to deteriorate and/or

cause damage through electrolytic action.

Cable Trunking and Fittings

The Contractor shall comply with IS EN 50085-1 and use trunking of each type from one manufacturer.

Medium impact metallic (galvanised steel) trunking shall be used by the Contractor. The following temperature restrictions shall apply to the metallic trunking system: -

5°C storage and transport; a minimum installation and application temperature of - 5°C, a maximum installation and application temperature of 60°C.

The metal trunking shall have a factory painted finish. The steel trunking shall comply with BS 4678-1. Partitions and covers the same material as the trunking shall be provided by the Contractor. The gauge of metal shall be as Table 1 of BS 4678.

Use trunking manufactured with inward return edge flanges and fitted with flange couplers which ensure that when the cover is removed a minimum of 80% of the nominal trunking or compartment width is available for access shall be used.

Protection provided by the trunking system shall be to BS 4678-1.

The trunking system's protection is further described as electroplated zinc having a minimum thickness of zinc coating of 0.0012mm inside and outside with additional coating of stoved or air drying paint, applied at least to the external surface. For all surfaces on the trunking system the Contractor shall provide the manufacturer's standard. The same shall apply to the colour of the trunking systems.

The Contractor shall use purpose made brackets to fix to structural steel or suspension rods. External fixing lugs shall be provided where specified protection for the installation is IP44 or greater. Bends, tees and angles of similar gauge, type and finish as trunking body and supplied by same manufacturer shall be used. The Contractor shall ensure partitions and covers within/on the trunking systems are electrically continuous with the body of the trunking or provide a connector for a circuit protective conductor. The Contractor shall ensure the gap between partitions and lids maintains segregation of circuits. The Contractor shall ensure the material of the partitions and covers are the same material as the trunking.

The Contractor shall use purpose made jointing pieces fixed with screws into captive nuts. Screws shall not protrude through the nuts. The Contractor shall ensure rigidity of the trunking is maintained across the joint. External dimensions of the trunking shall be maintained and not reduced by more than 4% across joints between trunking lengths and/or

fittings.

Purpose made fittings of the same manufacture where trunking connects to switchgear and distribution boards shall be used. Where applicable the Contractor shall provide flanges for the connection of flush floor trunking to vertical trunking to maintain the cross sectional area of compartments with 50 mm minimum radius.

Electrical continuity at each joint shall be maintained by a copper link, (tinned copper for galvanized trunking), fixed on outside of trunking, secured by screws, nuts and shakeproof washers. Screws must not project through the nut. The Contractor shall make provision for continuity to be achieved without the need to remove paint from ferrous metal where trunking has a painted finish.

The Contractor shall not use self tapping screws. Only cheese or round head screws shall be used except where provision is made for the use of counter-sunk heads.

These screws shall be steel zinc coated BS 3382 Parts 1 and 2.

The Contractor shall provide cable supports to horizontal trunking with removable cable retainers or bridges to retain cables in situ. Cables supports shall be provided to vertical trunking with pin racks to support cables at 3000 mm maximum spacing.

The Contractor shall use insulated pins or insulation sleeved pins on pin racks.

The Contractor shall use separate trunking or multi-compartment trunking for segregation of services. Steel partitions shall have a provision for connecting a circuit protective conductor. The separation of wiring for circuits shall be provided as required by NSAI IS 10101 and ET101.

The Contractor shall provide proprietary suspension systems comprising channel sections with return lips and compatible fixing accessories made of material to IS EN 10162, IS EN 10210 and/or slotted angles to BS 4345.

The Contractor shall ensure support components for Class 4 conduit have the same finishing method as the conduit carried out after manufacture. The Contractor shall ensure components in direct contact with conduit match profile of conduit.

All steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 3382 after manufacture. The Contractor shall not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

The Contractor shall provide cable trunking and fittings to BS 4678 for the trunking of insulating materials. The cable trunking and fittings shall comply with BS 4678. Use trunking

of each type from one manufacturer.

Separate or multi-compartment trunking shall be used for the segregation of services. Steel partitions shall have a provision for connecting a circuit protective conductor. The trunking system shall provide separation of wiring for circuits as required by NSAI IS 10101 and ET101.

The Contractor shall provide proprietary suspension systems comprising channel sections with return lips and compatible fixing accessories made of material to IS EN 10162, IS EN 10210 and/or slotted angles to BS 4345 for the trunking of insulating materials.

The Contractor shall ensure support components for Class 4 conduit have the same finishing method as the conduit carried out after manufacture. The Contractor shall ensure components in direct contact with conduit match profile of conduit.

The Contractor shall ensure all steel components such as studding, bolts and steel screws, bolts, nuts and washers are either cadmium plated and passivated or zinc electroplated to BS 3382 after manufacture. The Contractor shall not use metal fixing components likely to deteriorate and/or cause damage through electrolytic action.

The Contractor shall ensure entire system is electrically and/or mechanically continuous, to NSAI IS 10101 and ET101.

Fire Protection

Fire barriers shall be provided to comply with the requirements of ET101 wherever the conduit or trunking passes through the perimeter of a fire compartment (wall, floor or ceiling).

Appearance of Containment System

The appearance of the conduit, trunking and ducting shall be of neat appearance, and parallel with other service runs and lines of building construction, except where in screed or in-situ concrete. The Contractor shall ensure plumb vertical runs. Cable shall be installed in conduit, trunking or equipment enclosures only when completely erected throughout its length. The Contractor shall not use framework of partitions or similar unless indicated.

Expansion of Containment System

The Contractor shall make provision in conduit and trunking at expansion and settlement

joints to allow for movement of building structure. This shall be provided by circular through or adaptable boxes no more than 300 mm either side of expansion or settlement joints for conduit crossing.

Method of Installation and Reparation

The Contractor shall join boxes with flexible steel conduit type C or conduits arranged to form a telescopic joint and cover overall with PVC sleeve to provide minimum degree of protection of IP44 or purpose made telescopic joint protected by a PVC sleeve to at least IP44.

The Contractor shall cut conduit clean and square with axis. Any burrs prior to erection shall be removed by the Contractor.

Circular or adaptable boxes shall be used where the Contractor is unable to site form 90° in conduit. Bends and sets shall be constructed cold with a bending machine. The Contractor shall not apply heat when forming sets or bends. The Contractor shall use bending tools complying with British Standards appropriate to conduit material. The Contractor shall ensure no indentation or reduction in cross sectional area occurs during installation.

The Contractor shall ensure no tool marks or damage to components occurs by using the correct tools.

The Contractor shall ensure the maximum circuit lengths and groupings of cables indicated are not exceeded.

Where dimensions are not indicated select trunking and conduit sizes in accordance with the NSAI, ETCI regulations and manufacturers recommendations.

The Contractor shall install conduit, trunking and equipment clear of other services.

Measure distance from external surface of any thermal insulation. Notify instances where minimum clearance cannot be achieved and bond items concerned. Minimum general spacings between conduits, trunking, equipment and:

insulated steam services - 300 mm.

other services excluding steam - 150 mm.

above central heating radiators - 1000 mm.

The Contractor shall install conduit and trunking systems to ensure internal condensation does not affect operation of associated circuits.

Where conduit passes through external wall between two areas of different ambient temperatures or in other locations likely to cause condensation, install a conduit or adaptable box. After wiring fill box with inert, permanently plastic compound with high insulation value.

Painting

The Contractor shall paint joints of conduit and minor damages to finish of conduit and trunking immediately after erection or after damage occurs. Use paint ompatible with finish as follows:

Galvanized finish - use two coats zinc rich paint.

Black enamelled finish - use two coats of good quality, air drying, black enamel paint.

The Contractor shall remove grease, oil, dirt and rust before applying protective paint. Notify serious damage and repair or replace as instructed.

Cleaning

The Contractor shall clean inside of conduits and trunking with swabs immediately before wiring. All components shall be inspected and any foreign matter removed.

The Contractor shall fit temporary plugs to open ends of conduit and trunking to prevent ingress of water and solid material.

Segregation, Concealment and Re-Wiring

The Contractor shall comply with IS 10101 and ET101 when wiring installations. Circuits shall be segregated as indicated. Draw wires shall be left within empty conduits for use of specialist installers. Draw wires comprising nylon tapes with fitted eyelets shall be used by the Contractor.

For concealed conduit the Contractor shall ensure that the system is installed to enable re-wiring to be carried out from boxes for fittings or accessories only. Draw-in boxes will only be permitted with prior permission in writing.

The Contractor shall not use tallow or any other substances to facilitate drawing-in of cables.

The Contractor shall ensure conduit is not concealed until work has been inspected and approved. Obtain permission before horizontally chasing walls. The Contractor shall ensure that conduit and fittings buried in concrete or behind plaster are protected against corrosion or electrolytic action prior to rendering. The Contractor shall ensure conduit concealed in wall chases is covered by plaster and/or rendering to minimum depth of 12 mm.

The Contractor shall provide draw-in boxes in conduit at maximum intervals of 10 metres or after bends and/or sets totalling 180 degrees.

The Contractor shall secure switch boxes and socket boxes using countersunk steel screws where provision is made for them or if not use round head screws. Use plug inserts and finally grout in position prior to plastering or screeding.

The Contractor shall support conduit in accordance with Appendix I of Guidance Note I

Selection and Erection published by the IEE. Ensure conduit is not under mechanical stress. Fix conduit boxes independently of conduit. Make allowance for any additional mechanical loading supported by conduit boxes.

Where protection is specified as IP44 or greater ensure fixings of conduit boxes are suitable to maintain degree of protection.

Use following methods of fixing conduit:-

LOCATION	TYPE OF FIXING
Floor screeds.	Saddles or crampets.
Buried in plaster or render.	Crampets or saddles.
Above false ceilings.	Saddles.
Surface.	Saddles.

Flexible and Pliable Conduit

The Contractor shall use flexible conduit for final connections to motors, other equipment subject to vibration or adjustment and to thermostats, motorised valves and similar items mounted in pipelines or ducts.

Sufficient length between equipment and circular through boxes at the ends of conduit runs (minimum 450 mm) to allow necessary full range of withdrawal, adjustment or movement shall be allowed for in the installation. Solid type adapters to terminate flexible conduit shall be used by the Contractor.

The Contractor shall use PVC covered flexible conduit where installed externally, exposed to weather or in any position where ingress of moisture or condensation may occur.

The Installation of Screwed Steel Conduit

The Contractor shall use materials clean and free from defects, rust, scale and oil.

They must obtain prior permission in writing for use of materials subject to remedial work before erection. Always repair any damage caused by threading, bending or erection by painting with zinc rich paint before any rust occurs.

The Contractor shall ensure length of thread on conduit matches that in conduit couplers, fittings or equipment with no thread exposed after erection except at running couplers. Ensure conduits butt inside couplers. The Contractor shall use lubricant when cutting threads and use a minimum number of running couplings

When running couplings in Class 2 conduit, use a coupler and locknut. Paint exposed thread with zinc rich paint. The Contractor shall use three piece conduit unions for running

couplings in Class 4 conduit.

In the unlikely event that conduit is buried below ground, use Class 4 conduit. Do not use any buried conduit boxes unless prior permission in writing has been obtained.

Wrap conduit with PVC self-adhesive tape, half lapped. Extend taping 150 mm beyond point where conduit leaves ground. Install circular through conduit boxes at the end of the tape. Fill conduit boxes after cable installation with inert, permanently plastic compound with high insulation value, and wrap in PVC self adhesive tape.

Access

The Contractor shall arrange trunking to allow access to wiring. Locate covers on top or sides of trunking if practicable. Arrange access so covers are on a continuous face and cables can be laid in throughout the length of the trunking. Notify where either condition cannot be achieved.

Fixing Trunking

The Contractor shall ensure trunking is independently fixed and supported from building fabric. Obtain approval for proposed fixings/supports. Support trunking in accordance with the manufacturers' requirements. Use two fixings minimum per standard length.

Steel Trunking Installation

Install steel trunking in accordance with the manufacturers' requirements and those of IS10101 and ET101. Use trunking to avoid multiple parallel conduit runs, subject to approval.

Cut trunking clean and square with axis, prepare ends and remove burrs and sharp edges. Ensure inside of trunking is free from anything liable to damage cables either during installation or after covers are fitted.

When trunking is held in a vice, ensure surfaces remain undamaged and components are not warped. Avoid tool marking or damage to trunking system components. Do not site fabricated trunking tees, bends, flanges and other accessories. Use only factory made accessories. Form circular holes over 6 mm diameter in trunking body using correctly sized punch sets. Use twist drill for holes up to 6 mm maximum diameter.

Use only factory formed openings for accessories. Line unprotected apertures in trunking with PVC or nylon edging strip. Fit ends of runs with removable blanking plates. Ensure connections are not made to covers unless indicated or approval obtained.

Provide fixed section of cover projecting 25 mm either side of fabric where trunking passes through wall, floors or ceiling. Fit cable retaining straps at 500 mm intervals except where cover is on top.

Trunking of Insulating Material (plastic for example)

The Contractor shall comply with the manufacturer's instructions. Do not install trunking where ambient temperature is below – 5°C or working temperature is above 60°C.

Use solvents recommended by trunking manufacturer when making solvent welded joints. Remove excess solvent before surface damage occurs. Hold joints rigid and in position until welds set.

Use manufacturer's standard radiused bends, connector tees, off-sets, end plates and component parts of trunking system assembly.

Ensure no type of trunking other than that specified is installed without approval.

Trunking may be substituted for conduit at certain positions subject to approval.

CABLING AND INSTALLATION PRACTICES

General

Cable Manufacture

The Contractor shall use new cables, delivered to site with seals intact, manufactured not more than one year prior to delivery, labelled with manufacturer's name, size, description, BS number, classification, length, grade and date of manufacture.

Mark all types of cables with CENELEC cable certification marking or if included in British Approvals Service for Cables (BASEC) in accordance with BASEC regulations and those detailed below.

Standard Flexible Cords and Industrial Cable with LSOH Sheathing

Supply cables with Low Smoke Zero Halogen (LSOH) sheathing, tested in accordance with IS EN 50267 and IS EN 50265.

Mineral Insulated Wiring and Power Cable with LSOH Sheathing

Supply cables with Low Smoke Zero Halogen (LSOH) sheathing, tested in accordance with IS EN 50267 and IS EN 50265.

Standard Power Supply Cables, Copper Conductors, Thermosetting Insulation, Sheathed and Armoured

The Contractor shall provide these cables to the following standard: BS 5467, Tables 4, 6, 8, and 12. These cables shall be mechanically protected by the armour.

Standard Power Supply Cables, Copper Conductors, LSF Sheathed And Armoured

The Contractor shall provide these cables to the following standard: BS 6724, Tables 4, 6, 8, and 10. These cables shall be mechanically protected by the armour.

Standard Cables For Conduit And Trunking, Copper Conductors, LSF Insulated

The Contractor shall provide these cables to the following standard: BS 7211, Tables 3(a) and 4(a). These cables shall be mechanically protected by the conduit and trunking.

Standard Flat Cables, 2-Core or 3-Core, Copper Conductors With or Without CPC, LSF Insulated Sheathed

The Contractor shall provide these cables to the following standard: BS 7211, Table 7.

Control and Auxiliary Cables with LSOH Sheathing

Supply cables with Low Smoke Zero Halogen (LSOH) sheathing, tested in accordance with IS EN 50267 and IS EN 50265.

Paired, Screened and Unarmoured Control Cables:

The Contractor shall provide these cables to the following standard: BS 5308-1, Tables 3, 5 and 9. These cables shall be type 1 un-armoured cables.

Paired, Screened and Armoured Control Cables

The Contractor shall provide these cables to the following standard: BS 5308-1, Tables 3, 5 and 9. These cables shall be mechanically protected by the armour integral to the cable. These are type 2 cables.

Multi-Core Armoured LSF, Sheathed Auxiliary Cables

The Contractor shall provide these cables to the following standard: BS 6724, Table 18. These cables shall be mechanically protected by the armour integral to the cable.

Fire Alarm Cable

The Contractor shall provide these cables to the following standard: BS 7629-1.

These cables shall be unarmoured but housed within containment offering mechanical

protection.

The fire performance of these cables shall be to BS 5839-1 Standard.

Information Communication Technology Cables – Structured Wiring

The Contractor shall provide these cables to the following standard: ISO/IEC 11801 : 2002 with amendments 1 & 2; ISO/IEC 61034 & 61156-5; EN 50173-1 : 2002; EN 50288-6-1; ANSI/TIA/EIA 568C & B.2.1 : 2002

Type CAT6a, U/UTP, 100 Ω , 4x2xAWG 23/1 premium grade Class 6a or FTP.

For the manufacturer and reference see schedule of Equipment in Section B of the specification.

The above mentioned structured wiring cables shall be flexible cables for wiring and power signals, control and auxiliary signals and for communications.

Optical Fibre Cable

Standard - IS EN 60794 and ISO 11801.

Cable Glands

The Contractor shall provide glands to the following standard: IS EN 50262 nonmetallic, cable retention, IP54; BS 6121-2, A1P. these are for indoor environments.

Cables glands for armoured cables, in dry conditions indoors for power wiring, control and auxiliary shall be to IS EN 50262 metallic, with cable retention Class A and protective connection to earth, IP54.

Cables glands for armoured cables, in conditions outdoors for power wiring, control and auxiliary shall be to IS EN 50262 metallic, cable retention Class A, protective connection to earth, IP54 with shroud.

Cable Terminating And Jointing Sockets

The Contractor shall provide cable terminating and jointing sockets to the following standard: IS EN 61238-1 when termination or jointing is of the compression type.

Cable Joints And Terminations

The Contractor shall only use cable joints as supplied or recommended by cable manufacturer.

For power cables the joint arrangement shall be straight through or tee. The joint type shall be to BS 6910, cold pour or heat shrink. The Contractor shall use where necessary accessories such as armour bonds, BS 7197; filling compounds. These joint types shall be used in

underground environments.

Cable Ducts

The Contractor shall provide ducting installations to BS 65, DN 90; BS 4660; or NJUG 6.

Cable Sleeves

The Contractor shall provide supply and hand to others for installation non ferrous cable sleeves for incorporation into the structure where cables pass through fire compartment floors and walls.

Packing material

The Contractor shall install either weak mix mortar, intumescent, plaster or mastic, solid intumescent material or intumescent granule filled bags as packing material.

Cable Covers and Markers

The Contractor shall provide cable covers and markers made from recovered plastic, with integral tape where applicable.

These shall mark the location of telephone or electricity lines. They will have plastic marker tape and be yellow, marked with electricity or telephone.

Workmanship and Installation Practices of Cables

Cable Installation - General:

The Contractor shall use and install cables only as directed in the appropriate standard or as directed by the manufacturer in writing. Lay cables in one length unless otherwise indicated. Obtain permission from supervising officer for all through joints, and where overall length requirement exceeds practical drum size. The Contractor shall install cables when ambient temperature is 5°C or greater, using cables stored at or above this temperature for not less than 24 hours. The Contractor shall use drum stands, drum axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation.

Cable Installation in Low Temperatures

The Contractor shall install cables at lower installation temperatures when authorised by manufacturer in a written statement.

Installation of LSF Cable

The Contractor shall install LSF cables in accordance with manufacturer's instructions. Ensure ambient temperature is above 5°C. Ensure oversheaths are not damaged by abrasion or scuffing.

Installation of Unarmoured Cables

The Contractor shall install and use unarmoured cable to BS 6004, BS 6007, BS 6500, BS 7211 and BS 7919 in accordance with BS 7540 or the manufacturer's written instructions.

Cable Trenches

The Contractor shall ensure that trenches for cables and cable ducts are prepared, backfilled and reinstated. Supervise all work to cable trenches by others. The Contractor shall carry out a walk over survey of the trench route and dig a trial hole in any area considered to be potentially difficult. The Contractor shall establish location of any other underground service adjacent to cable route. The Contractor shall re-plan cable routes after survey and trial holes. Submit report of survey and trial holes. The Contractor shall then carry out any instructed work to adjacent services. Set out cable trenches, excavate trench carefully setting aside any materials required for backfilling or reinstatement.

Minimum cover in cable trenches

The following depths apply to the following cables:

MV cables 800mm; LV cables 600mm; communications cables 600mm; all cables 1000mm under roadways.

Trench

For trenches that are to house all underground services it shall be constructed as a grade trench bottom to a maximum slope of 1:12. The trench shall be cleared at the bottom of loose stones with bedding placed the full width of the trench.

Bedding in Trench

The bedding in the trench shall be riddled earth 6mm grid for cables; riddled earth 12mm grid for ducts; imported soft sand; or pea shingle, for ducts. The bedding thickness shall be 75mm or 100mm for ducts. The installation of cables or ducts will be in a bedding material to a minimum depth of 75mm above highest cable or duct.

Cable or duct identification

A yellow warning tape with a black legend will be provided for cable or duct identification.

The trench shall be backfilled using two layers of 100mm thick hand rammed earth.

The backfilling shall be completed in layers and the trench reinstated. The backfill

material will be earth excavated from the trench.

Cable Installation in Trenches Cables shall be laid on newly prepared bedding. The Contractor shall ensure multiple layers of cable are separated vertically by a 50mm layer of hard rammed bedding material.

When using a power winch the Contractor shall ensure tension on the cable is taken by element of the cable designed for that purpose, that is armour or conductor cores as appropriate and not plastic sheath, metal sheath or core insulation.

When hand pulling the cable the Contractor shall ensure no kinks are formed and that flaking, when used, is done in the correct direction.

The Contractor shall not allow the cable to twist during installation. The Contractor shall use swivels to connect the pulling bond to cable stocking or equivalent fitting.

The Contractor shall check drum is suitable for jacking before commencing the installation. If the drum or reel is unsuitable for jacking, flake the cable in the correct direction in maximum size turns from drum or reel before commencing the installation. Use skilled labour to supervise all the unreeling, flaking or running of cable from a drum.

Lay the cables in the formation shown, ensuring spacing is not reduced below that indicated.

The Contractor shall bind trefoil groups at 1m intervals. Any associated earth or protective conductor to its cable or trefoil group shall be bound at 1m intervals.

The Contractor shall ensure the installation radii and permanent bending radii are not less than those recommended by the manufacturer.

The Contractor shall lay cables to BS 6004, BS 6007, BS 6500, BS 7211 or BS 7919 direct in the ground.

Cable Ducts

The Contractor shall supervise the laying of ducts by others. The Contractor shall lay ducts in the formation shown, on to newly prepared bedding. The ducts shall be jointed in accordance with the manufacturer's instructions.

The Contractor shall ensure that ducts slope no more than 1:60 vertically or 1:30 horizontally and ensure that pre-formed duct bends used at ends of duct routes meet the requirements of the cable manufacturer for bending radii.

Construct manholes, draw pits and jointing chambers

The Contractor shall prove alignment of completed duct run by drawing through a mandrel 7mm diameter less than nominal duct bore for minimum length 250mm.

The Contractor shall clean completed duct run by drawing through a circular wire brush 12mm diameter more than nominal duct bore.

The Contractor shall install a draw wire of corrosion resistant material and minimum breaking strength 550N in each empty duct. All ducts shall be sealed and plugged with proprietary duct plugs, on completion.

Cable Installation into Ducts

The Contractor shall install cables into newly proved and cleaned duct. The Contractor shall use lubricants, recommended by the cable manufacturer in writing, to assist with the drawing process.

Flake the cable if drums or reels are not suitable for jacking. At intermediate draw pits with the exit duct more than 15 degrees off line of entry duct, flake cable before entering or provide comprehensive system of corner plates, roller and blocks. The Contractor shall use maximum practical size of turns when flaking and ensure the direction is correct.

The Contractor shall not exceed manufacturer's installation tension on cable and ensure the pulling tension is taken on cable elements designed for that purpose, that is armour or conductor cores and not on other elements, such as plastic sheath or conductor insulation.

The Contractor shall not allow cables being pulled into ducts to twist. Use appropriate swivel between pulling bond and cable stocking or similar appliance.

Bind trefoil groups of single core cables installed into a single duct at 1m intervals.

Install earth or protective conductors into the same duct as the associated cable where practical, through manholes, draw pits and jointing chambers. Bind the two cables together. Pull all cables in one duct as a group. Ensure group does not twist or cross over. Report any damage to cable sheath during installation and carry out any instructed work to remedy the damage.

Between the cable and duct ends seal after cable installation. Ensure cable ends in jointing chambers are temporarily sealed where required.

Cable Installation in Conduit and Trunking:

Install cables so that they are orderly and capable of being withdrawn.

Arrange single core wiring generally using the loop-in method.

Trunking

In vertical trunking provide pin racks at 3m intervals. Use ties at 2m intervals for all wires of the same circuit reference. Mark ties with circuit reference number at 10m intervals.

Conduit

Provide cable clamps in conduit boxes at 10m intervals in vertical conduit. Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.

Cable Installation on Tray and Rack

Place cables side by side or as indicated. Fix using cleats or cable ties so that any cable may be individually removed. Use metallic ties on cables with specified fire performance.

Cable Surface Installation

The Contractor shall dress cables flat, free from twists, kinks and strain, and align parallel to building elements. When glands and clamps are not required, take the sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.

Cable Installation of Flexible Cords

Grip cords securely at connections. Where they do not form an integral part of the connected accessory or equipment, provide separate proprietary cord grips.

Cable Jointing and Terminating Generally

The Contractor shall ensure all joints and terminations are made by appropriately ualified cable jointers, using jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121-5.

Cold pour resin and heat shrink joints in accordance with BS 6910-2

The Contractor shall cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more than 24 hours to prevent the ingress of moisture. The Contractor shall seal the plastic sheathed cables using proprietary shrink on end caps. Strip cables to bring out the cores and expose conductors, for the minimum length required for

connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce number of strands. Secure all strands at terminations.

The Contractor shall clean the armour thoroughly prior to jointing or terminating. At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore.

Form all compression connections to components using tools that cannot be released unless the correct degree of compression has been achieved.

The Contractor shall install and inspect compression and mechanical connectors on conductors in accordance with BS 6360 to BS 7609. Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices. Do not bunch more than three cores at clamping terminals or bolted connections.

Mark cable conductor phasing, or other core identification, at each end of all cables, and at all joints, maintaining consistency of marking with any existing system. Connect all cores, including multicore cable spare cores, at all joints and terminations. The Contractor shall bond any unused cores or multicore cables to earth at both ends, unless otherwise indicated.

Cable Jointing and Terminating - Elastomer and Plastic Insulated Cables

The Contractor shall joint cables using glands of the type indicated, in accordance with the manufacturer's instructions. Use shrouds at all glands, unless otherwise instructed. At core connections to equipment without integral clamping terminals use compression lugs unless otherwise indicated.

Terminating - Mineral Insulated Cables

The Contractor shall use terminations in accordance with IS EN 60702-2 and components and materials recommended or supplied by cable manufacturer. Use seals with maximum temperature rating indicated, stub caps to the largest size available, and drilled caps and headed sleeves for larger sizes.

The Contractor shall use glands of type indicated. At terminations to accessory boxes within a plaster or render finish, cable clamps fixed to accessory box and firmly gripping cable sheath may be used. Use earth tail seals with sheath grip type accessory boxes.

At equipment not provided with threaded entries, secure glands using lock washers and locknuts or brass conduit bush. Use gland shrouds when plastic covered MI cables are used.

Using PVC, PIB or LSF material tape to BS 3924 or IS EN 60454 to match sheath, tape overall gland any bare copper sheath and form seal to cable sheath under all shrouds. Mark the core sleeving with the appropriate identification. Install voltage surge suppressors in accordance with manufacturer's recommendations and surge suppressors to ET101.

Cable Joints - Mineral Insulated Cables:

The Contractor shall joint mineral insulated cables using methods and materials recommended by cable manufacturer. Terminate cables in externally threaded glands using seals with temperature rating indicated. Join conductors using crimped connectors. sleeve of correct size. Protect brass sleeve using heat shrink sleeve.

Communications Coaxial and ICT Cable Installation, Jointing and Terminating

Use methods approved by cable and accessory manufacturers.

Employ labour certified by acceptable body as qualified to install and make joints and terminations in the referenced cable. Obtain in writing approval of cable manufacturer for accessories not supplied by them.

Identify cables using structured numbering scheme.

Cabling Support and Containment

General

Cables referred to in this section are only those types that can be installed without further mechanical protection.

Cable supports

The Contractor shall support all cables throughout their length using conduit; or trunking and enclosures; or cable tray; or cable racking; or special support systems; or cleat or clip fixing direct to building fabric as indicated on the drawings/schedules. The Contractor shall ensure tray, racking and special support systems are continuous and firmly fixed to building fabric. Allow space for additional cables as indicated on the drawings/schedules. The Contractor shall ensure cable support system allows for spacing in accordance with ET101 for the design current of the cable.

Fixings finishes

The Contractor shall ensure finish for all support components, fixings, hangers and accessories are as the cable support system or manufacturer's standard.

Cable Support System - Perforated Tray

The above shall be of the flanged or return flanged type.

Perforations shall be of the admiralty pattern for light or medium duty; GDCC pattern standard 23; or manufacturer's standard pattern. The thickness shall be as the manufacturer's standard thickness for type.

The Contractor shall use factory made fittings throughout of same material, type, pattern, finish and thickness as cable tray. The Contractor shall use reducers, inside angles and outside angles as manufacturer's standard. The Contractor shall use flat bends, equal tees, unequal tees and crosses with corners gusseted.

Lengths of tray shall be joined and fittings using manufacturer's standard shouldered ends, fish plates, or couplers, with galvanized or zinc plated slotted domed head 'roofing' bolts, nuts, washers and shakeproof washers.

The Contractor shall use hot rolled steel galvanized after manufacture to IS EN ISO 1461; or bending and profiling quality hot dipped galvanized steel to IS EN 10142 or IS EN 10143 and IS EN 10147. The finish shall be self-colour galvanized.

Cable Support System - Cable Cleats

The Contractor shall use one piece or single way pattern or claw pattern or two bolt pattern. The material shall be die cast aluminium alloy; moulded black polyethylene; or nylon. The finish of the cleats shall be self finish.

Cable Clips and Cleats

These shall be manufactured to standard IS EN 50368. They will be made from impact resistant material. They shall have resistance to electromagnetic forces and be of the one piece type.

Polypropylene surface type with pre-fixed hardened steel pin for general use except on mineral insulated cables.

For mineral insulated cables use bright copper one hole 'P' clips for unsheathed mineral insulated cables, PVC covered for sheathed mineral insulated cables.

Proprietary cable ties

Proprietary cable ties shall be of the two piece cable tray pattern type. Two piece cable tray pattern, on cable tray only. Wrap round self locking non releasable pattern on everything except cable trays.

Cable Support System - Two Way Saddles

The Contractor shall use bright copper for unsheathed mineral insulated cables. PVC

covered bright copper for sheathed mineral insulated cables.

Cable Tray Installation

The Contractor shall support from the building fabric with minimum clearance behind of 20mm and install fixings at regular intervals to prevent visible sagging when loaded, with maximum spacing 1.2m and 230mm from fittings.

The Contractor shall keep cutting of cable tray to a minimum. Cut along a line of unperforated metal. Make good finish with zinc rich paint, primer and top coat, or two pack epoxy paste, as appropriate to tray material and finish. The Contractor shall fit holes cut in tray for passage of cables with grommets, bushes or other lining. All bolts, fixings and hangers shall be installed with threaded portion away from cables.

Cable Cleats, Ties, Saddles and Clips Installation

For cables on horizontal tray use ties for each circuit. Use tie manufacturer's special tensioning tool where available. Crop off tie ends.

For cables on vertical tray use cleats bolted to tray for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. Use cleats sized to grip cables firmly without undue pressure or strain on cable, but preventing slipping.

For cables on vertical or horizontal rack use proprietary fixings to rack for paper, plastic or elastomeric insulated cables and saddles or clips for mineral insulated cables. On continuous flat surfaces of wood, plaster, brick etc.

Use polypropylene surface fixing clips with prefixed hardened steel pin for PVC insulated and sheathed cables and sheathed or bright mineral insulated cables. Use round or flat or flat twin pattern as appropriate, manufactured specifically for cable being fixed.

Use one hole 'P' clips or two way saddles of bright copper for unsheathed mineral insulated cable. Use PVC covered for sheathed mineral insulated cables.

Space cleats, ties, saddles and clips in accordance with NSAI and ETCI regulations

POWER

General Services and General Purpose Power Installations

General

The Contractor shall supply, install, test and commission the complete general services and general purpose power installations as indicated on the drawings and as specified herein.

Equipment

General services equipment shall be as indicated on the Schedule of Equipment.

General Services Socket outlets

The Contractor shall provide socket outlets where shown on the drawings. No more than 4 twin socket outlets are to be wired on the one circuit. Each socket circuit will be protected by a 20A MCB and 30mA ELCB at the local distribution board.

Socket outlets generally shall be of the surface mounted metal clad type to BS 1363, IS 411, switched with no indicating lamps unless otherwise indicated on the drawings. Socket outlets shall be mounted at 450mm AFFL unless otherwise indicated. Socket outlet circuits shall be wired in 4sq.mm LSF/LSF cabling in trunking and conduit. Single un-switched socket outlets shall be provided for low-level kitchen equipment where shown on the drawings.

Where low level under counter sockets are installed a double pole isolation switch shall be installed above the counter for each socket.

The Contractor shall supply plug-tops for 25% of the quantity of socket outlets in the building or 30No plug-tops, whichever is the greater.

The Contractor shall supply protective socket covers to all sockets.

Connection Units/Spur Outlets (FSCU's)

Connection units/spur outlets shall be provided where shown on the drawings. No more than 4 spur outlets shall be wired on the one circuit with the exception of power supplies for later heaters and hand dryers and any other services indicated on the drawings. Each spur outlet circuit shall be protected by a 20A MCB on the local distribution board unless otherwise indicated. Spur outlet circuits are to be wired directly from distribution boards on their own circuits. Spur outlet circuits shall not be wired in a radial fashion off of another general services power circuit.

Connection units shall generally be mounted at 450mm AFFL for low level services and at 2100mm AFFL for high level services unless otherwise indicated. Connection unit circuits shall be wired in 4sq.mm LSF/LSF cabling in trunking and conduit.

Connection units for general purpose power services shall be of the switched fused indicating types to BS 4662 unless otherwise indicated

Connection units for Security equipment shall be of the unswitched fused indicating type to BS 4662 and be on the same phase. Connection units for CCTV equipment shall be of the unswitched fused indicating type to BS 4662 and be on the same

phase. Connection units for Fire Alarm equipment shall be of the unswitched fused indicating type to BS 4662 and be on the same phase.

Cooker Control Unit

The Contractor shall provide 45A DP Cooker control units - without sockets to BS 4177, (enclosure box to BS 4177) and associated cord outlet to BS6733 shall be provided where shown on the drawings. The cooker control switch shall be wired in 3 core 10sqmm XPLE/SWA/LSF.

Isolating Switches

The Contractor shall provide isolating switches to IS EN 60669-1 with rocker bar switch type where shown on the drawings. The rating and pole configuration shall be DP, three pole or TPN as indicated on the drawings.

The isolating switches shall be wired as follows:

SP&N

20A = 3 core 4sqmm LSF/LSF & earth

25A = 3 core 4sqmm LSF/LSF & earth

32A = 3 core 6sqmm LSF/LSF & earth

50A = 3 core 10sqmm LSF/LSF & earth

63A = 3 core 16sqmm LSF/LSF & earth

TP&N

20A = 4 core 4sqmm LSF/LSF & earth

25A = 4 core 4sqmm LSF/LSF & earth

32A = 4 core 6sqmm LSF/LSF & earth

50A = 4 core 10sqmm LSF/LSF & earth

63A = 4 core 16sqmm LSF/LSF & earth

Weatherproof Sockets

The Contractor shall provide weather proof sockets with cable and appliance couplers for 16A, 240V single phase for general purpose use, to IS EN 60309-2 as indicated on the drawings. They shall be of polycarbonate construction with male and female connectors.

Weatherproof sockets shall be wired as follows:

SP&N

20A = 3 core 4sqmm LSF/LSF & earth

25A = 3 core 4sqmm LSF/LSF & earth

32A = 3 core 6sqmm LSF/LSF & earth

TP&N

20A = 4 core 4sqmm LSF/LSF & earth

25A = 4 core 4sqmm LSF/LSF & earth

32A = 4 core 6sqmm LSF/LSF & earth

Mechanical Plant and Controls Cabling Installation

The Contractor shall include for the complete wiring and testing of all cabling associated with the mechanical plant and controls.

The general allocation of responsibilities for the installation of the mechanical plant and controls cabling as described below.

Power Wiring

The Mechanical specialist/building management system specialist shall confirm to the Electrical specialist the power wiring cabling requirements. The installation, glanding off, termination, testing and permanent labelling shall be carried out by the electrical contractor. The building management system contractor/specialist supplier shall verify the termination of the power wiring cabling.

Controls Wiring

The Controls Specialist shall confirm to the Contractor the controls wiring cabling requirements. The installation, glanding off, termination, testing and permanent labelling shall be by the electrical contractor. The final verification of termination shall be by the Controls Specialist.

Controls Devices

The supply and labelling of controls devices shall be by the Controls Specialist. The installation of the pipeline and ductwork mounted instruments/devices shall be by contractor. The installation of the room mounted instruments/devices shall be by the Contractor.

MCCs and Panels

The supply and delivery shall be by the Controls Specialist. The offloading and positioning of MCC panels shall be by the Mechanical Services Specialist. The installation of the MCC panels shall be by Contractor. The commissioning of these panels shall be by the Controls Specialist.

Variable Speed Drives Outside of MCC Panel

The supply and delivery of VSD's shall be by the Controls Specialist. The offloading and

positioning of the VSD's shall be by the Mechanical Services Specialist. The installation of the VSD's shall be by the Contractor. The commissioning of the VSD's shall be by the specialist supplier to the Controls Specialist.

Variable Speed Drives Inside of MCC Panel

The supply of VSD's within the MCC panels shall be by the Controls Specialist. The installation in the MCC panels shall be by the Contractor. The commissioning shall be by the specialist supplier to the Controls Specialist.

Variable Speed Drive Sizes

The specialist supplier of the VSD's shall issue a questionnaire for information required to the Controls Specialist. The Controls Specialist shall advise the specialist supplier and the Contractor of all relevant manufacturers' details.

LIGHTING SERVICES

General Lighting

General

The Contractor shall include for the supply, installation, wiring, testing and commissioning of the general lighting installation as described in other sections of this specification and as indicated on the tender drawings. The Contractor shall further refer to the Section B of this specification for the particular selection of light fittings and associated items intrinsic to the lighting installation.

Standards & Regulations

IS 10101

ET101

CIBSE Lighting Guides

IS EN 12464

The Building Regulations

Wiring and Installation

The internal lighting circuits shall be run in 2.5sq.mm, with 2.5sq.mm earth throughout the installation. All lighting circuits shall be protected by MCB's of a minimum size of 10A. The circuits shall be arranged to minimise voltage drop and provide the correct operating voltage for each luminaire.

The Contractor shall ensure that support is adequate for weight of the luminaires provided.

Ajustable fixing brackets shall be used/supplied to fit all Surface Mounted Fluorescent Luminaire in order to clear ceiling tile.

Power supply for each luminaire shall be extended in cable and conduit to a position not less than 1.2m in plan length from the lighting outlet point. The power supply shall be extended via a connection box mounted in the ceiling space, to facilitate the installation of light switches. Cabling to light switches shall be carried out in cable in galvanised steel conduit as described in the containment section earlier in the technical specification, installed on the surface of fair faced hollow block walls.

The Contractor shall provide the following minimum number of supports for each luminaire longer than 600mm.

Luminaire width (mm)	Minimum number of supports
Up to and including 300	2
Over 300	4

Where a luminaire is supported from trunking the Contractor shall use proprietary clamps or brackets appropriate to the luminaire and trunking.

The Contractor shall not support luminaires directly from trunking made from nonmetal or heat sensitive materials, where the temperature of the material may exceed 60°C or the mass suspended exceeds 3kg.

Where unavoidable and two or more phases are present in the Switchbox, phase segregation barriers shall be installed in the Switchbox and labels shall be provided within the Switchbox. Every attempt however, shall be made to avoid multiple phases in the switchbox.

Equipment

Luminaires shall be as detailed in the attached specification. All luminaires' photometric data shall comply with BS 5225. All luminaires shall be in accordance with IS EN 60598. The Contractor shall ensure that luminaires of similar type have same photometric performance as published data within the tolerances defined by BS 5225. All hazardous area luminaires shall comply with IS EN 60079, and IS EN 50014; IS EN 50018 or IS EN 50020 as appropriate.

The Contractor shall ensure that the lamps of each type are from same manufacturer and are of the same colour temperature and rendering characteristic.

The Contractor shall incorporate integral photo-cell on luminaire where indicated on the drawings.

The Contractor shall clarify with the consultant before hand the lighting control strategy. Where photocells are indicated separate from the light fitting mounted on the underside of the ceiling this is how they shall be installed. The Contractor shall alert the consultant immediately after being appointed as the successful Contractor as to any changes to the lighting control strategy.

The Contractor shall employ a lighting control specialist to fully test and commission the lighting control system.

The Contractor shall install high frequency electronic control ballasts for any tubular fluorescents. These shall be mounted integral to the light fitting or shall be fully accessible if in a concealed location.

Throughout this installation the Contractor shall install all lamps.

Testing and Commissioning

The general lighting installation shall be fully tested and commissioned in accordance with the above standards and the lighting manufacturer's recommendations. 100hrs burn-in shall be apply by the contractor before handover.

Emergency Lighting

General

The Contractor shall include for the supply, installation, testing and commissioning of the entire emergency lighting installation as indicated on the drawings and specified herein.

Standards & Regulations

The emergency lighting installation shall comply in its entirety, and be certified upon completion, with the standards detailed above.

Wiring and Installation

Emergency lighting circuits shall be run in 2.5sq.mm., 2-core cable, with 2.5sq.mm earth as above, and cables shall be colour coded to latest NSAI and ETCI Regulations. The supply to the Emergency Luminaires shall be taken from the Adjacent Distribution Centre.

All emergency luminaires shall be fed from the downstream terminals of the MCB feeding the local lighting circuits, with not more than four luminaires per circuit, via a normally

closed contact of a multi-pole relay. The multi pole relay in each Distribution Boards shall be controlled from a Central Test/Timer Unit.

Equipment

Exit signs

Exit signs shall be as indicated in the schedule of equipment and be of the combined type.

Central Test Unit

The entire emergency lighting system shall be installed such that a Central Test System is capable of testing each Emergency Luminaire and/or circuit in a manner as defined by IS 3217:2008 and in conjunction with CLC/BTTF 6/8 “Automatic test Systems for Battery Powered Emergency Escape Lighting”.

The central test/timer unit shall be four channel electronic, with digital indication, as manufactured by NEL Limited or equivalent, which shall energise the relay coil at specific times (software selectable) to discharge the emergency luminaires for specified periods, nominally for-five minutes and three hours.

Emergency luminaires

The Contractor shall provide all exit luminaires of the maintained, self-contained type with stove-enamelled steel body, opal diffuser LED lamps with the word EXIT in 125mm high lettering in accordance with IS3217. These luminaires shall have a silkscreen printed in green upon the diffuser and shall be operated from a three hour battery set with automatic re-charging set. All exit luminaires shall comply with EN 1838:1999 and have a Running Man Pictogram.

Twin spot emergency luminaires shall be of the non maintained, self combined type with 2 No. 20 or 21 Watt Tungsten Halogen Spot Lights mounted in a metal battery cabinet, complete with three-hour battery set with automatic re-charging set. The cabinet shall be stove enamelled.

Twin spot emergency luminaires, where provided in accordance with M&E drawings, shall be wall mounted or supported from the trusses/purlins by means of clamp on type brackets by the nominated sub-Contractor.

The emergency lighting luminaires/equipment shall be to the approval of the engineer and comply with the requirements of EN 60598-2-22.

Emergency Conversions

All invertors shall be of the fully enclosed type, either metal or plastic can.

All batteries utilised integral to luminaires shall be high temperature (55°C), sintered plate, nickel-cadmium, secondary cell type, rechargeable. All conversions shall, wherever possible, be integral to the original luminaire, only following specialist assessment, investigation and test, to ascertain the suitability for conversion from an electrical, electronic, mechanical, thermal, EMC, serviceability and safety viewpoint.

All conversions shall not affect the Ingress Protection Classification (IPXX) of the original luminaire and shall not affect the photometric performance of the original luminaire and shall also not affect the Safety Classification of the luminaire (Class I, II, III).

The Contractor shall include for the recertification of the original luminaire following the conversion process, specific to the EMC and LV Directives, Ingress Protection Classification, Safety Classification and Performance criteria by the System Supplier. High temperature nickel cadmium battery packs suitable for use with 26mm diameter tubes shall be installed in fluorescent luminaires and shall power one of the lamps on mains failure for a duration of three hours.

The battery and charger circuit utilised shall be fully encapsulated and come complete with battery disconnect male/female connector(s) to aid isolation and services. All batteries used shall be either Gas recombination Sealed Lead Acid or the High Temperature variety or Sintered Plate, High temperature Nickel Cadmium. All batteries shall be suitably sized to power the required load for a minimum period of 3 Hours with a 25% ampere-hour capacity to allow for capacity fall off with age over useful life (i.e. 4 years) yet still maintain 3 Hours duration. All Chargers shall be solid state, constant voltage or constant current format, depending on battery type utilised. Each charger unit shall come complete with solid state controls to initiate deep discharge protection of the battery automatically in the case of extended power failure. All chargers and changeover controls shall be fully automatic and fail-safe upon power failure or resumption of supply. The charger shall come complete with a neon warning light to indicate that all circuitry is complete and functioning correctly and that the batteries are being charged. Batteries shall have a minimum recharge time of 24 hrs at 230V 50 Hz.

Ballast Lumen Factors

All emergency lighting luminaires shall utilise ballast and battery combinations such that the following, minimum ballast lumen factors of performance are achieved for the stipulated standard lamp types following power failure. Non-listed non-standard lamp's ballast lumen

factor figures should be verified with the Engineer prior to ordering:

Lamp Type	Wattage	Minimum Ballast Lumen Factor
T5	4W	Greater than or equal to 0.60
T5	6W	Greater than or equal to 0.50
T5	8W	Greater than or equal to 0.45
PL	5W	Greater than or equal to 0.40
PL	7W	Greater than or equal to 0.40
PL	9W	Greater than or equal to 0.38
PL	11W	Greater than or equal to 0.38
2D	10W	Greater than or equal to 0.47
2D	16W	Greater than or equal to 0.26
2D	21W	Greater than or equal to 0.24
2D	28W	Greater than or equal to 0.22
PLC	18W	Greater than or equal to 0.24
PLC	26W	Greater than or equal to 0.17
PL-L	18W	Greater than or equal to 0.20
PL-L	24W	Greater than or equal to 0.19
PL-L	34W	Greater than or equal to 0.15
PL-L	36W	Greater than or equal to 0.14
PL-L	40W	Greater than or equal to 0.14
PL-L	55W	Greater than or equal to 0.10
LV	20W	Greater than or equal to 0.80
LV	50W	Greater than or equal to 0.80
T5	14W	Greater than or equal to 0.30
T5	21W	Greater than or equal to 0.21
T5	28W	Greater than or equal to 0.22

All lamps utilised as part of the emergency lighting system shall be suitable for the required purpose and be of a major brand name manufacture only and available within the Republic of Ireland ex-stock for a minimum period of 10 years following installation completion. All lamps shall be professional long life, low-energy variants.

Overload & short circuit protection

All emergency luminaires shall incorporate separate protection for each incoming supply line, to include the unswitched and switched supplies, integrally, within the luminaire by means of suitably fused terminal block(s) to aid safety, isolation and discrimination functions. All fused terminal blocks for the purpose of connection to the supply network shall be suitably sized for the connection to each terminal of at least 2 No. 1.5sq.mm cables or 1 No. 4.0sq.mm.

Testing & Commissioning

The Contractor shall include for testing and commissioning of the system by the system suppliers and for attendance on the suppliers during commissioning.

The system shall not be deemed complete until a satisfactory commissioning Certificate is submitted to the Employer's Representative. Certificate shall be in exact accordance with I.S. 3217; 1989 - Appendix C.

The external lighting installation shall be carried out as indicated on the Drawings and as specified. Luminaires shall be as set down and described equal & approved in the Schedule of Luminaires

External lighting circuits shall be run in 6sq.mm two-core PVC/SWA/LSF Cable to ground mounted luminaires and in 2.5sq.mm cables in conduit to building-mounted luminaires. The switching of all site luminaires shall be by means of **contactor** control circuits from a switching position adjacent the main distribution board.

The external luminaires shall be controlled by solar dial time switch/photo cell distribution centre via a contactor, with an over-ride switch facility positioned as indicated on the drawings.

Photo electric cells shall be normally open, close on low-light type, complete with conical plastic cover and shall be mounted at roof level away from all direct light sources. The photoelectric cell shall be of the adjustable type setting from 2 -800 lux, and shall be complete with sixty seconds time delay on/off.

The building flood lighting/carpark lighting shall be controlled by separate time switches and photocells. The switching details shall be as indicated on the drawings.

5 DATA & COMMUNICATIONS

Information Communications Technology Installation

General

The system offered and quoted by the Contractor shall incorporate all features and facilities listed in this specification

Data Communication Systems

The Contractor shall supply, install, commission and set to work a data communication system consisting of any or all of the following subsystems:

- a) Work location subsystem
- b) Horizontal subsystem
- c) Administration subsystem
- d) Backbone subsystem
- e) Equipment room subsystem
- f) Campus subsystem

Data Communication Specialist

The entire installation shall be carried out by a Data Services Specialist employed by the Contractor. The Services Specialist shall be fully trained and certified to install the specified product and fully authorised to issue a warranty certificate. Only the specified product/s shall be priced by the Services Specialist.

All products shall comply with the Category 6a standard, EIA/TIA 568-B, 568-B, IS 11801 and EN 50173

All products shall be of one manufacturer, as specified below. (Alternative or ADHOC systems will invalidate tender)

Class 6a channel performance of min 500 MHz (and specified to 1000 MHz) is required.

The solution required shall be one of the following only:

Systimax Cat6a solution

Brandrex Cat6a solution.

Belden Cat6a solution

Safety of Equipment

The Services Specialist shall ensure all data communications is installed and commissioned in accordance with optical communication system to IS EN 60950.

Approvals

The Services Specialist shall ensure all equipment connected to a service providers system

meets the requirements of the service provider.

Electromagnetic Compatibility

The Services Specialist shall ensure all data communication system equipment is compatible, and does not adversely affect any other equipment installed in the same location.

Software

The Services Specialist shall ensure that the end user is conversant with the patching records applicable to the passive patching system to be installed by the contractor. Provide application software in accordance with BS 7649.

Open System Interconnection

Plan, provide and install data communication system complying with the ISO Open System Interconnection 7 layer model, set out in BS ISO/IEC 10731.

Workmanship / Installation

All work shall be completed in a thorough and conscientious manner according to industry guidelines and industry standards, and shall be subject to inspection and acceptance. The plan and installation of the structured cabling system will be completed in accordance with the cable manufacturer's recommendations and IS EN 50174-1 and IS EN 50174-2.

Local regulations or codes shall be followed at all times.

The Services Specialist shall be certain that all installation work areas are secure and made safe in accordance with Health and Safety regulations.

The Services Specialist shall maintain conductor polarity (tip and ring) identification at the main equipment room, splice enclosures encapsulations, service entrances, risers and station connecting blocks in accordance with industry practices.

The Services Specialist shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the distribution system.

The Services Specialist shall be responsible for labelling all cables and cords, distribution frames and outlet locations, according to industry standards. Labels should be computer generated or typewritten.

All cable plant installed by the Services Specialist shall be fully tested for continuity, polarity

reversals, wire transpositions, AC and DC voltages, opens and shorts prior to acceptance. Please note that cable pair faults (other than factory) shall be cleared by the installation Services Specialist.

It shall be the responsibility of the installation Services Specialist to furnish any special installation equipment or tools necessary to properly complete the installation. This may include tools for terminating cables, testing and splicing equipment for copper/fibre cables, communication devices, jack stands for cable reels, or cable winches.

The Services Specialist shall not roll or store cable reels without an appropriate underlay.

The Services Specialist shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus.

The Services Specialist shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded at any time during the placement of the facilities. Failure to follow the appropriate guidelines may require the Services Specialist to provide the additional material and labour necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the installation Services Specialist during the implementation.

The installation Services Specialist shall mount any equipment or electronics as close to the wiring wall fields (if appropriate) as possible, taking into consideration future growth, to facilitate administration and service.

It shall be the responsibility of the Services Specialist to inventory all materials upon their arrival at the customer's location. Any items missing from the list of system components required for the full operation of the data-communications system will be the responsibility of the Services Specialist.

The Services Specialist shall be responsible for testing all cable prior to the installation of the cable. If the installation Services Specialist fails to perform this testing operation, the installation Services Specialist shall accept the cable as acceptable and assume all liability for the replacement of the cable should it be found defective at a later date.

The Services Specialist shall plug conduits and entrance holes where the cabling has been installed by the installation Services Specialist in the main equipment room, manholes, riser and other cable entrance locations with unalterable duct seal or flame retardant putty.

In some cases it may be necessary for the Services Specialist to remove or raise and support the existing facilities in order to install the new distribution system. The Services Specialist shall be responsible for providing an approved earth at all newly installed distribution frames and protector locations insuring proper bonding to any existing facilities. The Services Specialist shall also be responsible for ensuring earth continuity by properly bonding all

appropriate cabling, closures, cabinets, service boxes and framework. All earths shall consist of appropriate gauge copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground.

If the cross connect hardware is wall mounted, it shall be the responsibility of the installation Services Specialist to equip the entire wall surfaces with fire retardant plywood sheets. The plywood sheets shall be 8 feet x 4 feet x $\frac{3}{4}$ inches and shall be mounted vertically several inches above the floor level. The plywood sheets shall also be painted to customer specifications.

Construction Schedule

An appropriate construction schedule shall be developed by the Contractor and will be subject to approval by the Contractor. The construction schedule is expected to compass a number of weeks and should include at least one installation supervisor, or lead technician, for on-site management of the project.

Installation Supervisor

Prior to starting the installation, the assigned installation supervisor, or lead technician, shall participate in a walk through of the project location with the consulting engineer to review the engineering/installation documentation, verify that all construction necessary for the installation has been completed, and verify all installation methods and cable routes.

Site Progress, Cleanliness and Damage Prevention

The Contractor shall be responsible for completing a standardised report form addressing the weekly progress of the installation schedule. The Contractor shall maintain a work area free of debris, rubbish, empty cable reels, scrap wire, etc., and dispose of such items on a daily basis. The Contractor shall take precautions to avoid damage to the premises and property, and will perform restoration if damage should occur.

Payment for Additional Work

The installation Contractor must have prepayment approval for all additional work not detailed within this Specification or Contract. The Contractor is to submit a written listing of all additional work to be performed, with all incurred costs, prior to the commencement of the work. Payment for additional work shall not be made if this procedure is not followed.

Manufacturer's Guidelines

Carry out work in accordance with the manufacturer's guidelines and recommendations for their proposed solution.

Terminology

The following terminology will be utilised throughout this section: User Outlet (UO) - the end point of horizontal cable located in the work area; floor distributor (FD) - horizontal cabling subsystem termination point; building distributor (BD) - building backbone subsystem termination point; campus distributor (CD) - campus backbone subsystem termination point; main distribution facility (MDF) - consolidation point for FD/BD and/or CD; test jack frame (TJF) - telephone system / PTO / copper backbone termination point; data communication centre (DCC) – room within the educational facility where the MDF is housed; intermediate distribution facility (IDF) – a secondary area within the school from which voice and data services are distributed, akin to the MDF.

Technical Support Staff

The Services Specialist shall provide a list of their approved technical support staff, together with their working experience.

The Services Specialist shall state if their support staff are trained by the manufacturer, on-site training or other means.

The Services Specialist shall state their nearest branch office and dealer's office in relation to the site proposed for the installation. If none, the location of the main office shall be stated.

The Services Specialist shall state their nearest location of their principal's support centre. This centre shall have permanently stationed support staff that are capable of providing technical support if required.

The Services Specialist shall include for fishing cables through conduits and trunking throughout. All cable trays and conduits shall be supplied and fixed by others prior to the installation of data cables.

Programming

The Data Services Specialist shall include for the completion of the entire works, as described herein and on the accompanying drawings, in accordance with the programming of work. He shall include for liaising with the electrical contractors and project manager on the

completion for the programming of works.

Co-Ordination of Services

The Data Services Specialist shall include for co-ordinating the work as described herein and shall have regard for all other works in progress during the installation of the IT structured wiring system

The Services Specialist shall not put in hand any work under this section without written approval of the Employer's Representative.

Warranty

The entire voice and data network shall be fully guaranteed for a minimum period of twenty years. The Services Specialist shall be required to produce Warranties and Guarantees in this regard.

Standards & Regulations

The systems that shall be supported include, but are not limited to; Data Processing - IBM (3270 Type A, System 34/36/38 and AS/400), Wang, Unisys, DEC.

Data Communications - EIA-232-D, RS-422, RS-423, Ethernet (10Base-T), Token Ring, Twisted Pair Physical Media Dependant (TPPMD), Fast Ethernet, 100Base-T, 100VGAnyLAN, ATM at 155Mbps and transmission speeds of 622Mbps, Gigabit Ethernet and 10 Gbps Ethernet.

Voice Applications – Analogue, digital voice, basic rate and primary rate ISDN.

Video - Analogue Video, Digital Video, Video Conferencing, RGB Video and 550mhz broadband video.

The systems shall cover its capacity and functionality with minimum components, be flexible and capable of including new facilities or technologies as they become required or available.

Amendments and Revisions

In complying with any standard, the Services Specialist shall equally comply with any published amendments and revisions issued up to and including start on site (and subsequently where the Services Specialist can reasonably be assumed to be able to comply).

Standards Contradictions

Confirm that this document has been checked to identify any areas in which they feel it contradicts any of the following standards.

European Committee for Electro-technical Standardisation (CENELEC) – European

Telecommunications Industry Association (TIA/EIA) – American International Organisation for Standardisation (ISO) – International Identify any instances where their solution is only compliant with the above.

European Standards

Carry out work in accordance with the following European standards and all standards that are referenced within.

IS EN 50173-1 - Information Technology - Generic Cabling Systems.

IS EN 50174-1 - Information Technology - Cabling Installation. The specification and quality assurance.

IS EN 50174-2 - Information Technology - Cabling Installation. Installation planning and practices inside buildings.

Industry Practice

Carry out work in accordance with the industry practices.

The system shall specifically support the applications and associated transmission distances described in the SYSTIMAX 'Structured Cabling System Performance Specification'.

The Services Specialist will supply a statement of compliance that the system proposed meets the requirements of the EEC Directives on EMC. This statement should be backed by test documentation showing the compliance of the cabling system under stated test conditions.

The recommended test networks are 100 Mbps TPPMD, 16Mbps Token Ring and 10Mbps 10BaseT. EMC compliance should be provided as part of a 20 Year Extended Product and Applications Assurance Warranty.

The cabling installation shall comply with ISO IS14763, EN50174 and TIA/EIA 569. It shall also comply with the channel performance of the proposed new editions of TIA/EIA 568B, IS 11801 and EN50173 standards (or the standard itself if ratified before installation commences).

System Channel Performance

The solutions must focus on the performance of the channel as a whole, rather than the performance of individual components. This is a more useful parameter for measuring performance as it takes into account the combined components required to move a signal from the MDF/IDF to the desktop, thus providing a guarantee for the total signal quality.

Horizontal Cabling Subsystem Installation

The Services Specialist shall supply a horizontal cable to connect each information outlet to the backbone subsystem on the same floor. The type of horizontal cables used shall be 4-pair unshielded twisted pair (UTP), Category 6a LS0H.

The cable shall be able to support voice and data, to at least 10GBASE-T and shall have electrical performance specified out to 500MHz.

The horizontal cables shall be 4-pair unshielded twisted pair cables and shall be of 23/1 AWG (1.06 mm) solid copper conductors. The cables shall be PowerSum NEXT rated.

The 4 pair cables should be at minimum Independently Verified to be Category 6a by Underwriters Laboratories (UL).

The 4-pair UTP cable shall be run using a star topology format from the termination block at the administration subsystem on each floor to every individual information outlet. All cable routes to be approved by the consulting engineer prior to installation of the cabling.

The length of each individual run of horizontal cable from the administration subsystem (Main Distribution Facility) on each floor to the information outlet shall not exceed 90 metres. If necessary, additional Intermediate Distribution Facilities shall be added to maintain the required distances.

Contractor shall observe the bending radius and pulling strength requirements, given below, of the 4-pair UTP, cable during handling and installation:

- Bending radius - 4 times the cable diameter
- Maximum pulling tension - 11N

Each run of cable between the termination block and the information outlet shall be continuous without any joints or splices, except for the optional use of a consolidation point.

In existing structures, the Services Specialist shall place distribution cabling following the same basic route of the existing wiring, except where conduits are full or the outer is not easily accessible. In new structures, the Services Specialist shall place cabling in the existing, or newly installed, distribution media.

In suspended ceiling and raised floor areas where cable trays or conduit are not available, the Services Specialist shall bundle station wiring with plastic cable ties, tied loosely at appropriate distances (approximately 1m). The cable bundling shall be supported via the existing building structure and framework.

Pull boxes shall be used for the following purposes:

- Fishing the conduit run
- Pulling the cable to the box and then looping the cable to be pulled into the next length of conduit

A pull box shall, therefore, be placed in a conduit run where:

- The length exceeds 30 m
- There are more than two 90° bends
- If there is a reverse bend in the run

If the interior of walls are not obstructed, the Services Specialist shall conceal horizontal distribution wiring internally within the walls. If such obstructions exist, the Services Specialist shall secure approval from the Employer's Representative prior to the use of an alternate method.

The Contractor shall be responsible for removing and replacing all ceiling tiles required for the installation of the wiring. Any damage to the ceiling tiles will be made good by the Contractor.

Information Outlet

All information outlets shall be of EN 60603-7 (IEC 603-7) and EN 28877 (ISO 8877) 8-position modular MGS400 connectors and of the insulation displacement type. They shall be capable of receiving of 23 AWG solid and stranded wires. The information outlet shall be either surface or flush mounted in appropriate face plates or floor boxes.

The RJ45 information outlet shall be multivendor supportive and shall be wired in an EIA/TIA 568B configuration.

The RJ45 information outlet shall meet or exceed the Category 6a requirements of the ANSI/EIA/TIA 568-A, ISO IS 11801 and EN 50173 standards.

Active Data Host Looms

The Services Specialist shall provide host looming patch panels to allow attachment of active network devices without requiring them to be directly patched to the system. The active LAN equipment will be located in the equipment cabinets/open frames whereas the host loom patch panels will be located in the floor distributors. Each host loom shall be provided as multiple single-ended RJ45 fly leads. Form the plug end of the looms neatly to plug into the active equipment (or left spare for future connection). Terminate or present the other end of the fly leads on the active data RJ45 patch panel (DPP). Type 48 way host loom.

RJ45 Patch Panels

The RJ45 Patch Panel shall be able to accommodate 23 AWG (1.06 mm) stranded and solid cable conductors. The panels shall meet or exceed the ANSI/EIA/TIA 568- B, ISO IS 11801 and EN 50173 Category 6a standards. 24 port or 48 port versions shall be selected as a

appropriate.

The modular RJ45 patch panels must have patch cord routing incorporated (1 patch cord routing trough for every 48 ports).

Category 6a patch cords must be provided.

The Services Specialist shall provide the RJ45 patch panels in the DCC as part of the MDF and within the IDF if applicable.

Building Backbone Cabling Subsystem

The Services Specialist shall supply 23 AWG (1.06 mm) multi-pair Category 6a cables for voice and low speed data applications in the backbone sub-system. The Services Specialist shall supply 4 pair copper cables. These cables shall be able to support voice, data and building services applications. These cables shall meet or exceed the attenuation and PowerSum NEXT requirements of ANSI/EIA/TIA 568-B, ISO IS 11801 and EN 50173 standards. The Services Specialist shall observe the appropriate bending radius and pulling strength requirements of all backbone cables during handling and installation.

Multi Pair Copper Backbone Cabling

The Services Specialist shall supply multi-pair Category 6aCat (1.06mm CSA) cables for the voice and low speed data applications in the backbone sub-system. All cables should be duct grade, internal/external, LSOH outer sheath.

The Services Specialist shall observe the appropriate bending radius and pulling strength requirements of all multi-pair backbone cables during handling and installation.

The presentation/termination method is as follows:

- a) Telephone Joint Frame - Krone Frame
- b) Communication Cabinet- RJ45 Patch Panel Cat 6a
- c) Service Provider intake - Krone Frame

Cabinets and Frames

Provide cabinets to house the Building and Floor Distributors as indicated on the schematic drawing. All cabinets shall with the following specification.

Cabinets shall support 19” and ETSI mounting protocols. Cabinets shall be 1000 x 00mm 42U and carry a full range of accessories to enable complex configuration at

a later date if required by the client.

Cabinets shall provide excellent thermal management capabilities and enable speedy

installation and system maintenance. They shall be manufactured from 2mm high quality steel providing rigid robust framework and comprise of four heavy duty corner posts, top and bottom assemblies shall be capable of carrying loads of up to 500kg.

Steel side panels shall be manufactured from 1.2mm steel and have two beaded ribs for rigidity. Side panels shall be secured with twin locks.

Door frame side rails shall have slots for ventilation. Glass doors shall be framed to protect glass edges from damage and ensure full electrical bonding. No adhesives shall be used in the glass or steel construction so as to avoid door distortion at high temperatures from active equipment. Glass shall be toughened smoked glass. Doors shall be instantly removable via spring hinge pins and shall be readily mounted on left or right handed.

Doors shall open through 180degrees when cabinets are bayed or 270degrees when stand alone, so as to comply with EU standards for unobstructed personnel evacuation in case of fire.

Earth bonding studs shall be fitted. Door locks shall be fitted. The cabinet base shall have a large cable access port and front and rear cable access ports shall be provided in the base to allow cable entry when cabinets are mounted directly on solid floors.

The cabinet roof shall offer an extensive choice of cable entry ports. Roof fans shall be fitted and shall be replaceable (for maintenance or upgrade) without removing the cabinets roof or electronic equipment in the cabinet.

Cabinet mounting posts shall be manufactured of 1.5mm high quality steel and shall be fully adjustable, with 9.5mm pre-punched squares holes for “U” height equipment mounting. Mounting posts shall be bright Zinc activated for quality appearance and electrical bonding.

Cable tray shall be punched with cable tie slots.

Cabinets shall have castors, screw jacks or modular plinths as required.

Patch Cords

The system shall be completed with high grade Patch Cords and Connectors to Category 6a standard

Patch cords shall support FDDI/TPDDI and Data Speeds of 500Mbs

The Services Specialist shall include for Patch Cords and device cables as follows:-

(100% of installed points)No. 1 metre RJ45-RJ45 Category 6a 4-Pair Patch Cords

(100% of installed points)No. 3 metre RJ45-RJ45 Category 6a 4-Pair Device Leads

(100% of installed points)No. 1 metre RJ45-RJ45 Category 6a 4-Pair Patch Cords

Identification and Labelling

All labelling shall confirm to the agreed labelling and identification standards. The specialist contractor shall also include for slip-over ferrule type numbers to be fitted to each with the exception of cables terminating at rear of Work Station outlets. Numbering will consist of a four-digit system. Labelling of Work Station outlets may be glued to the face of each plate using super glue. Labels shall be TRAFFOLYTE or of a similar engraved type.

Port Plans

The Services Specialist shall include for maintaining an accurate detailed record of the works as they progress. The Services Specialist shall include for supplying copies of 'As-Installed' Port Plans upon completion of each area. Drawings shall be in AutoCAD 2006 format and shall be submitted to the engineer as directed.

Punchdown, Testing and Commissioning

The Services Specialist shall be responsible for punchdown at each end of each Voice/Data Cable, together with testing and commissioning to current requirements and for Warranty purposes. All cables shall be 100% continuity tested with results recorded on disc in Excel format.

All circuits shall be tested with an approval proprietary tester and all results shall be recorded in tabular form for the client.

The Services Specialist shall provide the Employer's Representative with three copies of operating and maintenance manuals consisting generally of as-installed drawings, hardware manuals, test sheets, port plans, certification and warranty.

The installation shall be fully tested (i.e. 100% of all cables) to comply with ISO/TEC 11801, TIA/EIA 568A to Category 6a limits.

Level III test instruments shall be used and all test results recorded on disc and included in the hand-over documents. Cables that fail the test must be replaced. The Employer's Representative reserves the right to witness some or all of the testing. The Services Specialist shall include for detailed hand-over documentation to include:

Product warranty; test results on CD; test results on hard-copy; labelling drawings and details; as-installed drawings on CD; as-installed drawings on hard copy; contact telephone numbers for emergency situations.

Public Address Installation

General

The Contractor shall supply, install, test and commission a 2-way public address system with speakers to all teaching spaces, offices, circulation areas and general purpose hall.

The system shall consist of the following:

Desk mounted console, containing amplifier, room selector switches with one master switch, input socket: for microphone lead and other external source lead. One gooseneck microphone shall also be provided.

Furthermore, wall-mounted speakers with built in microphone for talk-back in teaching areas; automatic class call system operating through a 24 hr master clock system complete with external sounder; a separate microphone outlet jack in assembly areas and general purpose hall; reproduction facilities for recordings and broadcasts.

The Public Address Control unit shall be located in the administration/reception area. The speakers shall be positioned on the corridor wall adjacent to the teacher's desk 1.6 m above the finished floor level.

Standards & Regulations

ISEN 60268-3 Sound System Equipment - Part 3: Amplifiers

ISEN 60268-4 Sound System Equipment - Part 4: Microphones

ISEN 60268-5 Sound System Equipment – Loudspeakers

ISEN 60268-16 Sound System Equipment - Objective Rating Of Speech Intelligibility

By Speech Transmission Index

Wiring and Installation

Speakers shall be wired 100V single 4 pair PVC/PVC.

Equipment

The Public Address system equipment shall be as indicated in the schedule of equipment.

Testing and Commissioning

The Contractor shall allow for the complete testing and commissioning of the PA system and class change system.

Digital TV Distribution Installation

General

The Contractor shall liaise with and provide attendance on the TV distribution utility company relating to the installation of a TV connection to the DCC room. A TV distribution system does not form part of the contract.

PROTECTION AND SECURITY

Fire Alarm

General

The Contractor shall supply, install, test and commission the complete fire alarm system in accordance with IS3218 and as detailed above.

The fire alarm system shall be as indicated on the drawings and specified herein.

The fire alarm system shall be an analogue addressable system.

The fire alarm system shall be connected to a remote monitoring station via the intruder alarm system multi channel digi-dialler over a standard PSTN phone line.

This shall be arranged and tested by the Contractor.

The Contractor shall be responsible for all liaison with the Remote Monitoring Company and if required the local authority fire brigade regarding setting up and testing the remote monitoring functions of the fire alarm system.

The Contractor shall submit a set of drawings to the fire alarm system specialist prior to commencement on site for comment and approval of conformation with current regulations.

The Contractor shall supply, install, test and commission the complete Disabled refuse system in accordance with BS 5839 Part 9:2003 and consist of Type B outstations which communicate with a master station.

Standards & Regulations

The fire alarm system shall comply with IS3218.

The Disabled refuse system shall comply with BS 5839.

Wiring and Installation

The entire Fire Alarm system shall be wired in MICC cabling with Red outer sheath.

Under no circumstances is “firetuff” type cabling to be used without the prior consent of the Employer’s Representative. Enhanced fire PH120 cable and accessories may also be considered for approval.

Cabling to be 750V heavy duty mineral insulated cables, LZ0H outer covering in accordance with IS EN 60702-1, section 15. Outer covering to be halogen free material to BS 60702-1, section 8.3. Sheath colour is to be red.

Use seals and glands for mineral insulated cables in accordance with IS EN 60702- 2, recommended or supplied by cable manufacturer. Gland Type to be cable grip type, externally threaded with lock washer and nut. Gland shroud to be LZ0H material to match sheath.

The Contractor shall provide seal types that are plain or earth tails and self-threading pots. Pot closures shall be of the plastic stub cap type. The pot sealant shall be a compound to

105°C standard. The conductor insulation sleeving shall be plain PVC. The maximum temperature rating of the seal shall be 105°C. Cables shall be straightened and dressed using methods and tools recommended by the cable manufacturer.

LZ0H sheathed cables shall be used in locations indicated, and where cables may come into direct contact with any material that may be corrosive to copper. The Contractor shall not allow extra length on installed cables to allow for cutting back of moisture affected ends. Store mineral insulated cables in the form as supplied by manufacturer.

Cable Termination

The Contractor shall use terminations in accordance with IS EN 60702-2 and components and materials recommended or supplied by cable manufacturer. The Contractor shall use seals with maximum temperature rating indicated, stub caps to the largest size available, and drilled caps and headed sleeves for larger sizes. The Contractor shall use glands of type indicated. At terminations to accessory boxes within a plaster or render finish, cable clamps fixed to accessory box and firmly gripping cable sheath may be used. Use earth tail seals with sheath grip type accessory boxes. At equipment not provided with threaded entries secure glands using lock washers and locknuts or brass conduit bush. Use gland shrouds when plastic covered MI cables are used. Using PVC, PIB or LZ0H material tape to BS 3924 or IS EN 60454 to match sheath, tape overall gland any bare copper sheath and form seal to cable sheath under all shrouds. Mark core sleeving with appropriate identification. Install voltage surge suppressors in accordance with manufacturer's recommendations.

Cable Joints

The Contractor shall joint mineral insulated cables using methods and materials recommended by cable manufacturer. Terminate cables in externally threaded glands using seals with temperature rating indicated. Join conductors using crimped connectors. Insulate connectors using PVC tape to BS 3924 or IS EN 60454, ensuring good seal to conductor sleeving. Make off glands into either end of internally threaded brass sleeve of correct size. Protect brass sleeve using heat shrink sleeve.

All fire alarm cabling must be run in the main 3-compartment trunking or on separate cable tray. Final connections to all devices on the building fabric must be run in 20mm steel conduit. Plan and install all fire detection and alarm system cables in accordance with IS3218 and the cable manufacturer's recommendations. Run cables point to point without tees or spurs. Design loop load to not exceed 80% of cable capacity.

Handling and Storage

Handle, store and install equipment and components of the fire detection and alarm system in

accordance with BS 5839 and the manufacturer's recommendations. Obtain all equipment and components from a single source. Inspect all equipment and components on delivery, before fixing and after installation and reject and replace any which are defective. Record all commissioning tests and provide the certification required by IS3218. Provide manufacturer's certificates of equipment design to an approved quality management system and CIE component selection.

Equipment

Fire Alarm Control and Indicating Equipment

The Fire Alarm Control and Indicating Equipment shall consist of a main fire alarm panel, battery and housing and mimic diagram as indicated on the drawings.

The fire alarm control and indicating equipment shall be in accordance the standards listed above and with BS 5839- 1, BS 5839-6 Annex B, IS EN 54-2, IS EN 54-4, IS EN 50130-4 and IS3218.

The main fire alarm panel shall have the following features: It should have a minimum of 2 Zones and a minimum 2No circuits (loops) for detection; have integral 80 character alphanumeric display with Indication of origin of alarms, fault zone indication, short circuit and open circuit faults, Incorrect addressing; unauthorised device removal or exchange, pre-alarm condition, detector contamination; panel mounted printer; no more than 512 detectors affected by first fault; a maximum of 200 addressable points controlled by a single processor.

Battery & Power Supply System

The Contractor shall supply test and install a battery and power supply system in accordance with IS3218 and as per the main fire alarm panel manufacturer's standard requirements.

Manual Call Points

The supply and installation of the manual call points shall comply with the following standards: IS EN 50130-4, IS EN 54-11 and IS3218.

Generally the Manual Call points shall be surface mounted at 1200mm above FFL, have protection against accidental operation, indication of operation and be addressable. Colour of device is to be Red in accordance with regulations. All manual call point units are to be of the fully re-settable type via key operation. The use of breakable glass in the call units is to be avoided.

Automatic (smoke) Detectors

Provide automatic fire detectors from the same manufacturers and with common facilities in accordance with IS EN 50130-4. All detectors shall have the following general characteristics:

Plug in bases; common bases for all detector types; addressable detector bases; 3 way or T bases;

All automatic fire detectors shall generally be of the optical smoke detectors type. These detectors shall have an address code setting. Separate addressable plugs for each detector shall be provided. The Contractor shall provide end of line devices mounted in sensor at the end of line. The Contractor shall label each detector and base with address number. The colour of detectors shall be white.

Detectors to be of the optical point type unless otherwise indicated on the drawings and shall be in accordance with BS 5446-1, IS EN 54-7 and IS3218. Sensitivity of the smoke detectors shall be set by the main panel control software.

Heat Detectors

Heat detectors to be of the type indicated on drawings and be in accordance with BS 5446-2, IS EN 54-5 and IS3218.

Sounders

Fire alarm sounders are to be Electronic type and in accordance with IS EN 54-3 and IS 3218.

Interface Units

Provide interface units where shown on the drawings and ensure that power supplies are available for same.

Testing and Commissioning

The complete fire alarm installation shall be tested and commissioned in accordance with the regulations and interfaces with other electrical sub-systems shall be tested for operability before the final certification is issued.

Record Drawings and Operating Instructions

The Contractor shall provide instructions on the use of installation to person(s) responsible for the use of the premises. Supply the user with a logbook and certificate of installation and commissioning, in accordance with IS3218.

The Contractor shall provide record drawings to the user for maintenance and record purposes.

The Contractor shall show the position of various items of equipment, junction boxes, etc.

and sizes and routes of cables and wires. Include wiring diagrams of junction boxes and distribution cases.

The Contractor shall provide circuit diagrams of the fire alarm system and its components.

Intruder Alarm

General

The Contractor shall include for supplying, installing, connecting, cabling, setting to work and commissioning of the complete Class 3 Intruder Alarm System, in accordance with ISEN 50131 and DD243:2004 (sequential verification of alarms). The Contractor shall be a certified NSAI installer or shall appoint a NSAI registered Intruder Alarm Specialist to complete the full works. The Services Specialist shall allow for the wiring of all items of his equipment from the nearest power outlet. Positions of power outlets required and connected load shall be indicated to the Employer's Representative and shall form part of the Contractor Drawings. The power supplies shall be taken from suitably rated, fused spur outlets with neon indicator. This work shall be carried out by a Qualified Electrician. The Services Specialist undertaking the intruder alarm installation shall need to be registered on the NSAI list of registered installers.

If the Contractor wishes to make a technical design proposal in accordance with the parameters set out hereunder. Proposals shall be submitted in sufficient detail to permit evaluation in terms of adequacy, quality and cost.

Alarm Sensors

Movement detectors shall be of the Class 3 Passive Infra-Red/Microwave 'Dual Tec' type of sufficient range and coverage for areas indicated. They shall be suitable for Wall or Truss Mounting as appropriate. The sensor shall be suitable for the coverage of the perimeter window areas as indicated on the drawing. The Services Specialist shall include for additional Sensors as necessary to ensure complete coverage of the perimeter areas indicated on the drawings.

All alarm sensors shall be suitable for the areas and locations which they are installed and shall include full anti-tamper facilities. All Alarm Sensors shall conform to ISEN 50131.

The Services Specialist shall note that ceilings are plaster finished in some areas and no access will be available above the ceiling.

Alarms

An audible alarm shall be provided to sound clearly throughout the premises. An external

audible and visual alarm shall be provided as per the drawings. Alarm sounders to suit architectural finishes shall be provided. A false external Bell Box, identical in finish to above, shall be installed (final location to be agreed) as shown on the drawings.

The wiring shall be installed throughout the Building and in its own recessed conduit to doors/windows where required.

All wiring shall be installed by the Services Specialist and shall be installed throughout its entire length, within a completely separate steel conduit system and within the low-Voltage compartment of cable trunking, with all patent glands, brushes etc. where necessary.

Trunking and conduit installations shall be carried out by the Services Specialist. The Services Specialist may consider as an alternative, other wiring systems on the basis of proven experience in this specialised installation work.

An external alarm unit shall be housed in a weatherproof cabinet which shall incorporate battery standby and be fitted with flashing strobe protected by a weatherproof wire cage.

Alarm Panel

The Services Specialist shall allow space for a minimum of 2 no. future detection loops in the intruder alarm panel. The intruder alarm system installation shall be as indicated on the accompanying drawings.

All LEM units shall be mounted in areas out of public view.

The Contractor shall include in its tender for sufficient cabling to locate LEMS.

Indication shall be presented at the local keypad of the status of each local zone.

The system shall be arranged so that all Alarm Bells are sounded and zone indication is given at the Control Panel. The Services Specialist shall be responsible for the correct operation of the system and all components. Should a fault develop on any part of the system within the twelve months maintenance period, the Contractor shall replace the faulty section/component free of charge (no charge to be made for materials, labour and/or expenses.) Should any component in the system have repeated faults/failures, the Contractor shall replace the component with a similar part of a different manufacture, free of charge.

The Services Specialist shall include for the supply and installation of an 8 Channel Digital Communicator located remote to the Intruder Alarm Panel. Upon completion of the system, the Contractor shall submit a Completion and Commissioning Certificate and give a full demonstration of the System. The Contractor shall also allow for the instructing of the Client's Nominee in the operation of the installation and shall obtain the Nominee's Signature stating that he is satisfied with the instructions given.

All tenders must be based on the System outlined in this Specification and indicated on the

Drawings. Alternative systems shall be submitted separately giving full detailed specification the proposals. The contractor shall be deemed to have visited the Site and familiarised himself with the building and service. The Contractor shall include for supplying all necessary permanent mains power supplies to the panel, the digital communicator and all standby power supplies. This work shall be carried out by a qualified electrician. The power supply shall be taken from an un-switched spur outlet with neon indicator. Upon completion of installation the system shall be capable of being programmed for 'Double Knock' operation whereby each space detector acting alone must be activated twice within a fifteen second period before an alarm is registered on the Control. (First single knock pulse count shall be provided). However, in the event of two or more detectors being activated, an alarm condition shall be registered immediately at the Control Panel without any time delay. The Contractor shall include in the Summary of Prices for an Employer's Representative to be present at all alarm call outs during the first four weeks of operation of the system by the Employer. The Contractor shall include in his Tender for 12 Months Maintenance/ Defects Liability Period.

CCTV Installation

General

The Contractor shall supply, install, test and commission the entire CCTV installation as indicated on the drawings and specified herein. The Contractor shall include for all equipment, cabling and containment associated with the CCTV installation on a CAT6 infrastructure in accordance with ISEN 50132. The Contractor shall be a certified NSAI installer or shall appoint a NSAI registered CCTV Specialist to complete the full works. The Services Specialist shall provide a digital video recording system with the components mentioned below and be capable of providing the following functions:

An internal matrix enabling any of up to 16 cameras to be switched to any of the two monitors; multi-user / triplex™ capability which enables live and recorded images to be viewed simultaneously on one monitor while continuing to record. Two independent split screens shall be provided by the Services Specialist. A storage capacity of 5TB shall be provided with a min of 2TB installed. An audio recording capability shall be provided. Jog/shuttle control for variable-speed forward, reverse play and frame-by-frame searches shall be provided. Ethernet connectivity for remote access to live and recorded images shall be provided.

The completed CCTV system will allow the users to print or copy to a CD-recorder without the need of a PC. The ability to search video clips using motion search to find motion in a

user-defined area will be provided. The Services Specialist shall supply two 22" CCTV colour monitor to be located in the DCC room and Admin Office. The Services Specialist shall install and connect both monitors to the CCTV system.

Standards & Regulations

The CCTV installation shall comply with the following standards and regulations:

ISEN 50131-1 "Alarm Systems - Intrusion Systems - Part 1: General Requirements"

ISEN 50132-2-1 "CCTV Surveillance Systems For Use In Security Applications - Black And White Cameras"

ISEN 50132-5 "Alarm Systems - CCTV Surveillance Systems For Use In Security Applications - Part 5: Video Transmission"

ISEN 50132-7 "Alarm Systems - CCTV Surveillance Systems For Use In Security Applications - Application Guidelines"

Wiring and Installation

Cabling of CCTV cameras shall be as indicated in the following table.

Application		Distance	
Indoor	Outdoor	250m	500m
Surface Installation	Trunking, Conduit	CAT6, RG59	RG11, CT125, (CAT6)
PTZ Head	Catenary or Flexible	CAT6, URM70	
	Ducting	CAT6, URM70	RG11, CT125, (CAT6)
	Directly Buried		CT125RBS

Cabling run internally in the building shall be installed in the ELV compartment of the main runs of 3-compartment trunking with the final runs of cabling run in conduit. All external cameras shall have top mounting brackets.

Final selection of camera lenses shall be carried out by the CCTV camera supplier to suit conditions on the site.

The Services Specialist shall supply a Camera dome interface unit to allow integration of the

Dome camera to the CCTV recording system.

Equipment

All equipment shall be as indicated in the Schedule of Equipment and shall generally meet the following requirements:

Internal Dome CCTV Camera Specification.

Colour 2.8 - 11mm Lens

Image Sensor 1/3" HAD CCDII

Resolution:600 TVL (H)

Minimum Scene Illumination 0.15 Lux

S/N Ratio >52dB (Min AGC)

Iris Mode AES only

Electronic Shutter (AES) 1/60s – 1/120,000 sec

Lens 2.8-11mm / F/2 Auto Focus

Horizontal Angle of View 94.4°

Adjustable Viewing Position 120° (Horz) 120° (Vert) 360° (Rot)

White Balance: Automatic

Power Source 12-24 VAC or VDC

Power Consumption 7.80W

Operating Temperature -10° C to 50° C

Humidity 0% to 90% relative, non-condensing

External CCTV Camera

The external CCTV camera shall consist of:

a) Standard CCTV camera to the following specification:

Resolution 650 TV Lines

Sensitivity 0.1 Lux

Effective Pixels (H x V) 500 x 582

Video Output 1V pk to pk composite video via 75 Ohm BNC connector on rear of camera or CAT6

CCIR 625 lines of 50 fields per second, 2:1 interface

S/N Ratio >52dB

AGC Built-in 28dB

BLC Selectable on / off. Weighted to centre third of screen
Gamma Selectable gamma of 0.45 normal or 1.0 linear via dip switch
Sync. System Line lock. Option to switch to internal is provided via dip switch
Adjustable V Phase +/- 120°
Lens Options C/CS Mount
Auto Iris (Vid. Drive) Via 3 way, two part terminal block at rear of camera
Auto Iris (DC Drive) 4 pin square (Chausemen) plug
Operating temperature -10°C ~ +50°C
And an external housing to the following specification:
Housing material: Polycarbonate (no metals allowed)
Heater: 12VDC-24VAC absorption 2.5W max
Blower with thermostat and air filter: 12VDC input absorption 2.5W max
Camera Power Supply Wide range input 100-240VAC output 12VDC, 1A max
Operating temperature -20°C up to +50°C (with heater)
Digital Video Recorder.
16 video input, 5 channel output digital video recorder with a minimum of 2TB harddrive install, internal matrix and as specified above.

Testing and Commissioning

he entire system shall be tested and commissioned in accordance with ISEN 50132.

Lightning Protection Installation

General

The Contractor shall include for the complete, supply installation and testing of the complete lightning protection installation as indicated on the drawings and as specified herein.

The lightning protection system shall be in accordance with the main conductor routes indicated on the Drawings and as set out and described hereinafter.

Standards & regulations

BS 6651 The Protection of Structures Against Lightning.

IS EN 62305 - Protection Against Lightning

Equipment, Wiring and Installation

Air Terminals shall be copper taper-pointed Air Rods of 500mm length and 15mm diameter, complete with flat saddle for support on flat surfaces, or ridge saddle for support on ridges.

The flat and ridge saddle to be complete with a four-way passthrough tape joint and Four No. Fixing Points, 100mm separate and 90° displaced from each other.

Conductive Tape on roof shall be of high-conductivity PVC coated, annealed copper, measuring 25mm wide x 3mm thick. PVC cover shall be provided to all horizontal conductors on Main Roof.

Conductive Tapes shall be fixed to the roof structure and wall structures with nonmetallic clips, suitable for copper tape and complete with screw fixing. Square Tape Clamps for forming straight-through, cross or tee joints shall be provided where required.

Test Connectors shall be provided, as indicated on the Drawings.

Equipment Earthing Points shall be as indicated on the Drawings and shall be manufactured from copper and cast into the concrete structure.

They shall be bonded to the Structural Steel Members which shall be used as the own-conductor, by means of 70sq.mm. bare copper cable, clamped to the steel and 'Cad-Welded' to the earthing point.

Earth Rods shall be molecular bonded 99.99% pure electrolytic copper, with a minimum thickness of 25mm onto a carbon steel core. Rod couplings shall be counter-bored and made from silicone aluminium bronze.

All metal protrusions from the Building and their associated services shall be bonded to the Lightning Protection System.

PVC Wrapping Tape of similar colour as the PVC covered tape shall be wrapped around all joints.

Denso Tape shall be wrapped around all underground tape and joints.

All windows between building corners and down conductors shall be bonded to the down conductors.

Testing & Commissioning

Upon completion of the installation, the whole of each system shall be tested and all results duly recorded.

The Installation shall not be deemed to be complete until a satisfactory Test Certificate is issued.

Door Entry System

General

The Contractor shall include for the supply, installation of the complete door entry system as shown on the drawings and as specified herein.

Standards & Regulations

IS EN 50133.

Wiring and Installation

Wiring for the door entry system shall be in 8 core 1.5 sq.mm LSF/LSF

Equipment

Refer to the schedule of equipment.

Emergency Call System

General

The Contractor shall include for the supply, installation of the complete emergency call system as shown on the drawings and as specified herein.

Wiring and Installation

Wiring for the emergency call system shall be in 8 core 1.5 sq.mm LSF/LSF

Equipment

Refer to the schedule of equipment

MISCELANEOUS ELECTERICAL SERVICES

Earthing and Bonding

General

The Contractor shall supply, install, test and commission the complete earthing and bonding installation as indicated on the drawings and as specified herein. The Contractor shall supply, install, test and commission the complete lightning rotection system in accordance with the drawings and as specified herein.

Wiring and Installation

Dissimilar Metals

Ensure, where dissimilar metals are used for system, that purpose made jointing materials are used such that corrosion and deterioration of the electrical connection are not caused. Ensure bonding connections to other metal parts of building are electrolytically compatible with those metal parts. Use the guidance given in BS 7430 Table 8 when bonding dissimilar materials.

Copper Tape Joints

Provide waterproof protection at joints subject to moisture. Joint copper tapes by brazing, using zinc-free brazing metal with melting point at least 600°C or thermic welding.

Stranded Conductor Joints

Provide waterproof protection at joints subject to moisture. Joint copper stranded conductors with compression joints to IS EN 61284.

Protective Cable Terminations

Where bolted connections are to be used, the Contractor shall use crimp type lugs compressed by automatic tool to achieve the correct pressure and crimp depth. Make connections between tape and equipment using high tensile grade brass bolts with brass nuts, washers and locking devices. Use phosphor bronze bolts, nuts and washers where connections are liable to corrosion.

Earth Electrodes

Location

Locate electrodes not less than 2m distant from building/structure protected, and away from telecommunication and pilot cables and metallic fences.

Driving the Electrodes

Drive rods vertically into ground with purpose designed electric hammer. (Where impenetrable strata encountered at shallow depth, drive at 30° to horizontal). The depth of rod should be 2.4m minimum below finished ground surface. The depth of the electrode heads shall be located just below ground level. Where electrodes are installed in a group ensure minimum distance between electrodes is twice the depth of the rods. The depth of the interconnecting tape or electrode tape shall be 750mm below finished ground level, rising vertically at each electrode. The groups of electrodes to main earth conductor shall be connected via bolted link in the inspection pit as BS 7430 recommends for test purposes.

Materials

Use materials and installations methods for the earthing system in accordance with BS 6651, IS10101, ET101, BS 7430, ESB Requirements as appropriate and those detailed below:

Rod earth electrodes for lightning protection systems conforming to BS 6651 roll threaded rod.

The dimensions of the rod diameter shall be a nominal 15 mm. The rod length shall be 2.4m (2 x 1.2) minimum.

Use silicon bronze alloy or aluminium bronze alloy for the earth electrode couplings, counter bored to completely enclose rod threads. Ensure that the rods meet in the centres of the coupling. Use a high strength driving cap in contact with the driven rod and couplings of a compatible material fully enclosing the rod threads. Interconnect the electrodes using 25 x 3 mm bare copper tape.

Earth Electrodes Drawpits

The Contractor shall provide a concrete cover, permanently labelled, for electrodes installed through cable drawpit bases. The material and size shall of a minimum be based on BS 7430 Table 4. Molecularly bonded copper clad steel rods to BS 7430 or BS 6651 shall be used within the drawpits.

Accessories

The Contractor shall install rod to tape clamps or U-bolt clamps as is necessary for the complete installation of the underground earthing network. The accessories shall be sized to suit the earth rods and connectors. The accessories for earth rod electrodes for system earthing shall conform to BS 7430. Earth rods with female hreads each end shall be used.

Dimensions

The dimensions of the earth rods shall be a nominal rod diameter of 15 mm, with a minimum 2.4m (2 x 1.2) minimum rod length.

Main earth conductor connection

The Contractor shall connect the main earth conductor to the first electrode using heavy duty purpose made, silicon, aluminium, bronze body, conductor clamp and high tensile phosphor bronze bolt.

The material and minimum size shall be as BS 7430 Table 4 fabricated from copper.

Earth Electrode Clamps

The Contractor shall connect tape to electrode head using heavy duty purpose made silicon aluminium bronze body connector clamps or leaded gunmetal body connector clamps, and high tensile phosphor bronze bolts to IS EN 12163.

Earth Electrode Inspection Facilities

The Contractor shall provide an enclosure for each connection between the earth conductor and the associated earth electrode system. The Contractor shall install so that the top of the electrode is flush with the finished ground or floor level. Ensure enclosure provides adequate access for testing purposes. Provide pit details for builders work.

The earth electrode inspection facilities shall be labelled with the wording 'earth'.

Main Equipotential Bonds

The Contractor shall provide main equipotential bonds in accordance with BS 7430 and ET101. The material used for this equipotential bonding shall be single core insulated cable to BS 6004. There shall be no joints in the main equipotential bonds.

Supplementary Equipotential Bonds

The Contractor shall provide supplementary equipotential bonds to BS 7430 and ET101. Joints are not allowed in these bonds. The material used for this equipotential bonding shall be single core insulated cable to BS 6004.

Circuit Protective Conductors

The Contractor shall provide insulated cable of a single core to BS 6004 as indicated on drawings and in documents for the circuit protective conductors. These CPC's shall take the form of metallic screwed conduits (excluding flexible); metallic trunking with tinned copper links; armouring and/or metallic sheathing of armoured cables or integral conductor of multi-core cable. The size of the CPC's shall be as stated in the documents, as shown on the drawings and sized in accordance with IS10101 and ET101.

Earthing Clamps

The Contractor shall use clamps complying with BS 951, for bonding pipes and lead sheathed cables.

Earth Busbars

The Contractor shall provide earth busbars manufactured from hard drawn, tinned, high conductivity copper bar.

Substation Earth busbar

The substation earth busbar shall be a minimum of 75 x 13mm cross section 600mm minimum length and shall be in accordance with ESB requirements.

Main Earth Terminal busbar

The main earth terminal busbar shall be a minimum of 25 x 6 mm for incoming live conductor not exceeding 50mm and a minimum of 50 x 6 mm for incoming live conductor over 50mm².

Test Links

The Contractor shall provide two test links, in connections between main earth conductors and earth busbar. The Contractor shall fabricate each from two additional sections of earth busbar. Mount one section on stand-off insulators matching earth busbar and use the remaining section as removable test link. Secure the 12mm high tensile brass studs to fixed sections of the busbar and drill the corresponding clearance holes in the test links and provide

brass washers, nuts and locking devices to secure the frame/neutral earthing and the test links.

Lugs/Tags

The Contractor shall provide lugs or tags to enable connection of the bonding conductors to the equipment earth terminals.

Protective Cable Terminations

For bolted connections the Contractor shall provide crimp type lugs compressed by automatic tools to achieve correct pressure and crimp depth.

Protective Conductor Warning Notices/Labels

The Contractor shall provide a permanent label durably marked in letters 4.75mm minimum height "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE", in visible position, at each bonding conductor connection to extraneous conductive parts.

Main Earth Conductor

The Contractor shall provide green/yellow PVC warning tapes labelled "EARTHING CONDUCTOR" over the complete external lengths of main earth conductors at 300mm depth below finished ground.

Earth Bar Label

Label the earth bar "SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE" with wall mounted laminated plastic tablet engraved in 10mm high red letters on white background.

Surge Protection

General

The Contractor shall supply, install, test and commission the surge protection installation as indicated on the drawings and as specified herein.

Equipment

The surge protection equipment is listed in the Schedule of Equipment.

Identification and Labelling

Labels and Notices Apply identification labels and notices in accordance with IS10101

ET101 to all electrical cables plant and equipment including components of mechanical systems.

Identification of protective devices

The Contractor shall provide diagrams, charts and tables to comply with IS 10101 regulations. Warning notices, for voltages in excess of 250 volts shall be provided. Periodic inspection and test notices, residual current device notices, earth electrode safety electrical connection label, bonding conductor connector point to extraneous conductive parts label, earth free local equipotential bonding areas warning notice, electrical separation areas warning notice and outdoor equipment socket outlet notices shall all be supplied and installed on the above services by the Contractor.

Labels and Notices Materials

The Contractor shall use materials for labels and notices with a predicted life equal to or greater than the design life of the electrical cables, plant, equipment or installation to which it refers. Externally the labels/notices shall be sign written, or stencil in paint compatible with the surface. The colour of the background shall be the plant standard finish and the lettering shall be white. Internally the labels/notices shall be engraved thermosetting plastic laminate with a white or red background with the lettering the opposite colour of the background, i.e. white background, red lettering and vice versa.

Fixing

The fixing of all labels and notices shall be achieved using materials compatible with label or notice and surface to which it is fixed. This shall generally be by screws into a tapped hole or bolted complete with washer nut and locking device.

Arrangement

The Contractor shall obtain approval prior to the manufacture, with regard to the style, colour, lettering, size and position of all labels and notices. The Contractor shall provide a sample showing the style, colour, lettering and size, for approval.

Lettering and Size of Labels and Notices

The Contractor shall ensure that all lettering and symbols comply with the requirements laid out in ET101 and BS 5499. Use BS 5499-1 for height of lettering where not otherwise indicated. Ensure the labels and notices are of adequate size for the lettering required, and allow a minimum margin around all lettering of one line space vertically and two letter

spacing horizontally. The font shall be helvetica of medium size. Size - BS 5499-1 or 5mm minimum high letters.

Conductor Arrangement

Arrange circuit polarity so that phases read in phase rotation order followed by the neutral, if any, from top to bottom in horizontal conductor layouts and left to right in vertical conductor layouts. Ensure the flat horizontal arrays have leading phase to the left and neutral to the right from left to right when viewed from supply point. Arrange the phase or live pole of two wire apparatus at top or left hand and neutral and earth both at bottom or right hand side. In all cases, ensure the conductor arrangements defined are when viewed from front face of all equipment and terminating facilities. Apply identification markers in accordance with IS10101 and ET101 to all conductor termination points.

Graphical Symbols for Use on Equipment in Accordance with IS EN 80416

Graphical symbols for use on equipment are to be created and applied in accordance with IS EN 80416-1, IS EN 80416-2, IS EN 80416-3.

Equipment Signs and Labels

Safety Signs

The Contractor shall label all electrical plant and equipment using safety sign 8.A.0044 of BS 5499-5 where voltages above ELV exist. The Contractor shall provide with each safety sign 8.A.0044 supplementary or text signs complying with BS 5499-5

Label all electrical plant and equipment with the labels specified in the appropriate British Standards for that plant or equipment. Identify each substation and main switchroom with safety sign 8.A.0044 to BS 5499-5 with supplementary signs, notices and signs required by BS 5499-5 for any fire extinguishing system and notice giving details of:

Name of the Substation or switchroom.

The presence of Medium and Low Voltages.

Administrative instructions for access.

Location and method of contacting controlling authority.

Actions to be taken in an emergency.

Plant and Equipment Labels

Fit labels on all items of plant, equipment, switches, etc., include the following information:

service controlled, circuit reference, voltage, type of supply and phase etc., circuit protection type and rating.

Maintenance Notices

Fix notices giving warning of and instructions on, any special maintenance procedures to plant and equipment.

Colour Corrected Light Fittings

Fix a warning or identification disc to light fittings containing colour corrected fluorescent tubes or other colour corrected light sources to ensure that maintenance staff install the correct lamps.

Engraved Accessory Plates

Engrave switchplates, spur units, pushes and special plates for bed head units, call systems, fire alarms, etc. Use 6mm high letters with engraving coloured red.

Switchgear

Fit labels on switchgear as required by ET101 and IS EN 60439 to indicate duty of unit, its voltage, phase and current rating, protective device rating size of conductor involved, and all other necessary details.

Use an agreed serial coding system, provide at the switch a key to the coding system.

Distribution Boards

On each distribution board identify every outgoing way with a laminated circuit chart in a permanently fitted inside the distribution board cover. Clearly indicate in typed script, circuit identification number, cable size, miniature circuit breaker rating and a description of item supplied and area supplied by circuit.

Schematic Diagrams

The Contractor shall provide purpose made schematic diagrams permanently fixed showing the connections of the equipment and the plant.

The location and materials shall be as indicated in contract preliminaries.

Special Purpose Earthing

Fit labels to special purpose earthing conductors and connection points, describing their

purposes and any instructions necessary for their operation and maintenance.

Indicator Lamps and Push Buttons for Power Systems

Use indicator lamp and push button colours in accordance with IS EN 60073. Indicator lamps shall have three different colours denoting the following stages of alarm: Red, danger or alarm; yellow, caution; green, safety.