

Part B-Work Requirements

9.0: Specifications

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9.1 MATERIALS AND WORKMANSHIP PREAMBLES

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MATERIALS AND WORKMANSHIP PREAMBLES

GENERALLY

Weights and Measures

- A Weights and measures referred to in this document are those normally in use in Montserrat.

Calculation of Quantities

- B All work, unless otherwise described, has been measured nett as fixed in position and the Contractor shall allow in his prices for waste, laps, etc. The quantities given are therefore not to be used for the ordering of materials.

Dimensions

- C Figured dimensions on drawings shall be followed in preference to scaled dimensions and large scale drawings in preference to small.

Manufacturer's Recommendations

- D All branded materials shall be used strictly in accordance with the manufacturer's recommendations or instructions unless otherwise instructed by the Architect. Should the Contractor obtain from the Architect recommendations or instructions varying from the manufacturer's, he shall notify the Architect in writing and obtain his written approval before proceeding with the work. The Contractor shall be responsible for obtaining from manufacturers all relevant details regarding the use of their products and shall allow for all costs in connection therewith.

Where a manufacturer's name or the proprietary name of an article appears in this document, it is given as an indication to tendering contractors of the standard and description required and contractors may quote for any manufacturer's article, provided it is of the standard and description specified and approved by the Architect in writing prior to the submission of the tender.

Protection

- E Where an item is measured for protection, the Contractor is to include for all labour and materials necessary to protect finished work for which payment has been made in interim certificates from damage of any kind. Where the Architect considers that insufficient protective measures are being taken, the Contractor will be instructed to upgrade the level of protection. The issue of such an instruction will not constitute a variation requiring adjustment of the Contract Sum since the Contractor is assumed to have included in his tender amount for providing sufficient protection.

Testing of Materials

- F Where the Contractor is required to carry out tests on materials he is to include within his prices for those items, for the cost of testing together with the cost of delivery, fees payable, preparation of reports, plant and consumable goods.

GENERALLY (Cont'd)Materials not incorporated in the completed Works

- A Materials which are not to be incorporated into the completed building, for example: formwork materials, will be treated as plant and equipment and will not be paid for in interim certificates as materials on site.

Materials and Workmanship

- B Materials and workmanship shall be of the best quality and executed in accordance with proper working practices conforming to the relevant British Standards and Codes of Practice referred to in these Preambles. The works shall be carried out in accordance with the drawings and specifications and the quality and standard of materials and workmanship shall be to the reasonable satisfaction of the Architect.

Accuracy in building shall be in accordance with the permissible values as set out in BS 5606.

Setting out the Works

- C The Contractor shall diligently and accurately set out the works in conformity with the contents of BS 5964.

EXCAVATIONS AND EARTHWORKS

GENERAL

- A The Contractor is referred to the Civil and Structural Specification which is embodied within these preambles for items referring to Excavations and Earthworks.

Definitions

Nature of Ground

- B The Contractor shall be deemed to have inspected the site and examined the soils report to determine the nature of and difficulties which might be encountered during the excavations. No assurance is given that the soils report is typical of conditions over the area of excavation and he must make whatever investigations as he considers necessary to determine to his own satisfaction the nature of excavations to be carried out. Prices for excavations shall include for excavating in all types of material except rock.

Normal Water Level

- C If excavations are to be carried out below the normal water table, the level shall be measured and agreed with the Quantity Surveyor prior to pumping operations being commenced.

Termite Treatment

- D Subterranean termite treatment of the site of the building shall be with one of the following toxicants as an emulsion in water at the minimum concentrations listed:

Termidor SC - 0.125% finished solution

Toxicant emulsions shall be applied by spray immediately before pouring of concrete at the rate of 4.5 litres per square metre of surface area of excavations and 9 litres per square metre, on filling and sand beds, etc.

Treatment shall not be carried out when rain is falling or when ground is excessively wet.

A warranty of at least 5 years is required against infestation by subterranean termites, during which period the Contractor shall carry out any remedial work free of charge.

EXCAVATIONS & EARTHWORKS (Cont'd)Rock

- A Rock is defined as any material to be excavated which requires for its removal the use of wedges and levers, compressed air jack hammers or explosives. Prices for excavation are to include for any other material than that defined herein.
- B Both the Engineer and the Quantity Surveyor are to be informed before any excavation in rock is commenced.

BS and CP References

- | | | |
|---|---------|--------------|
| C | BS 6031 | Earthworks |
| | BS 3882 | Top soil |
| | CP 2004 | Excavations. |

CONCRETE WORK

General

- A The Contractor is referred to the Civil and Structural Specification which is embodied within these preambles for items referring to concrete works.

Responsibility

- B No approval or acceptance by the Architect or his representative shall in any way relieve the Contractor of his responsibility for the quality of materials and the standard of workmanship in the finished works and for the strength and durability of the finished concrete works.

Cements

- C The cement shall be Portland cement complying with BS 12.

All cement shall be delivered in the original sealed containers of the manufacturer. No rebagged cement will be permitted to be brought on to the site.

On no account shall a change in the type or source of supply be permitted during the course of construction and every endeavour shall be made to ensure that the colour of the cement is constant throughout the contract.

Labour

- D The Contractor shall employ sufficient skilled and unskilled workers under trained and experienced supervision to ensure that degree of skill necessary to produce the quality of workmanship demanded.

Finished work to Concrete Faces

General

- E After removal of the formwork, no treatment of any kind other than that required for curing the concrete shall be applied to the concrete faces until they have been inspected by the Architect's and Engineer's representatives.

Exposed Concrete Faces

- F Unless otherwise specified, all concrete faces to be exposed in the finished works shall be left as struck.

After inspection, all superfluous fins and similar projections shall be carefully removed.
No render or other applied finish shall be used to obtain a fair face to the concrete.

CONCRETE WORK (Cont'd)Water Stops

- A Water stops shall be ADCOR ES which is a swellable, conformable synthetic water stop.
- B The water stop is supplied in rolls 1" x ½" 16 feet long and secured in place using ADCOR ES adhesive.

Concrete surfaces must be clean and free from all contaminants, debris and loose concrete prior to the application of the adhesive.

Defective Work

- C Where in the opinion of the Architect or Engineer any of the finished works or the materials or workmanship in any part of the works, does not comply with all the relevant requirements of this specification that part of the works shall be classed as defective work.

All work classed as defective work shall be cut out and removed from the works and replaced to the satisfaction of the Architect and the Engineer.

The extent of the work to be removed and the methods to be used in the removal and replacement of this work shall be in accordance with the Architect's and Engineer's directions. In all cases cutting out of defective concrete work shall be carried back to a satisfactory construction joint before the replacement of defective work and any other work thereby affected is commenced.

Concrete Prices

- D Prices for concrete shall include for placing in position, vibrating and curing and forming all necessary construction joints. Prices for concrete cast in earth or rock cuts shall include for any additional concrete over the size stated necessitated by the irregularity of the surfaces retaining concrete.

Formwork Prices

- E Include in the price for formwork for all cleaning and oiling of forms. F

BS and CP References

BS	12	Portland Cement
BS	882) Aggregates
BS	1198 - 1201)
BS	5328	Ready mixed
BS	3148	Test for water

9.0 Specifications

CONCRETE WORK (Cont'd)

BS	4027		Sulphate resisting Portland
BS	4466		Bending dimensions of bars
BS	4449)	Steel bars
BS	4461)	
BS	4482 - 3		Steel fabric
BS	4429 (Part 2)		Metric sizes of bars
BS	340		Kerbs
BS	368		Paving slabs
BS	1239		Lintels
BS	1881		Concrete test cubes
BS	5642		Coping units
BS	4374		Sills
CP	101		Foundations
CP	102		Protection from ground water
CP	111		Structural recommendations
CP	114		Reinforced concrete for walls
CP	114.100)	Suspended concrete floors
CP	114.105)	roofs and staircases
CP	116		Structural use of precast concrete
CP	117		Composite construction in structural steel concrete

A Barbados National Standards Institute

BNS 69 Portland Cement

Protection

- B Protection of finished work is clearly imperative at all times and the Architect reserves the right to condemn previously accepted work if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that the Contractor has included elsewhere in the Bills of Quantities for these costs.

BLOCKWORKGeneral

- A The Contractor is referred to the civil and structural specification which is embodied within these preambles for items referring to Blockwork.

BS and CP References

B	BS 12	Portland Cement
	BS 890	Limes
	BS 1198-1200	Sand
	BS 882	Aggregate
	BS 743	Damp proof courses
	BS 5628	Structural use of masonry
	BS 4887	Mortar plasticisers
	CP 101	Foundations
	CP 012	Protection from ground
	CP 111	Structural recommendations
	CP 121	Block walling

Barbados National Standards Institution

C	BNS 69	Portland cement
	BNS 38	Hollow concrete blocks

Protection

- D Protection of finished work is clearly imperative at all times and the Architect reserves the right to condemn work previously accepted if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all finished work and where no price is included against this item, it will be assumed that the Contractor has included elsewhere in the Bills for these costs.

ROOFING

- A The water proofing of the concrete flat roofs shall be undertaken using Aquafin-1K which is a polymer modified cement waterproofing compound, colour: white.
- B Mixing of the product must be done in strict adherence to the manufacturer's instructions.
- C Aquafin-1K must not be applied when the ambient temperature exceeds 86°F (30°C), thus the product ought to be applied early morning or late evening.
- D The substrate must be prepared as follows:
1. Remove remaining concrete fins and projections and general surface dirt.
 2. Remove grease, oil and other contaminants. Use high pressure water blasting or other methods recommended by the manufacturer to clean the surface of the concrete.
 3. Follow the manufacturer's instructions to clean and prepare surfaces.
 4. Repair cracks, honeycombs and the like.
- E Rinse the concrete surface several times so that the concrete is thoroughly saturated, surfaces must be moist not wet when the waterproofing is applied.
- F Mix the Aquafin in the proportions recommended by the manufacturers.
- G Apply the Aquafin in quantities as per the manufacturer's specifications and recommendations.
- H Protect the finished surface with polyethylene sheeting in order to prevent premature drying out.
- I Moisture cure the finished work in accordance with the manufacturer's instructions.

ROOFING (Cont'd)Protection

- A Protection of finished work is clearly imperative at all times and the Architect reserves the right to condemn previously accepted work if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that the Contractor has included elsewhere in the Bills of Quantities for these costs.

CARPENTRY AND JOINERYTimber Generally

- A Timber shall be sound with reasonably straight grain and at least 85% heartwood, free from large shakes, waney edges splits, loose or dead knots, worm, rot, fungus, decay or infestation.

Pitch Pine

- B Pitch pine shall be best imported quality of mature growth, free from gross defects, well seasoned and having a minimum density of 673 Kgs/m³ and an average equilibrium moisture content of 10 per cent in accordance with BS 1186 Part 1.

Hardwood

- C Purple heart, mahogany and green heart shall be the best quality available and must be free from gross defects. The Contractor must exercise care in selecting this timber and shall notify the Architect and obtain his written approval of the type and sources of the hardwoods he proposes to use.

Treated Timber

- D Treat softwood against termite attack and decay damage by wolmanising or similar pressure/vacuum impregnation with an approved preservative in order to obtain a minimum net chemical retention of 8.01 Kgs/m³ of timber in accordance with the manufacturer's instructions and thereafter either air dry or kiln dry all timber to the satisfaction of the Architect. Provide a certificate of treatment from the timber suppliers if requested by the Architect.

Where cross cutting or boring of treated timber is unavoidable, liberally swab or dip treat all exposed faces with an approved preservative. Where timber is described as having a natural oiled or varnished finish, an approved clear preservative shall be site applied to the approval of the Architect.

Wood preservation is to be in accordance with BS 4072.

Plywood

- E Plywood shall conform to BS 6566 and marine plywood shall conform to BS 1088.

Where plywood is to have a natural or varnished finish, Grade 1 shall be used.

Where plywood is to be painted, Grade 2 may be used.

Tolerances

- A All structural timbers shall be sawn timbers to the section given on the drawings. Permissible tolerance on cross section dimensions will be + 6mm and - 3mm with no allowance for wane.

Exposed Faces

- B Timber which is to be exposed in the finished work shall be 'dressed' unless otherwise described. The term 'dressed' where used in this document shall mean the hand selection of timber members and site preparation by means of planer and/or belt sander.

NB: Where the term 'nominal size' is used in this document, it shall mean the sawn size and where timbers are to be wrought or dressed 3mm shall be allowed from the nominal size for each wrought face or edge.

Plastic Laminate

- C Plastic laminate shall be 2mm 'Formica', 'Arborite' or equal and approved and comply with the BS 3794 and be bonded to plywood or timber backing with synthetic resin adhesive to BS 1204 strictly in accordance with the manufacturer's printed instructions.

Solid Surfacing

- D Solid surfacing shall be 12mm thick Wilsonart Gibraltar or 3mm Wilsonart SSV fixed to 12mm thick chipboard backing.

Joinery Work

- E All joinery work shall be carried out in accordance with BS 1186, Part 1 & 2.

Carpentry Work

- F All carpentry work shall be carried out in accordance with CP 112.

Natural Finish

- G When natural finish or finish for staining, clear polish or varnishing is specified, the timber in adjacent pieces shall be selected and matched to be uniform and symmetrical in colour and grain.

Fixings

- A All fixings, plates, shoes or straps shown on the drawings shall be neatly formed out of mild steel plate drilled and welded as necessary. Prior to erection, all mild steel components shall be wire brushed and primed with one coat of red zinc chromate primer. All surfaces in contact with wood shall be painted a further two coats of bituminous paint. All fixing accessories shall conform to BS 1494.

Ironmongery

- B Provide samples of all ironmongery for selection by the Architect without charge.

Carefully wrap and protect all ironmongery until completion of the work and replace any which may be defaced or damaged without charge as the Architect shall direct. Oil all locks and adjust and leave in perfect working order on completion and properly label all keys and deliver up in accordance with the Architect's instructions.

Fix all ironmongery with screws of the same metal and finish as the fitting themselves. Remove and replace with new ones all screws damaged when driven by the turnscrew or from any other cause.

Remove all ironmongery when painting or carrying out other works likely to damage the fittings and replace on completion.

Door Frames and Doors

- C Door frames shall be constructed to conform with BS 1567 and BS 4748 Part 1, and where frames are to be painted, shall be primed on all faces prior to fixing.

Doors shall be constructed in the joinery shops of the Contractor or by a specialist joinery manufacturer and not upon the site. Timber for use in doors shall be specially selected for straightness and freedom from faults, tenoned, glued and wedged or pinned together.

Furnish the owner with an extended guarantee to warrant wood framed doors solid core flush wood doors against warping, twisting, core ghosting, swelling, sagging, splitting and delamination for a period of three (3) years from the date of the certificate of Practical completion of the work.

External Doors

- D External doors shall conform to BS 459 and BS 4787. Framing shall comprise 100mm wide stiles top and bottom rails, securely tenoned and glued together having intermediate rails filling 60% of the core void. Plywood facings shall be in accordance with BS 1186 and 4mm thick. Facings shall be glued to framing with Type WPB glue to BS 1204.

Internal Doors

- A Internal doors shall conform to BS 459 and BS 4787. Framing shall comprise 100mm wide stiles, top and bottom rails securely tenoned and glued together having intermediate rails filling 40% of the core void. Plywood facings shall be in accordance with BS 1186 and 4mm thick. Facings shall be glued to framing with Type MR glue to BS 1204.

Window Frames and Windows

- B Windows shall be constructed to conform with BS 644 and where frames are to be painted, shall be primed on all faces prior to fixing.

Windows shall be constructed in the joinery shops of the Contractor or by a specialist joinery manufacturer and not upon the site. Timber for use in doors shall be specially selected for manufacturer and not upon the site. Timber for use in doors shall be specially selected for straightness and freedom from faults, tenoned, glued and wedged or pinned together.

Furnish the owner with an extended guarantee to warrant window frames and windows warping, twisting, core ghosting, swelling, sagging, splitting and delamination for a period of three (3) years from the date of the certificate of Practical Completion of the work.

Storage of Materials

- C Materials shall be protected from the weather during transit to the site and shall be stored clear of the ground in a clean, dry, ventilated enclosed structure.

Where timber for carpentry and joinery work is incorporated into the works, the Contractor is to ensure that adequate protection is provided to prevent staining or damage caused by inclement weather or other causes.

Include in prices for timber selected for staining and varnishing or other clear finish for secret fixing. Where required and where timber is polished, include for fixing with brass screws let in and pelltated.

BS and CP References

A	BS 1202	Nails
	BS 1494	Fixing accessories
	BS 1579	Connectors for timber
	BS 1860	Strength of structural softwood
	BS 4174	Drive screws
	BS 1297	Softwood flooring
	BS 4471 Part 1	Softwood
	BS 4471 " 2	Wood battens
	BS 1186 Parts 1 & 2	Quality of timber in joinery
	BS 1210	Wood screws
	BS 1455	Plywood
	BS 1088	Plywood, marine
	BS 3493	Information about plywood
	BS 3842	Preservatives for plywood
	BS 584	Wood trim
	BS 644	Windows
	BS 4787 :459	Doors
	BS 1567	Door frames and linings
	BS 5212	One part gun grade polysulphide based
	BS 585	Stairs
	BS 1195	Kitchen fitments
	BS 1292	Storage fitments
	BS 5756	Tropical hardwood
	BS 6375	Performance of windows
	BS 4190	Isometric black bolts, screws and nuts
	BS 4072	Wood preservation
	CP 98	Preservative treatments
	CP 112	Structural use of timber
	CP 201 Part 1	Wood flooring
	CP 151 " 2	Doors, windows and frames.

Generally

- B The work is to be framed as soon as possible after the Contract is signed and it is to be kept in a dry place under cover and arranged so that a current of air can freely circulate around it but must not be wedged up until required for fixing. Should any joints give or open in the least before the maintenance period has expired, such defective joinery is to be taken down, refitted and redecorated or replaced by new joinery as the case may be and all work disturbed made good at the Contractor's expenses.

Construction

- A The Contractor shall be responsible for sound construction of components using recognised forms of joints in appropriate positions where these are not specified. Joints shall be in accordance with BS 1186 Part 2. In framed work all joints shall be mortice and tenon, wedged and glued where required. Faces of members jointed shall be flush with one another when intended to be so.
- B Exposed timber shall be secret nailed wherever possible. Where it is not possible to secrete nail, nails shall be punched below the surface and the depression filled flush with putty and sanded off.

Carpentry Generally

- C The whole of the carpentry work is to be framed, fixed and executed in the best and most workmanlike manner. Joints shall be so placed that knots do not occur in tension zones.

The word 'framed' is to be understood as including all the best methods of jointing woodwork together by mortice and tenon, dovetail or other method.

In addition, the quality of workmanship for structural timber shall be not less than that recommended in CP 112 Part 5, as modified by any specific requirements given in this Specification.

Joinery Generally

- D The quality of workmanship shall be not less than that set out in BS 1186 Part 2, as modified by any specific requirements given in this Specification.

Nails, sprigs, etc., shall be punched below the surface; holes shall be stopped with putty or other equal and approved filler specially selected to match colour and texture of timbers which are to be polished, etc.

Screws (other than brass screws with cups) shall be countersunk head wood screws driven to 38mm below the surface. Screw heads in work for painting shall be stopped in putty or other equal and approved filler before any trace of rust appears; all rusted screws shall be replaced before painting. Screw heads in work described as flush pelltated shall be let in at least 6mm below the surface and pelltated in grain with matching hardwood glued in.

Cross tongued joints shall be glued.

All joinery that is to be painted shall be knotted and primed with the primer before being fixed. This applies particularly to the 'covered up' or 'hidden' parts of joinery work. All external joinery work shall be put together in a thick mixture of red or white lead and linseed oil or waterproof adhesive. The arrangement, jointing and fixing of all joinery works shall be such that shrinkage in any part and in any direction shall be compensated in the joints and shall not impair the strength and appearance of the finished work and shall not cause damage to contiguous materials or structures.

Framed Joinery

- A Joinery work described as 'framed' shall be jointed using mortice and tenon, combed or dovetail joints only.

Construct joinery exactly as shown on the Architect's details. Where joints are not specifically indicated they shall be the recognised forms of joints for each position.

Surface Finish on Joinery

- B The surface finish on joinery shall be such that if properly finished with a gloss paint, imperfections in manufacture will not be apparent.

Double Tenons

- C Lock rails shall have double tenons.

Cutting back Tenons

- D Tenons in the edges of door stiles to receive clear finish shall be cut back 1/4" and made good with matching wood.

Door Frames and Linings

- E Door frames and linings shall be constructed in accordance with BS 1567 and BS 459 Part 3, except that profiles and sizes of individual members shall be as detailed.

Priming before Fixing

- F Priming of (or first coat of clear treatment on) joinery before fixing has been specified in the painting section but rates for joinery shall include for priming, lacquering or varnishing (as appropriate) any surface exposed by cutting and fitting.

Tolerances

- A All structural timber shall be sawn timbers to the sections given on the drawings. Permissible tolerances on cross- section dimensions will be plus 6mm and minus 3mm with no allowance for wane.

Provide reasonable tolerance at all connections between joinery work and the building carcass so that any irregularities, settlements or other movements shall be adequately compensated for.

Shrinkage

- B Arrange, joint and fix all joinery work in such a manner that shrinkage in any part and in any direction shall not impair the strength and appearance of the finished work and shall not cause damage to adjoining material or structure.

Fixing to Blockwork or Concrete

- C Where timber is described as plugged or fixed to blockwork or concrete it shall include for cutting holes as required and for supplying and fixing wooden plugs treated with termite fluid. Alternatively, plugs may be 'Rawlplug' or other approved proprietary make. The use of any approved system of fixing to blockwork or concrete with special nails, screws or bolts, inserted with spring cartridges or power tools will be permitted in lieu of plugging.

Protection

- D Protection of finished work is clearly imperative at all times and the Architect reserves the right the condemn work previously accepted if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that the Contractor has included it elsewhere in the Bills for these costs.

METALWORKGeneral

- A Mild steel plates, bars, sections, tubes, etc., shall conform to BS4360.

The surface of steel shall be smooth, clean and free from rust. Loose rust and scale shall be removed from the steel prior to despatch from the works, and any subsequent accumulation of dirt, oil or grease shall be cleaned off immediately prior to erection.

Welding

- B Weld by an approved method using suitably qualified operatives to give ductility and tensile strength comparable with that of the metal joined.

Grind all soldered or welded joints, seams, etc., to a smooth finish, remove all rough edges and leave the whole perfect to the satisfaction of the Architect.

Forged Work

- C Clean all forged work and put together in the best and most workmanlike manner, drill all holes and clear off burrs and ensure that all counter-sinkings are concentric and threads and tappings are accurately fitted.

Bolts

- D All bolts unless otherwise described shall be BS Whitworth black bolts with hexagonal heads and nuts and round washers. Use splayed washers where necessary to effect tight joints.

Fixing

- E Form all mortices, chases, etc. and securely anchor to the structure all metalwork and make good the surfaces to which they are fixed.

Leave Clean

- F Clean all exposed metal surfaces on completion with water or an approved petroleum product such as methylated spirit or kerosene. Make good any damage caused by the use of an improper cleaning material. Painting of metal work is described in the Painting and Decorating Section of these Preambles.

METAL WORK
Aluminium Windows

A Definitions

- A. Performance grade, AAMA “HC-Heavy duty commercial”.
- B. Structural test pressure, for uniform load structural test: 150 per cent of design pressure.

B Performance Requirements

- A. Structural Requirements: The work as erected shall meet or exceed the windload requirements indicated in the CPP, Inc. wind tunnel test analysis report.
- B. Seismic Requirements: The work as erected shall meet or exceed all seismic requirements.
- C. Air and Water Infiltration: Design and Install the windows for permanent resistance to air and water leakage through the system in accordance with the following:
 - 1. Air Infiltration: Air leakage through the panel system shall not exceed 0.248 cubic metres per minute per square metre of fixed wall area when tested in accordance with ASTM E 283 at a positive and negative test pressure differential of 300 PA.
 - 2. Water Penetration: Water penetration shall be defined as uncontrolled water, on the interior face of any part of the work, which is not drained to the exterior, or damages insulation or finishes before draining to the exterior.
 - a. No uncontrolled water penetration when tested in accordance with ASTM E 331 at a pressure differential of 59kg/m². Mock-up shall first be subject to a positive and negative pressure differential equal to 50% of the full positive and negative design loads for a period of 10 seconds.
 - b. No uncontrolled water infiltration when tested in accordance with AAMA 501.1, using a dynamic pressure of 74kg/m².
- D. Structural Performance: Provide frames and glazing capable of withstanding design wind loads indicated under in-service conditions with deflection no greater than the following, based on testing manufacturer’s standard units according to ASTM E 330 by a qualified independent testing and inspecting agency.

- (a) Maximum Deflection: 1/240 of the span.

A Submittals

- A. Product data for each type of window required, including:
 - 1. Construction details and fabrication methods.
 - 2. Data on hardware, accessories, and finishes.
- B. Shop drawings for each type of window required. Include information not fully detailed in manufacturer's standard product data and the following:
 - 1. Layout and installation details, including anchors and flashings.
 - 2. Elevations at 1/4-inch (6.35mm) scale and typical window unit elevations at 3/4-inch scale.
 - 3. Full-size section details of typical composite members and mullions including reinforcement and stiffeners.
 - 4. Hardware including operators.
 - 5. Glazing details.
 - 6. Accessories.
 - 7. Window cleaning bolts/anchors.
- C. Samples for Color Verification: Submit samples of each specified finish on 12 inch (305mm) long sections of window members.
- D. Additional Samples: The Architect reserves the right to require additional samples, that show fabrication techniques and workmanship, and design of window and accessories.
- E. Certification: Provide certification by a recognized independent testing laboratory or agency showing that each type and size of window unit complies with performance requirements indicated.

B Quality Assurance

- A. Installer Qualifications: Engage an experienced Installer who has completed installation of aluminium windows similar in design and extent to those required for the project and which has resulted in construction with a record of successful in-service performance, and is certified in writing by the window manufacturer.
- B. Single-Source Responsibility: Provide aluminium window units from one source and produced by a single manufacturer.
- C. Design Concept: The drawings indicate the size, profiles, and dimensional requirements of the aluminium window types required and are based on the specific manufacturer, type and model indicated. Aluminium windows by other referenced manufacturers may be considered provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect.

A Test Results Required

- a. Preload.
- b. Air infiltration static method.
- c. Water penetration static method.
- d. Water penetration dynamic method. e. Uniform load deflection test.
- f. Air infiltration static method.
- g. Water penetration static method.
- h. Water penetration dynamic method.
- i. Structural test at 1.5 times the design load. j. Seismic Displacement test.

In the event of a test failure the manufacturer shall repair, design and retest the specimen as necessary at no additional cost to the Owner.

B Project Conditions

- A. Field Measurements: Check actual window openings by accurate field measurement before fabrication. Show recorded measurements on final shop drawings. Co-ordinate fabrication schedule with construction progress to avoid delay of work.
 - 1. Where necessary, proceed with fabrication without field measurements and coordinate fabrication tolerances to ensure proper fit of window units.

C Warranty

- A. Aluminium Window Warranty: Submit a written warranty, executed by the window manufacturer, agreeing to repair or replace window units that fail in materials or workmanship within 5 years after the date of Substantial Completion. Failures include but are not necessarily limited to:
 - 1. Water leakage, air infiltration, or condensation.
 - 2. Structural failures including excessive deflection.
 - 3. Failure to meet performance requirements.
 - 4. Faulty operation of sash and hardware.
 - 5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - a. Warranty period for finishes 20 years.
- B. The warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and is in

addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

A Products

- A. Aluminium Extrusions: Provide alloy and temper recommended by the window manufacturer for the strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength and not less than 0.125 inch (3.18mm) for sill members and 0.062 inch (1.59mm) thick for other frame members.
- B. Fasteners: Provide aluminium, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by the manufacturer to be noncorrosive and compatible with window members, trim, hardware, anchors, and other components of window units.
 - 1. Reinforcement: Where fasteners screw-anchor into aluminium less than 0.125 inch (3.18mm) thick, reinforce the interior with aluminium or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive, pressed-in, splined grommet nuts.
 - 2. Exposed Fasteners: Do not use exposed fasteners except where unavoidable for application of hardware. For application of hardware, use fasteners that match the finish of the member of hardware being fastened, as appropriate.
- C. Anchors, Clips, and Window Accessories: Depending on strength and corrosion-inhibiting requirements, fabricate anchors, clips, and window accessories of aluminium or nonmagnetic stainless steel. Anchors, clips, and window accessories fabricated of zinc-coated steel or iron complying with ASTM B 633 may be used for concealed work.
- D. Compression-Type Weatherstripping: Provide compressible molded expanded EPDM or neoprene weatherstripping gaskets complying with ASTM C 509.
- E. Sealant: For sealants required within fabricated window units, provide type recommended by the window manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating. Unless otherwise indicated.

B. Fabrication

- A. Fabricate aluminium window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.
 - 1. Comply with AAMA 101/1.S.2, HC
 - 2. Provide units that are reglazable from the inside without dismantling framing.
- B. Weepholes: Provide weepholes and internal passages to conduct infiltrating water to the exterior.

A Finishes

- A. Comply with NAAMM “Metal Finishes Manual” for recommendations relative to application and designations of finishes.
- B. Finish designations prefixed by “AA” conform to the system established by the Aluminium Association for designating aluminium finishes.
- C. High-Performance Organic Coating: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer’s instructions.
 - 1. Fluoropolymer 3-Coat Coating System: Manufacturer’s standard 3-coat thermocured system, composed of specially formulated inhibitive primer and fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent Atofina “Kynar 500,” polyvinylidene fluoride resin by weight; comply with AAMA 605.2.

B Installation

- A. Comply with manufacturer’s specifications and recommendations for installation of window units, hardware, operators, and other components of the work.
- B. Set units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place. Do not bridge thermal breaks.
 - 1. Separate aluminium and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with the requirements specified under paragraph “Dissimilar Materials” in the Appendix to AAMA 101.
- C. Set sill members and other members in abed of compound or with joint fillers of gaskets, as shown, to provide weathertight construction. Refer to Section 07920 “Joint Sealants” for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the work.

C Cleaning

- A. Clean aluminium surfaces promptly after installation of windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and

sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

METALWORK (Cont'd)

B. Clean glass of preglazed units promptly after installation of windows. Comply with requirements of the "Glazing" Section for cleaning and maintenance.

BS and CP References

- A BS 4190 Bolts
 BS 4360 Weldable structural steels BS
 1387 Steel tubes and tubulars BS 729
 (Part I) Galvanizing.

Protection

- B Protection of finished work is clearly imperative at all times and the Architect reserves the right to condemn work previously accepted if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that the Contractor has included elsewhere in the Bills for these costs.

FLOOR, WALL AND CEILING FINISHES

General

- A Where a manufacturer's name or the proprietary name of an article appears in this section, it is given as an indication to tendering contractors of the standard and description required and contractors may quote for any manufacturer's article, provided it is of the standard and description specified and approved by the architect in writing, prior to the submission of tender.

Vinyl Tiles

- B Vinyl floor tiles shall be vinyl tiles to BS 3260 laid with an approved adhesive all in accordance with the manufacturer's printed instructions and with CP 203. On completion of the works the tiles are to be thoroughly cleaned and two coats liquid floor polish applied.

Granolithic Paving

- C All granolithic paving to be carried out in accordance with CP 204. The mix is to be cement/sand/aggregate 1:1:2 by weight aggregate, size 5 - 10mm, laid monolithically 25mm thick with an approved hardener.

Porcelain/Ceramic Tiles

- D Porcelain/Ceramic tiles shall be unglazed to BS 6431 Parts 2 & 6, and shall be laid in accordance with BS 5385. Tiles shall be laid with BAL-CEM GOLD STAR cement based tile adhesive to BS 5980, possessing Class AA water resistance with BAL-ADMIX ADI additive. Joints between tiles shall be a constant width 3 mm wide.

Floor tiles shall be grouted with BAL-EPOXY GROUT WF. The joints shall be completely filled.

BAL products are manufactured by Building Adhesives Limited, Longton Road, Trentham, Stoke-on-Trent, Tel. 0782 859921: Fax 0782 643909.

The manufacturer's printed instructions must be strictly adhered to.

Granite Tiles

- E Granite tiles shall be 3/4" thick with a polished finish laid with tile cement on screeded beds joints 0.08 inches wide.

Cement/Sand Bed

F Screeds shall be laid in accordance with CP 204.

Mix screeds of cement and sand (1:4) and lay to the thickness described. Finish screeded beds with a rough surface to receive ceramic tiles and a steel trowelled surface to receive vinyl asbestos tiles, ceramic tiles when fixed with approved adhesive and floor paint. Thoroughly brush clean surfaces to receive screeds of all foreign matter and well soak prior to laying screed.

Provide an adequate bond between screeds and in-situ concrete by the use of an approved concrete bonding agent or by well hacking, wetting and applying cement grout immediately prior to laying the screed.

An approved hardener is to be added to the cement/sand mix such as 'Cementone No. 8' 'Lithurin' or other equal and approved.

Beds shall be laid in bays not exceeding 375 square feet. Edges of adjoining bays shall be well hacked and wetted prior to laying the next day. Immediately the beds are laid, they shall be cured and protected for at least five days to prevent damage or shrinkage of any kind. The method of curing is to be approved by the Architect.

Carpet Tiles

- A Modular carpet shall be Milliken carpet tiles or approved and equal and shall meet the following specifications:
- | | |
|--|---------------------------------------|
| Construction | - Tufted |
| Gauge | - 1/10 |
| Rows | - 8.3 in. |
| Face Yarn | - Antron XL Continuous Filament nylon |
| Dye Method | - Yarn dye / Millitron |
| Yarn weight | - 28 oz. / sq.yd Finished |
| pile height | - 0.20 in. average Backing |
| - Synthetic hardback Total thickness (nominal) | - 0.39 in. |
| Total weight (minimum) | - 127 oz./sq.yd. |
| Module size | - 18" x 18". |
- B The Contractor shall submit duplicate samples of each colour of carpet selected for the Architect's approval. The samples shall be accompanied by manufacturer's specifications covering the construction of the carpet.
- C The Contractor shall submit a working layout for each area to be covered for the Architect's approval. This layout shall also show the colour, type of mouldings and any other pertinent installation details. No carpet shall be installed until the Architect's approval has been received.

- A All carpet shall be delivered to the job site in the original mill wrappings with each batch having its register number properly marked. The carpet shall be protected from damage, dirt, stains, moisture, etc.
- B Adhesives for carpet installation shall be as recommended by the manufacturer of the carpet only.
- C The modular carpet must be installed by a specialist carpet layer approved by the Architect.
- D Before laying carpet the Contractor shall carefully examine all base surfaces and report any defects to the Architect before work is commenced. Installation of carpet shall be considered an acceptance of the surfaces to be covered and if repair of these surfaces is required after installation of carpet, it shall be the responsibility of the Contractor.
- E Surfaces to receive carpet shall have grease and foreign matter removed by cleaning and scraping as necessary. Any ridges and high spots shall be ground smooth and level. Cracks and holes in base surfaces shall be filled with latex emulsion filler compatible with adhesive used.
- F Floor temperatures should be at least 60 degrees F, concrete pH should be no more than 10.0. Modules should be conditioned at 60 degrees F, (min): 90 degrees F, (max): for 24 hours prior to installing. The presence of any moisture will interfere with the curing/performance of the adhesive.
- G Concrete slabs to be thoroughly dry, clean and cured to a hard, non-powdery finish. If necessary, to ascertain dryness of concrete, moisture tests are to be conducted and satisfactory results obtained before work is started.
- H Surfaces to receive carpet shall be thoroughly vacuumed and damp mopped.
- I Carpet shall be applied directly to the floor with a carpet adhesive approved by the manufacturer.
- J Adhesive application shall be in accordance with manufacturer's printed recommendations.
- K Install carpet using a grid and perimeter gluing technique as recommended, unless specifically directed otherwise by the Architect.
- L Carpet modules shall be installed strictly in accordance with the manufacturer's printed instructions.

Levels Generally

- A Ensure that the levels of floors within any one area and between adjoining areas are constant unless specifically described or shown to be otherwise. Make up for any variations in the thickness of precast or premoulded floor finishings and irregularities in the surface of the structural base by adjusting the thickness of the screed as necessary.

Protection

- B Protect all premoulded floor finishings from walking or other disturbance for five days after laying.
Cover all floors up to the completion of the works with a temporary covering approved by the Architect. On completion of the works, remove covering, clean off stains and mortar splashes, etc., from the floors and leave perfect for handing over.

Wall Finishes:Rendering

- C Mix rendering of cement and sand (1:4) including a plasticiser additive at the rate as detailed in the manufacturer's printed instructions.

Proportion materials by measure and not by estimation and provide proper approved measuring boxes for this purpose. Make up mix on site in a close boarded wood platform with upstand edges.

Where approved mechanical batch mixers are employed, rotate each batch in the drum at least two minutes and use immediately thereafter.

Mix only quantities which can be used at once and reject rendering which has begun to set before being required.

Carefully float all work and finish to the stated thicknesses with surfaces perfectly flat to stand the straight edge every way, free from all cracks and leave perfectly clean. External angles shall be true and slightly rounded.

Walls

- D 'Throw' all rendering and plaster onto the wall and give the minimum of 'working' to ensure a plumb and even finish.

Complete each section of walling in one operation but where this is not possible, the existing edge shall be well hacked and wetted before recommencing operations. Throughout the whole of the works, order sufficient sand to prevent any discrepancy between the quality of different renderings.

Thoroughly prepare and set all surfaces prior to commencement of operation and allow for any additional thicknesses required in dubbing out and for working around and behind pipes with their connections and fixtures. An approved filler shall be applied to the surface of internal and external plasterwork to obtain a smooth surface suitable to receive the finishing decoration.

The raking out of joints or hacking faces of blockwork to provide a key for rendering have been referred to in the Blockwork section of these preambles. The prices for rendering on concrete surfaces shall include for hacking the face of concrete to provide a key.

Glazed Wall Tiling

- A Glazed wall tiles shall be of sizes and thicknesses specified and shall be accurately fixed to floated backing with cement and sand (1:5) and grouted with white cement. Alternatively, tiles may be fixed with an approved tile adhesive and grouted with white cement. All tiles shall be of the cushion-edge type. All external angles shall be rounded edge tiles of radius approved by the Architect. Tiles shall be in accordance with BS 1281 and BS 5385, Part 1.

Plasterboard

- B Gypsum wall board to BS 1230 Part 1 type 1 shall be taper edged boards fixed with plasterboard screws or flat head nails as BS 8212 Clause 6.3. Boards shall be as manufactured by British Gypsum Limited and shall be installed in accordance with BS 8212 and the manufacturers printed instructions. Wall boards shall be jointed by applying jointing compound to the depression between the boards, firmly embedding the jointing tape, covering it with the jointing compound and striking off flush. Finishing compound shall be applied over the joint and feathered out approx. 2". This process shall be repeated and feathered out a further 2" beyond the first application, finished flush and smooth. Nail holes shall be filled and finished flush.

Textured Ceiling Finish

- C The underside of fair face concrete slabs shall be rubbed smooth to remove all projections and all small voids are to be filled with an approved filler.

Textured ceiling finish shall be 1mm interior grade white Berger textured finish or other equal and approved by the Architect.

Suspended Ceiling Systems

- D The suspended ceiling system shall be acoustical non-combustible mineral fibreboard with standard type suspension hung directly from concrete soffits.

The ceiling panels shall be Armstrong Fissured Minatone tiles, Ref. No. 705, size 600 x 600 x 19mm thick tegular edge lay-in panels for Prelude exposed tee grid.

The suspended ceiling system shall be installed in accordance with CP 290 by skilled workmen. The suspension systems shall be supported by No. 12 gauge steel hanger wires secured to the concrete soffit and the exposed grid framing shall be securely fixed to the hangers. The lay-in panels shall be set loose within the grid and care shall

be taken not to stain or damage the panels on the exposed face or on the edges. The installation must be carried out in accordance with the Manufacturer's written instructions, all to the satisfaction of the Architect.

The panels shall have factory applied washable white vinyl latex paint finish.

The suspension system shall be exposed grid type with electro-galvanised steel framing finished on exposed surface with low sheen satin white enamel.

Spares

- A The Contractor is to supply the Employer at practical completion of the works with the following spares:

- Floor and Wall Ceramic tiles	- 2% of quantity
- Suspended ceilings:	- 1 box tiles
- Carpet tiles	- 2 boxes
- Vinyl tiles	- 1 box

BS and CP References

B	BS 12	Portland Cement
	BS 1199	Sand for screeds and plaster
	BS 1369	Metal lathing
	BS 1246	Glazed wall tiles
	BS 5262	External rendering
	BS 5492	Internal rendering
	BS 5385	Internal wall tiling
	BS 8212	Dry linings
	BS 5325	Installation of textile floor
	CP 202	Inflexible floor tiling
	CP 203	Flexible floor tiling
	CP 204	In-situ floor finishes
	CP 290	Suspended ceilings

Protection

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PLUMBING INSTALLATION

Generally

- A The whole of the work shall be carried out in accordance with the Byelaws and Regulations of the Sanitary Water and Gas Authorities and to the entire satisfaction of their inspectors.

The entire plumbing and drainage installation shall be carried out by experienced craftsmen under the supervision of a competent foreman to the entire satisfaction of the Architect.

Rainwater Pipes and Fixtures

- B Rainwater pipes and fittings shall conform to BS 4576 Part 1, with spigot and socket joints and neoprene sealing gaskets conforming to BS 2494 Part 2.

All pipes for use as soil and waste pipes shall comply with the provisions of BS 4514 and those for cold water service pipes with BS 3505. Fittings shall be of the solvent weldable type. Brackets and clips shall be of non-ferrous metal or PVC coated steel. Traps shall comply with the provisions of BS 3943 and have a 75mm deep seal.

PVC Pipes

- C PVC pipes for use as soil and waste pipes shall comply with the provisions of BS 4514 and those for cold water service pipes with BS 3505. Fittings shall be of the solvent-weldable type. Brackets and clips shall be of non-ferrous metal or PVC coated steel. Traps shall comply with the provisions of BS 3943 and have a 75mm deep seal.

Polythene Pipes

- D Polythene pipes for use as cold water service pipes shall comply with the provisions of BS 1972 or BS 3284. Fittings shall be of the solvent weldable type. Brackets and clips shall be of non-ferrous metal or PVC coated steel.

Galvanized Steel Pipes

- E Galvanized steel pipes shall comply with the provisions of BS 1387. Fittings, clips, brackets and hangers shall be galvanized steel, wrought or malleable iron. Joints shall be screwed and socketed. Unless otherwise described, pipes shall be of medium weight (blue band). Lightweight (brown band) pipes shall not be used.

Copper Pipes

- F Copper pipes shall be light gauge pipes complying with the provisions of BS 2781 Part

1, underground pipes complying with the provisions of Table Y. Fittings shall either be of the capillary type (Yorkshire, Wendesbury or equal) or 'compression' type (Securex or equal) as described and conforming with BS 864 Part 2. Alternatively,

PLUMBING INSTALLATION (Cont'd)

fittings may be site made and bronze welded provided that this is carried out by thoroughly experienced workmen. Pipe clips, brackets and hangers shall be of copper, brass, bronze or gun metal.

Stainless Steel Pipes

- A Stainless steel pipes shall comply with BS 4127 Part 2. Fittings shall be either capillary or compression type as specified for copper pipes.

Valves

- B All valves, taps, cocks, etc., shall be fullway and comply with the provisions of BS 1010 where applicable. They shall be fixed so as to be easily accessible and so that re-washing may be carried out without the necessity for cutting away walls, etc.

Bending Pipes

- C Wherever possible, bends shall be made in the run of the pipe. Bending springs, sand loading or other suitable means shall be employed to ensure a true diameter all round the length of the bend.

Fixing Pipes

- D Soil waste and overflow pipes shall be fixed vertically or at 2½ degrees from the horizontal. Water pipes shall be fixed vertically or with slight falls towards draw-off points to facilitate draining off of the system. Overflow pipes shall be fixed to discharge in readily observed positions.

Workmanship

- E All plumbing work shall be carried out by skilled workmen and by or under the supervision of a licensed Sanitary Contractor and in conformity with the Regulations of the Sanitary and Water Authorities. Installation shall comply with CP 304 for Soil and Waste Pipes above ground, with CP 310 for Water Service and Distribution Pipes and with CP 312 for Plastic Pipework.

Testing

- F The testing of pipework and fittings shall be carried out to the satisfaction of the Architect and Sanitary and Water Authorities. The Contractor is to include in his prices for testing which shall include for supplying all necessary appliances, water and attendance.

Cutting, Patching, Repairing, etc.

- G The Plumbing sub-contractor shall furnish the Contractor with the sizes and locations of

chases and openings in walls, partitions, etc., before they are built. The Contractor shall furnish and install, without delay in the execution of the work of other trades, the

sleeves or boxes in the form of floor slabs for all his pipes before the floor slabs for all his pipes before the floor slabs are poured.

The Contractor shall do all drilling required for the installation of hangers.

All cutting of walls, partitions, floors, etc., required for the installation of work called for under this section, will be done by the Contractor. Cutting of structural members shall not be done without the approval of the Architect. All patching will be done by the General Contractor. Any cutting or patching required in connection with the installation of this work, due to errors on the part of the Plumbing sub-contractor, shall be paid for by him.

Excavation and Backfilling

- A The Contractor shall do all excavating and backfilling necessary to the installation of work, including the patching and repair of pavements, shall provide all sheeting and shoring required to perform and protect the excavations and to safeguard employees and shall remove from the premises all rubbish and surplus earth occasioned thereby. Trenches shall not be backfilled until the facilities therein have been tested and the work has been accepted as tight.

BS and CP References

- B
- | | |
|----------------------|--|
| BS 864 | Capillary and compression type fittings of copper and copper alloy |
| BS 1010 | Draw-off valves and stop valves |
| BS 1387 | Steel tubes |
| BS 1415 | Mixing valves |
| BS 1972 | Polythene pipe for cold water services |
| BS 2494 (Part 2) | Neoprene gaskets |
| BS 2871 (Part 1) | Copper tubes |
| BS 3284 | Polythene pipe for cold water services BS |
| 3505 | U PVC pipe for cold water services BS 3943 |
| U PVC traps | |
| BS 4346 | Joints and fittings PVC pipes BS |
| 4515 | U PVC soil and waste pipes BS 4576 |
| (Part 1) | Rainwater pipes and fittings CP 304 |
| Soil and waste pipes | |
| CP 310 | Water supply |
| CP 312 | Plastic pipework |

Barbados National Standards Institution

- A BNS CP 16 (Part 1).

Protection

- B Protection of finished work is clearly imperative at all times and the Architect reserves the right to condemn work previously accepted if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that the Contractor has included elsewhere in the Bills for these costs.

ELECTRICAL INSTALLATION

Regulations

- A All electrical work shall be carried out in strict conformity with local regulations and a certificate of test from the Government Electrical Inspectorate shall be handed to the Architect by the Main Contractor at completion of the work.

Drawings

- B Drawings and/or diagrams giving details of the circuits, panel boards, etc., as installed shall be prepared by the Contractor or nominated sub-contractor and 2 copies handed to the Architect at completion of the work.

Where an Electrical sub-contractor has been nominated, the sub-contract amount shall be deemed to include for the preparation of the aforementioned drawings.

Cutting, Patching, Repairing, etc.

- C The Electrical sub-contractor shall furnish the Contractor with the sizes and locations of chases and openings in walls, partitions, etc., before they are built. The Contractor shall furnish and install, without delay in the execution of the work of other trades, the sleeves or boxes in the forms of slabs, beams and columns for all conduit and fittings before concrete is poured.

The Contractor shall do all drilling required for the installation of hangers, supports, etc.

All cutting of walls, partitions, floors, etc., required for the installation of work called for under this section, will be done by the Contractor. Cutting of structural members shall not be done without the approval of the Architect. All patching will be done by the General Contractor. Any cutting or patching required in connection with the installation of this work due to errors on the part of the Contractor or Electrical sub-contractor shall be paid for by him.

Excavation and Backfilling

- D The Contractor shall do all excavating and backfilling necessary to the installation of the work, including the patching and repair of pavements; shall provide all sheeting and shoring required to perform and protect the excavations and to safeguard employees and shall remove from the premises all rubbish and surplus earth occasioned thereby. Trenches shall not be backfilled until the facilities therein have been tested.

ELECTRICAL INSTALATION (Cont'd)Protection

- A Protection of finished work is clearly imperative at all times and the Architect reserves the right to condemn work previously accepted if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item measured is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that the Contractor has included elsewhere in the Bills for these costs.

GLAZINGGenerally

- A Glass shall be obtained from an approved manufacturer and shall conform to BS 952. All glass shall be delivered in proper containers with maker's name, guarantee, type of glass and thickness or weight of glass attached to the outside of the containers. The work shall be carried out in accordance with BS 6262.

Guarantee

- B Furnish the owner with an extended guarantee to warrant the work of this section as follows:
- Installing glass units: against interpane misting or dusting for a period of five (5) years.
 - All glazing installed in frames against leakage or defects for a period of five (5) years.
 - Guarantee periods shall commence from the date of the certificate of Practical Completion of the Work.

Sheet glass

- C Sheet glass shall be selected glazing quality (SQ) and of the weights and thicknesses stated.

Float and Plate glass

- D Float glass and plate glass shall be of the thicknesses stated and be perfectly flat and true.

Wired glass

- E Georgian wired glass shall be 3" thick and be perfectly flat and true. When set in position, the wires shall be perfectly horizontal and vertical and align with those of adjacent panes.

Laminated Glass

- F Laminated glass should be grey tinted and reflective and be able to withstand wind speed of 130mph and meet the Miami Dade Code for hurricane resistance.
- A. Laminated Glass: Comply with ASTM 1172 for kinds of laminated glass indicated and other requirements specified.

- B. Interlayer: Interlayer material as indicated below, clear or in colors, and of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

1. Interlayer Material: Polyvinyl butyral sheets.
2. Patterns and colors as indicated on the drawings.
3. Thickness: 0.8mm for vertical surfaces, 1.60mm for sloped and horizontal surfaces.

C. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets as follows:

1. Laminate lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.

Glazing

- A Cut glass to sizes required as measured on site with a small clearance and set plumb, square, level and at their proper elevation and plane and locate in proper alignment with other work. Cut louvre blades to sizes specified and polish arrised edges. The Contractor is to allow for cleaning all stains from the glass both inside and out and for leaving perfect to the satisfaction of the Architect.

All glass and timber fixing beads are to be fully bedded in mastic compound.

Mirrors

- B Mirrors shall be of selected quality polished plate glass silvered and enamelled after cutting, polishing edges and drilling. Fix mirrors with chromium plated dome headed screws and plastic washers to walls with 12mm thick plywood backing, lipped all round with hardwood lipping.

BS and CP Reference

BS 952	Glass for glazing
BS 4315 Part 1	Methods of test for resistance to air and water penetration
BS 5215	One part gun grade polysulphide based
BS 544	Linseed oil putty
BS 6262	Glazing of buildings
CP 145	Patent Glazing.

Protection

- A Protection of finished work is clearly imperative at all times and the Architect reserves the right to condemn work previously accepted if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that Contractor has included elsewhere in the Bills for these costs.

PAINTING AND DECORATING

Generally

- A All painting shall be carried out in accordance with BS 6150.

All materials used unless otherwise stated, shall be anti-fungus.

Supply paints on site in sealed cans bearing the manufacturer's name and all thinning, mixing, etc., shall be in accordance with the manufacturer's instructions.

Produce vouchers as and when required by the Architect to prove to his satisfaction that all materials supplied are genuine and as specified herein.

Preparation

- B Thoroughly dust and clean down all surfaces to be painted, cut out and fill cracks, stop holes, treat knots and resin pockets in wood with two coats knotting varnish and clean steelwork of rust, oil, grease, scale and moisture, all in accordance with approved practice. Apply an approved filler to the surface of internal plasterwork to provide a smooth surface where painting is specified.

Previously painted surfaces must be thoroughly cleaned to remove all dirt, grease, etc. All loose and flaking material to be rubbed down with a fine grade sandpaper and touch primed.

Aluminium and zinc must be washed with a detergent to remove all grease and treated with a self etching primer.

Before applying polyurethane varnish or wood stain, the wood must be perfectly dry and rubbed down with fine sandpaper to remove all dust and debris to provide a smooth, clean surface.

All nail holes and other defects in timber shall be filled with putty or other approved filler after priming and rubbed down to give a smooth surface. The backs of all joinery surfaces, notches, etc., and where areas are to be hidden by the fixing of, metal work shall be primed before these are fixed in position.

Concrete surfaces are to be smooth and even, free from loose sand, mortar splashes and efflorescence with all small voids filled with an approved filler, prior to receiving painted finish. The Contractor is to allow in his price for all such preparatory work.

Application

- C Apply paint by brush, roller or spray with the minimum of dilution.

Strain the prepared paint free from skins and similar impurities immediately before application.

Allow to dry and well rub down each coat of paint before the next is applied and no two successive coats shall be to the same tint.

No paint shall be applied to a damp surface and no external painting shall be carried out during wet weather.

Remove metal hardware and fittings before painting to general surfaces and afterwards refix. Alternatively, they shall be adequately protected to prevent being marked by paint.

Allow for carrying out work in such positions and in such order as shall be directed by the Architect.

Cover and protect all surfaces which may become marked by paint and thoroughly clean all surfaces throughout, after completion of the work, all to the satisfaction of the Architect.

On no account shall the Contractor allow employees to empty washings or painting materials into sanitary fittings or drainage systems and shall provide a suitable receptacle outside the building to receive same.

Brand Names

- A All brand names of painting materials shall be approved by the Architect. Oil paint shall be best quality alkyd enamel or equivalent grade. Prepare surfaces and apply paint in strict accordance with the specifications of the manufacturer of the brand approved by the Architect.

Colour Schemes

- B Allow for varying colours in the individual rooms in accordance with the Architect's colour scheme and also for executing fairly large sample panels of the finishing colours, as and when directed by the Architect.

BS and CP References

- | | | |
|---|--------------|--|
| C | BS 544 | Linseed oil putty |
| | BS 1055 | Water paints |
| | BS 1215 | Oil stains |
| | BS 1282 | Classification of wood preservatives |
| | BS 1336 | Knotting |
| | BS 2521) | |
| | BS 2523-4) | Priming paints |
| | BS 3698) | |
| | BS 2525-2527 | Undercoating and finishing paints exterior |

BS 4800 Paint colours for building purposes

BS 5082)	
BS 5358)	Priming paints
BS 6150		Painting of buildings
CP 2008		Protection of iron and steel structures from corrosion.

Protection

- A Protection of finished work is clearly imperative at all times and the Architect reserves the right to condemn work previously accepted if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that Contractor has included elsewhere in the Bills for these costs.

EXTERNAL WORKS

General

- A The Contractor is referred to the Civil and Structural Specification which is embodied within these Preambles for items referring to External Work.

Drainage Regulations

- B The Contractor shall conform with the regulations and bye-laws of the Public Health Authority and/or other competent authority. The whole of the drainage works shall be executed to conform to BNS Code of Practice CP 16 Part 1.

Materials

- C The sand, aggregates, cement and steel shall be as specified under 'Concrete Work'.

Hollow blocks shall be as specified under 'Blockwork'.

Cement mortar shall be as specified under 'Blockwork' for hollow block-wallings.

Cement/sand render shall be as specified under 'Wall Finishes'.

PVC pipe and fittings shall be obtained from an approved manufacturer and shall conform to BS 4660. All fittings shall be of the same joint design as the pipe and must conform to BS 2494 Part 2. Prices for fittings on all types of drain pipe shall include for cutting and extra joints.

Concrete pipes and fittings shall conform to BS 556 with ogee joints jointed with cement mortar 1:1.

Workmanship

- D The drains shall be laid to suit the general progress of the building work and at such time and in such a manner as to be adequately protected against damage and deterioration.

All drains and pipes shall be kept clear of obstruction during the process of laying and maintained until completely clear of obstructions and handed over in a clean condition.

The holes previously left below joints for jointing purposes shall be carefully filled in.

Pipes passing through manholes shall be securely made good with cement mortar.

Testing

- A The drains, soil and vent pipes shall be tested in the presence of and in a manner approved by the Architect. Prices for testing are to include for providing all necessary equipment, water and attendance.

Pipelines shall be submitted to a hydraulic test before the trenches are completely backfilled. Test pressures shall be 12 times the working head. If any leaks are discovered, the joints shall be resealed and the pressure pipes shall be removed and replaced with sound pipes. The Contractor shall provide all equipment and materials necessary for the tests and attendance upon the Engineer while the tests are being carried out.

During the tests, the backfilling of the trenches shall be complete except that the joints of the pipe and fitting shall remain exposed for visual inspection. Upon satisfactory completion of the test, the remainder of the backfill shall be undertaken in the same way as described in 'Backfilling'.

Excavations

- B Excavations are to be carried out to the lines and levels shown on the Engineer's drawings or to such other dimensions as the Engineer may specify.

Excavations shall be kept dry regardless of the source of water and the Contractor shall allow for all measures necessary to achieve this.

The Contractor shall allow for the provision of all temporary works for the support of excavations where necessary, to avoid slips, falls and excess excavation.

The extent of all excavations in open cut shall be the minimum necessary or practicable for the construction of the works.

Trenches shall have at the bottom, at least 150mm clearance between the barrel of the pipe to be laid and the face of the excavation or timber sheeting. Roomy joint holes shall be provided so that pipes may rest for their whole length on a properly prepared bed.

Excavations with battered or stepped sides may only be adopted with the prior approval of the Engineer.

The excavation of trenches more than two days in advance of pipe laying and permission to open up new lengths of excavation will be conditional on satisfactory pipe laying and initial backfilling. Trenches shall not be left open longer than is reasonably necessary. The Contractor must inform the Quantity Surveyor 24 hours prior to commencing backfilling any excavations associated with drainage.

Laying Concrete pipes

- A A bed of concrete (Grade B:21N/mm⁵ at 28 days) for the concrete pipes shall be laid in a minimum thickness of 2". Purpose-made precast concrete blocks shall then be set on the concrete in cement mortar and carefully levelled. The pipes shall be laid on the blocks, care being taken to ensure that the jointing rings are correctly located and are not damaged during laying. After laying, the pipes shall be true to line and level and there shall be a gap not less than 3" and not more than 2" wide, between the end of the spigot and the inner face of the socket. The use of steel packings will be permitted on top the concrete blocks to raise the pipes.

Backfilling

- B After laying the pipes and placing the concrete cradle under the pipe, 'selected fill' shall be carefully placed around the pipe in 4" layers and well compacted to at least 90% of the materials maximum density.

'Selected fill' shall be placed and lightly tamped over the crown of the pipe for a depth of not less than 12" unless otherwise specified on the drawings.

'Selected fill' shall be uniform readily compactible material, free from tree roots, vegetable matter, building rubbish, clay and stones greater than 1" diameter.

Additional filling required to complete backfilling shall be carried out with suitable excavated material placed in 6" layers and thoroughly compacted.

Protection

- C Protection of finished work is clearly imperative at all times and the Architect reserves the right the condemn work previously accepted if subsequently damaged and to withhold further payment until the work has been rectified. The amount included for the item is deemed to include for the protection of all work and where no price is included against this item, it will be assumed that Contractor has included elsewhere in the Bills for these costs.

SPECIFICATION FOR EXTERNAL WORKS
REFERRED TO PREVIOUSLY.

EXTERNAL WORKSSurfacing Paved AreasA (i) Hot Rolled Asphalt Surfaces:

The works are to be directly supervised by a foreman who is fully in high quality surfacing to the approval of the Engineers.

The compacted marl surface shall be cleaned of any clay, soil or other foreign materials before the road 'metal' (crushed stone) is applied.

'Metal' shall consist of hard dense broken limestone which shall pass a (12") screen and be retained on a 10mm (3/8") screen. The metal course is to

tonnes or an equivalent vibratory roller to exact grades and cross falls as shown

on the drawings

The metal course shall be penetrated with an approved asphaltic binder emulsified asphalt using a power sprayer at a rate of 3 litres/square metre surface area.

The asphalt finish or wearing surface to all paved areas is to consist of mixed hot mixed asphalt laid on top of the base course either the same day or least the day following the laying of the base course asphalt layers. The mixed asphalt for the wearing surface is to consist of carefully dried and well

minimum size and not more than 17% of the total weight shall pass the No. sieve. Bitumen at a minimum of 6% and maximum of 8% by volume shall added at the pre-mix plant to produce a firm dense and easily compacted with a close surface texture and few voids.

The material specification for the wearing surface mix is to be as follows:

<u>Sieve Size</u>	<u>Percentage passing</u>		
25mm			100
20mm	86	-	100
12mm	76	-	90
6mm	66	-	79
3mm	52	-	65
#14	34	-	49
#36	19	-	33
#100	9	-	17
#200	3	-	7

Effective Bitumen Content: 6% to 8%.

The hot mixed asphalt is to be applied by a Barber Greene or equivalent approved paving machine. The wearing surface shall be laid in a single layer and properly rolled using a steel wheel roller followed by a rubber wheel roller and finished by a steel wheel roller, of not less than 8 tonnes for roads and paved areas and a minimum 2 tonne roller for footpaths. The surface of the paving must be laid to the grades and cross falls as shown on the drawings with a maximum allowable tolerance of + 6mm (3") vertically on a 3 metre (10'0") length.

The positions of construction joints in the surfacing are to be approved by the Engineer. At the beginning of adjoining surfacing, the course is to be cut back and primed with bitumen. The quantity of materials used in the mixes and the quantity of asphaltic binder or emulsified asphalt must be strictly adhered to; the wearing surface must be laid at the correct temperature of not less than 375 F. The qualities of the mix is subject to testing.

(ii) Emulsified Asphalt and Chip Surface

The marl and selected marl layers shall be laid and compacted as specified for hot rolled asphalt surfaces.

The top surfaces of the selected marl fill shall be formed to the falls shown on the drawings.

The marl layer shall be treated with a tack coat of emulsified asphalt, applied by a power sprayer at the rate of 2.25 litres/square metre (2 Gal/sq.yd.).

A 38mm (1 1/2") thick layer of graded crushed limestone shall be laid on the tack coat. This crushed limestone shall be graded stone from 20mm (3/4") to 10mm (3/8"). This surface shall be compacted with a roller of not less than 8 tonnes.

The crushed stone layer will be penetrated with a further application of emulsified asphalt, applied at a rate of not less than 3.4 litres/square metre (3 1/2 Gal./sq.yd.).

A further 12mm (1/2") thick layer of crushed stone shall be applied and rolled. The grading of this stone shall be 10mm (3/8") to 3mm (1/8"). This layer shall be bound by another application of emulsified asphalt, this time at the rate of 0.75 litres/square metre (1/2 Gal./sq.yd.) and the surface finally dressed with grits.

The final surface of the paved area shall present a uniform impermeable surface free from undulations and evenly graded to the elevations and falls shown on the drawings. It shall present a neat and even appearance.

Kerb and Slipper Drain and Swales

All concrete work is to be 1:2:4 nominal concrete mix to give works test cube strength results of 17N/mm² (2,400 p.s.i.) and 21N/mm² (3,000 p.s.i.) at 7 and 29 days respectively.

Concrete kerbs and slipper drains are to be cast in-situ and are to be to the levels, falls and dimensions as shown on the drawings. If an automatic kerb forming machine is to be used, only those machines which produce a dense homogeneous concrete will be approved. All exposed concrete surfaces to the kerbs and slipper drains are to be fair faced.

Existing concrete kerbs and slipper drains which are to be retained shall be taken over by the Contractor and the Contractor is to assume full responsibility for protecting such kerbs and slipper drains from damage during road and footpath construction. Any damage from the date of possession to virtual completion must be repaired at the Contractor's expense.

The details of the kerbs, slipper drains and swales shall be generally in accordance with the details given.

The thickness of the concrete in the slipper drain and swale shall not be less than 125mm (5"0). A cross fall of 1 in 9 shall be provided in the slipper drain in the direction of the kerb and in the swale in both directions to the centre-line.

Part B

9.2: MEP Scope & Specifications

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PLUMBING CODES & STANDARDS

General

Carry out the works in conformance with the **Montserrat Water & Sewerage Authority** regulations, **Montserrat Building Code** - and all relevant Bye-Laws and confirm thereto but give the Architect, Engineer and/or Project Manager notice of any difference between these requirements and those specified.

The whole of the plumbing and drainage installations shall be carried out by licensed craftsmen to the entire satisfaction of the Engineer and the approving agency. All fittings shall be properly stored and protected and left clean and in perfect working condition.

The Contractor shall carefully examine pipes and pipe fittings after delivery. All damage or defects revealed shall be removed to the satisfaction of the Engineer.

Potable water service pipes shall be of the requisite strength to withstand the highest pressure occurring in the utility's main. All pipes shall be designed for use with a working pressure of **0.70 N/mm² (100 lb/psi)** maximum.

Pipes and fittings, etc., supplied by the Contractor shall be tested and stamped where required by such regulations and the Contractor shall pay fees or charges for such testing and stamping.

Setting Out

The positions of all pipe runs including joints and connections shall be agreed with the Engineer before work is commenced.

Layout of Installations

The Contractor shall carefully consider the layout of the whole piping systems for the Contract but the Engineer's and the utility's permission shall be obtained before proceeding with the work.

PLUMBING CODES & STANDARDS

PVC Pipes and Fittings

PVC pipes and fittings shall conform to the following –

Potable Water - External - Schedule 40 PVC 200 PSI - ASTM D1784/1785 for use with push-on gasket joints **ASTM D3139**

Internal - Schedule 40 PVC 160 PSI - ASTM D1784/1785 for use with solvent joints **ASTM D2672**

Wastewater - External - Schedule 40 PVC 200 PSI - ASTM D1784/1785 for use with push-on gasket joints **ASTM D3212**

Vertical Risers & Stacks - PVC Schedule 40 DWV - ASTM D1784/1785 for use with solvent joints **ASTM D2665**

Horizontal Collectors & External Piping - PVC Schedule 40 DWV - ASTM D1784/1785 for use with solvent joints **ASTM D2665**

Hot Water - Schedule 40 CPVC ASTM D1784/1785 for use with solvent joints **ASTM D2672**

Fire Hose Reels - Schedule 40 Galvanized Steel

Galvanized Mild Steel Pipes and Fittings

Galvanized mild steel pipes shall conform to **B.S. 545**

Fittings for galvanised mild steel pipes shall be wrought pipe fittings (screwed BSP thread) complying to **B.S. 21**.

Steel Pipes Schedule 40 and Fittings

All pipes for the fire hose-reel system shall be seamless *Schedule 40* galvanised steel pipes with screwed fittings (up to 2" diameter).

Concrete Pipes and Fittings

Concrete sewer and drainage pipes shall conform to *ASTM C-14* or *ASTM C-118* except large pipes under traffic ways which shall conform to *ASTM C-76 Class II*.

Fittings for concrete pipes shall conform to *ASTM C-14 Class II*.

Fittings

All fittings shall be suitable for use with working pressures equal to or better than those applicable to the pipe on which they are installed.

Pipe Joints

All types of pipe joints used shall be subject to the approval of the Engineer and the Water and Sewerage Authority but in general the following types for each material will be acceptable in sizes **75 mm (3")** and larger.

Cast iron: a) Bell and spigot lead caulked joints.
 b) Bell and spigot with rubber gaskets.

Galvanized: Screw and socketed joints with laps of mild steel:
 yarn and red lead. Teflon tape may be used for cold
 water pipes.

PVC: a) Sleeve type coupling with rubber gaskets.
 b) Solvent cement welded joints.

Concrete: a) Bell and spigot with tarred yarn and cement and sand (1:2)
 mortar.
 b) Bell and spigot with rubber gaskets and cement and sand
 (1:2) mortar.

Pipe Joints - continued

All joints in concrete pipes shall have their sockets filled solidly with mortar and finished with a bold fillet of the same mortar on the outside of each joint.

For pipes smaller than **75 mm (3")** joints may be screwed or solvent cement welded. Screwed joints for galvanized mild steel pipes shall be given two coats of heavy bitumastic material approved by the Engineer after the joints are made up.

When open joints are required for irrigation purposes four small wedges not exceeding **13 mm (1/2")** wide shall be inserted between the pipes at the joints as shown on drawings to provide openings to enable the passage of external water into the pipes. All open joints shall be surrounded by gravel packing.

Pipes shall be in the maximum lengths possible to avoid unnecessary jointing. The Contractor shall allow for and include in his rates all straight couplings between lengths of pipe.

Adaptors

Adaptors shall be used to join pipes of different types, unless solid sleeves are indicated or approved. Adaptors shall have ends for the appropriate type of joints to receive the joining pipe.

Pipe Supports

For above ground installation of horizontal runs of PVC pipe, there shall be at least one support hanger located adjacent to the joint. The maximum spacing between hangers shall be **3 metres (10'-0")**. For vertical runs of PVC pipe supports shall be not less than every storey height and at the base of the run.

For horizontal runs of steel pipe, supports shall be placed at not more than:

PLUMBING CODES & STANDARDS

Pipe Supports

Spacing for Fixings

<u>Size Of Pipe</u>	<u>Horizontal Runs</u>	<u>Vertical Runs</u>
13 mm (1/2')	1 metre (3'-3")	2 metres (6'-6")
20 mm (3/4")	2 metres (6'-6")	3 metres (10'-0")
20 mm (3/4")	3 metres (9'-9")	3 metres (10'-0")
25 mm (1")	3 metres (9'-9")	3 metres (10'-0")
32 mm (1 1/4")	3 metres (9'-9")	3 metres (10'-0")
40 mm (1 1/2")	3 metres (9'-9")	3 metres (10'-0")
50 mm (2")	3 metres (9'-9")	4 metres (13'-0")
75 mm (3")	3 metres (9'-9")	4 metres (13'-0")

Defects

No defective pipe nor fitting shall be laid or placed in the piping system and any defective item discovered shall be replaced.

Laying Pipes and Fittings

Each pipe and fitting shall be cleaned of all debris, dirt, etc. before being laid and shall be kept clean until accepted with the completed work. Pipe fittings shall be laid accurately to the lines and grades indicated as required. Care shall be taken to ensure a good alignment both horizontally and vertically and to give the pipe a firm bearing along its entire length.

Handling and Cutting Pipes

Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion to the pipe coating.

Location of Water Pipes

- a) All water service pipes shall be a distance horizontally of not less than **3 metres (10'-0")** from sewer lines.
- b) In cases where water and sewerage pipes are placed less than **3 metres - (10'-0")** apart, the bottom of the water pipe must be a minimum of **305 mm (1'-0")** apart vertically. The number of joints in the water pipe shall be kept to a minimum. It is further recommended that the water pipe be encased in concrete.

Valves and Appurtenances

Valve working pressures shall be at least equal to that of the pipe on which they are to be installed. Listed below are the general features required for the various types of valves unless otherwise approved.

Gate valves **75 mm (3")** and larger shall be iron body, bronze mounted, solid wedge with bell or mechanical joints. Flange ends shall be used only where indicated or approved. Gate valves smaller than **75 mm (3")** shall be standard bronze, single wedge, rising stem, inside screw gate valves with screwed ends. Stems shall turn counter-clockwise to open. Buried valves **75 mm (3")** and larger shall have non-rising stems and operating nuts. Exposed valves smaller than **75 mm (3")** shall have rising stems and hand-wheels.

Isolation valves for fixtures shall be all chrome plated brass shut-off valves with rubber washers.

Valves and Appurtenances - continued

Hose bibs shall be all brass valves with rubber washers and end threads for garden hose fixing.

Ball valves shall be "Portsmouth" type with silencer pipe for high or low pressure as described. Floats not exceeding **13 mm (1/2")** diameter shall be plastic type; larger floats shall be copper type.

Corporation stop cocks and valves for service connections shall be installed essentially as shown on the drawings subject to modification by actual field conditions. Corporation stop cocks shall be tapered screw, all bronze unlaced, suitable for the service. Service connection shut off valves shall be bronze, inside screw, globe valve with screwed ends, operating handle and composition seal.

All valves, fittings and appurtenances needed for the pipelines shall be set and joined by the Contractor as indicated on the drawings or as required by these specifications.

Temporary Closure

When pipe laying is not actually in progress, the open ends of pipes shall be closed by temporary water tight plugs or by other approved means.

Sanitary Fittings

The sanitary fittings shall be supplied by the Employer and shall be fixed securely and neatly to walls and floors. Great care shall be taken when storing, handling and fixing the fittings to prevent chipping, cracking or other damage. Damaged fittings shall be replaced at the Contractor's expense.

PLUMBING CODES & STANDARDS

Field Testing

Except as otherwise directed all pipelines shall be tested. Pipelines laid in excavation or bedded in concrete shall be tested prior to the back-filling of the excavation or bedding in concrete and exposed piping shall be tested prior to field painting.

All testing shall conform to the requirements of the Water and Sewerage Authority where applicable and shall be to the satisfaction of the Engineer.

Testing

The Contractor shall fill and test the whole of the installations to the satisfaction of the Engineer, rectify all defects, drain and leave in a clean serviceable condition.

Pressure Test Report shall be filled out by the Contractor for each section of pipework being tested.

All pipework, fittings and appliances in connection with Sanitary and Rainwater Plumbing shall be inspected and tested in accordance with the Utility's requirements and in conformance with the **Montserrat Building Code**.

All rainwater downpipes to be cast into steel columns to be encased shall be tested before the concrete is cast.

All pipework, fittings and appliances in connection with Potable Water Services shall be inspected and tested in accordance with the Utility's requirements and in conformance with the **Montserrat Building Code** provided that the test pressure shall be the maximum working pressure plus **50 %** - and not less than **1.05 N/mm² (150 lb/psi)**.

Independent final tests, if required, for the whole of the work may be done by the Utility in conjunction with the Engineer.

Testing - continued

PLUMBING CODES & STANDARDS

The fact that any part of the work has passed any test will not relieve the Contractor of any of his obligations, and any defect shown by the independent final tests or appearing during the period of maintenance shall be located and made good at the Contractor's expense.

Excavation for Pipelaying

Excavate in such a manner and to such dimensions as will give suitable room for building appurtenant structures and laying and jointing the pipe.

Place all sheeting, bracing and supports and do all coffer damming, pumping and draining to render the bottom of the excavations dry and acceptable in all respects. In no case except as provided for hereinafter shall the earth be ploughed, scarped or dug by machinery so near to the finished sub-grade as to result in disturbance below the said sub-grade.

The last few millimetres of the material shall be excavated with pick and shovel just before placing the pipe, masonry or other structures.

Where pipe is to be laid in a gravel bedding or in a concrete cradle, the trench may be excavated by machinery to or just below the designated sub-grade provided that the material remaining at the bottom of the trench is not disturbed.

Where pipe is to be laid directly on the trench bottom the lower part of the trench shall not be excavated to the sub-grade by machinery but just before the pipe is to be placed the last few millimetres of material to be excavated shall be removed by means of hand tools to form a shaped bottom true to grade so that pipe will have a uniform and continuous bearing and support on firm and undisturbed material between joints except for limited areas where the use of slings may have disturbed the bottom.

PLUMBING CODES & STANDARDS

Safety

The Contractor shall provide adequate timbering to prevent collapse of the earth cuts where appropriate.

The Contractor shall be entirely responsible for the excavation and damage caused by such excavation to other parts of the Works.

The Contractor shall erect and maintain all necessary barricades around though excavations and danger signs by day and night for the protection of the public and workmen employed on the site and shall be responsible for any damage to persons or property due to any operation connected with his work.

Water

The Contractor shall be responsible for keeping the excavation free from water at all times. If necessary the Contractor shall provide a pump for this purpose.

Inspection

All excavations shall be inspected by the Engineer's Representative before any pipe or concrete is placed and the Contractor shall give due notice when an inspection is required.

Disposal

The excavated earth and rock fragments shall be stored in separate heaps on site and material taken from them for backfilling as directed by the Engineer. Surplus material may be spread over the site or disposed elsewhere.

Laying

Lay drains to minimum fall of **1:40** except where otherwise stated or shown.

Keep drains free from earth, debris, superfluous cement and other obstructions during laying and until the completion of the contract when they shall be handed over in a clean condition.

The pipe shall first be checked to ensure that there are no stones or other obstructions and the interior and then laid true to line and grade with uniform bearing under the full length.

Lay pipes with sockets leading uphill and rest on solid and even foundations for the full length of the barrel.

Sewer pipes shall be laid without break from structure to structure with socket ends of pipe up grade and the end of the pipe shall be protected by a stopper when the work is not in progress.

Where pipes are located under roadways they shall be suitably protected by bedding in sand or other suitable material.

Thrust and Anchor Blocks

Thrust and anchor blocks shall be formed at bends, tees and valves as shown on drawings or as directed by the Engineer. Slide slip and longitudinal slip anchors shall be constructed when directed by the Engineer.

Cleaning

Prior to the pressure and leakage tests, pipes shall be thoroughly cleaned of all dirt, dust, oil, grease and other foreign material. This work shall be done with care to avoid damage to inside coating where applied.

Cleaning

On completion of the work, immediately before handing over, the Contractor shall thoroughly cleanse the whole of the system and prove that it is functioning freely to the satisfaction of the Engineer.

Backfilling Trenches

The initial backfilling to **305 mm (1'-0")** above top of the pipe shall be of sand for PVC pipe or selected granular material for galvanized iron or concrete pipe. The final backfill shall consist of excavated material compacted in layers not exceeding **225 mm (9")**. Material shall be compacted to the Engineer's approval.

No backfilling of trenches shall take place until after the pipes therein have been treated and passed.

Protection of Existing Structures

All existing pipes, holes, wires, fences, kerbs, property line markers and other structures which the Engineer decides must be preserved in place without being temporarily or permanently relocated shall be carefully supported and protected from damage.

Make Good

Include in tender for fixing all pipes, fittings, etc. and for making good (if specified) the surfaces to which they are affixed inducing forming all hobs, chases, etc.

Builder's Work in Connection

The materials and workmanship required for general builder's work in connection with these installations shall be, in so far as they are applicable, all as described under the various section headings.

Pricing

Prices for Plumbing and Drainage Installations shall include:-

- a) Fixing pipes complete in all locations including the provision and fixing of all clips, pipe hooks, holderbats and brackets and making good the background to which they are fixed (if requested).
- b) Cutting pipes and for short lengths.
- c) Couplers or joints in the running lengths of pipes.
- d) Cutting pipes and making joints to fittings.

SCOPE OF WORKS

A. SCOPE OF WORKS

The **Plumbing Specification** outlined herein refers directly to the plumbing installation associated with the **Financial Services Commission Building** to be constructed at **Little Bay – Montserrat, W.I.**

The Plumbing Contractor shall be responsible for the supply of all materials (where specified), labour and supervision necessary to carry out the Works, complete in all respects as outlined below:

- a) Cold Water piping installation.
- b) Hot Water piping installation
- c) Wastewater piping installation - inclusive of all sub-grade and external piping, all as indicated on the drawings.
- d) Supply and installation of all owner-supplied fixtures and fittings (as specified).
- e) Supply and installation of **insulated condensate piping** from the AC fan coil units
- f) Supply and installation of hot water heaters in kitchens.
- g) Piping to septic holding tank.
- h) Supply and installation of main Utility PVC potable water metered connection.
- i) Supply and installation of all sanitary ware and fittings as detailed in the Bill of Quantities.
- j) All necessary Builder's Works in connection with the installation, including marking of positions and forming holes, mortises, chasing of floors and walls, making good etc.
- k) Inspections, testing and commissioning of the systems.
- l) Completion Certificate from Montserrat Water and Sewerage Authority for the whole of the installation.
- m) All other Works as described herein or as detailed on the Drawings.

B. PROJECT DESCRIPTION

The Plumbing Contractor will include as part of the external wastewater piping, all associated sand bedding and cover – trenching and backfilling to be carried out by the Main Contractor.

He will also include for all piping connection to the septic holding tank to be constructed by the Main Contractor.

SCOPE OF WORKS

B. PROJECT DESCRIPTION

A Utility metered potable water connection will be from the eastern side of the site (road leading to the Cultural Center).

The sanitary ware and fittings will be supplied and installed by the Plumbing Contractor, inclusive of all local isolating valves, flexible pipe connections, water hammer arresters etc.

The contract will also include for the supply and installation of **insulated condensate piping** from the AC fan coil units

This contract will also include for the supply and installation of the following items:

1. Hot water heater in kitchens, pressure relief valves and copper waste piping.
2. Hose bibs.

NOTE:

The construction of the reinforced concrete septic tank will be carried out by others – coordination with the Building Contractor on the construction of the above and all associated interconnecting pipework and sand/gravel media will form part of this contract.

Piping to be used on the job will meet the following minimum specifications -

Potable Water -	External - Schedule 40 PVC 200 PSI - ASTM D1784/1785 for use with push-on gasket joints ASTM D3139 Internal - Schedule 40 PVC 160 PSI - ASTM D1784/1785 for use with solvent joints ASTM D2672
Wastewater -	External - Schedule 40 PVC 200 PSI - ASTM D1784/1785 for use with push-on gasket joints ASTM D3212 Vertical Risers & Stacks - PVC Schedule 40 DWV - ASTM D1784/1785 for use with solvent joints ASTM D2665 Horizontal Collectors & External Piping - PVC Schedule 40 DWV - ASTM D1784/1785 for use with solvent joints ASTM D2665
Hot Water -	Schedule 40 CPVC ASTM D1784/1785 for use with solvent joints ASTM D2672

The Plumbing Contractor shall also be responsible for the following -

- a) All related Builders Works such as cutting and chasing of walls and/or floors, penetrations, making good, fixing and supporting of all pipework etc.

SCOPE OF WORKS

The Plumbing Contractor shall also be responsible for the following - continued

- b) Submissions of all applications and drawings for Utility connections and/or approvals.
- c) It is the responsibility of the Plumbing Contractor to ensure that all power tool(s) extension cords used are in a safe condition, and are NOT under any circumstances to make use should defective equipment or materials be found.
- d) Hard hats, proper eye protection and steel-tipped footwear are to be provided during all phases of this contract.
- e) The Plumbing Contractor is to closely coordinate with the Main Contractor and other services sub-contractors on the exact locations and routing of all electrical and related services.
- f) The Plumbing Contractor is to include in his pricing for any items that may be applicable to this contract. In this regard your attention, in particular, is directed to the following items:
 - 1. Details of all payments for plant and equipment held 'off-site' are to be provided with this submission, inclusive of advance payments for plant or equipment held 'off-site'.
 - 2. Any costs associated with storage areas are to be included as part of this contract.

PIPE SUPPORTS – All pressure piping within the vertical chases shall be secured to **Unistrut®** rack supports, with thrust-blocks installed at all elbows. An approved de-greasing agent shall be used at all joints, couplings, unions etc. prior to the application of the solvent for final pipe connections – as manufactured by **Christle Limited** or equal approved.

B. MATERIALS APPROVAL

The Plumbing Contractor, prior to purchasing, shall submit samples of all pipes, fittings and fixtures, valves etc. to the local approving agency for approval – written confirmation from the utility must be provided to the Architect, Project Manager and/or Services Engineer.

Duplicate samples must also be submitted to the Architect, Project Manager and/or Services Engineer for approval.

SCOPE OF WORKS

E. MISCELLANEOUS

1.0 DRAWINGS & SPECIFICATIONS

The Drawings and Specifications are intended to be complete and considered supplementary to one another. Materials or workmanship indicated, called for, or implied by one and not the other, shall be furnished and installed as though specifically called for by both. Should any discrepancy appear in either, call such discrepancy to attention of the Services Engineer for clarification and correction before executing the works. Failure to address design queries within a reasonable period will not constitute a claim for time extension.

It is the intent of the Drawings and Specifications to obtain a complete and satisfactory installation. The Mechanical and Electrical drawings are descriptive and diagrammatic but are to be followed as closely as the actual construction of the building and the work of other trades will permit.

The drawings are diagrammatic and indicate general arrangement of systems and equipment included in the scope of this project. The Plumbing Contractor shall follow drawing in laying out work; check drawings of all trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. The Plumbing Contractor must also verify all field dimensions, setbacks and penetrations using the site copy of the architectural drawings provided by the main contractor or any other recognized client's representative.

Where headroom or space conditions appear inadequate, the Project Manager shall be notified before proceeding with the installation. If directed by the Project Manager or Services Engineer, the Plumbing Contractor shall, without extra charge, make reasonable modifications in layout as needed to prevent conflict with work of various trades or for proper execution of the work.

Where variances occur between drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in contract price.

SCOPE OF WORKS

E. MISCELLANEOUS

1.0 DRAWINGS & SPECIFICATIONS

The Services Engineer shall decide on the item and manner in which the work shall be installed. Prior to fabrication and/or installation, the Plumbing Contractor shall submit detailed shop drawings and calculations as indicated in other sections of the specifications.

2.0 DESIGN QUERIES / CLARIFICATION

Any Design queries or issues which may require further clarification by the Project manager, Architect or Services Engineer shall be called to the attention of the Engineer at least four (4) days prior to the bid submission date.

3.0 TIMELY DELIVERY OF EQUIPMENT

It shall be the Plumbing Contractor's responsibility to obtain delivery dates for all of the essential equipment specified and approved to coordinate with project construction schedule so that materials arrive at job site in adequate time for installation.

4.0 COORDINATION OF SERVICES

This Section includes administrative and supervisory requirements necessary for coordinating construction operations on the Project to be collectively fulfilled by the Plumbing Contractor.

The Plumbing Contractor's responsibility includes, but is not limited to the following:

- General project coordination and scheduling procedures as directed by the Project Manager
- Conservation of all consumables and other materials required to complete the installation works

SCOPE OF WORKS

4.0 COORDINATION OF SERVICES

The Plumbing Contractor's responsibility includes, but is not limited to the following:

- Provision of coordination drawings as required
- Providing the necessary Administrative and supervisory personnel as required under the terms and conditions of the contract.
- Cleaning and protection of all finished works prior to handover to the client

Where applicable, the Plumbing Contractor shall participate in specified coordination requirements as directed by the project manager. Note that certain areas of responsibility may be assigned to a specific contractor.

The Plumbing Contractor through his site and administration representatives shall coordinate all construction activities with those of other prime contractors and other entities involved to assure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations included under different Sections of the Specifications that depend on each other for proper installation, connection, and operation.

The Plumbing Contractor, along with all other contractors, and the Architect will work together to provide for the most logical and expeditious assembly and progress, however this will not relieve the Plumbing Contractor of his obligations to coordinate with and accommodate the work of others.

The Plumbing Contractor shall schedule the construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

Where availability of space is limited, the Plumbing Contractor shall coordinate installation of different components with other services contractors to assure maximum accessibility for required maintenance, service, and repair.

SCOPE OF WORKS

4.0 COORDINATION OF SERVICES

The Plumbing Contractor shall make adequate provisions to accommodate items scheduled for later installation.

The Plumbing Contractor shall coordinate scheduling and timing of all required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and assure orderly progress of the Work.

These activities include, but are not limited to, the following:

1. Preparation of Coordination schedules.
2. Preparation of Coordination drawings
3. Preparation of “As Built” drawings
4. The installation and removal of temporary works and facilities as required.
5. The timely delivery and processing of technical submittals and samples for approval
6. Prompt attendance at all Progress / Site meetings as required
7. Completion of all project closeout activities to the satisfaction of the Project Manager

Note that the works covered under of all other contracts will affect the overall schedule and coordination of the Work of this Contract. Requirements and limitations of work progress as may be required by other contracts shall be binding on the schedule of this Contract. The Plumbing Contractor must therefore be totally familiar with the schedule requirements of all other contracts as they may affect the scheduling and progress of this contract.

The Plumbing Contractor will be required to undertake all integrations and coordination to ensure the seamless integration all associated systems between all services inclusive but not limited to the electrical works, plumbing works, HVAC works, BMS system, fire alarm, security systems and any other trade deemed necessary by the Project Manager.

SCOPE OF WORKS

5.0 COORDINATION OF SERVICES

The Architect / Project manager will note and facilitate the coordination efforts between the various contractors and parties involved in the Project. It shall however remain the sole responsibility of the Plumbing Contractor for this Contract to ensure the Work is fully and properly coordinated with the work(s) of all other contracts, contractors, or parties involved in the Project.

No claims for delays or damages will be allowed where such delays or damages could have been avoided or mitigated through coordination or cooperation by and/or between this Contractor and any other contractor, contractors, party, or parties involved in the project.

The Plumbing Contractor shall maintain the work in such a condition as to allow the related works of other contracts to be installed. The work of others, which will be covered or built in by this Contract is to be installed prior to proceeding with the "covering or building-in" of such work or work areas.

No cutting and patching of floor slabs, finishes, or other "systems" to allow insertion of the work(s) of others will be permitted without the express permission of the Project Manager.

6.0 EQUIPMENT

All equipment specified herein shall be of the type and capacity shown on the equipment schedules in the drawings. Equipment shall be as manufactured by one of the manufacturers designated on this specification or shall be an equivalent.

Any deviations from the specifications must be submitted under separate cover as an alternate proposal to the contractor's primary bid and will be reviewed by the Services Engineer.

E. MISCELLANEOUS

6.0 EQUIPMENT

For ease of maintenance and parts replacement, equipment from a single manufacturer shall be used to the maximum extent possible. Plant and equipment shall be delivered to the job site in manufacturer's original unopened containers clearly labeled with manufacturer's name, brand designation and reference specification. Damage sustained by products in transit to job site shall be repaired to the satisfaction of the Services Engineer.

If damage sustained while transporting products to job site is not repairable, the products shall be replaced with new ones at no cost to owner. Equipment will not be accepted unless **“fixed in place”** by the contractor or placed into storage with the proper insurances and security.

The scheduled delivery of plant, equipment and other installation materials to job site must be done in accordance to contractors schedule and must take into account the requirements of job progress so as not to delay the work.

7.0 WARRANTIES & GUARANTEES

The Plumbing Contractor shall guarantee that all plant and equipment installed has been selected to the capacity specified and that under normal conditions, will operate without excessive noise or vibration.

The Plumbing Contractor shall also furnish the client with a written guarantee covering all workmanship and materials for a period of one (1) year from date of acceptance or substantial completion as determined by the Project manager or Architect.

The warranty shall also include an agreement to repair or replace, at the contractor's expense, including labor and material, all the defects that may appear at the time, which in the opinion of the Architect or Services Engineer are due to defective workmanship and/or material.

SCOPE OF WORKS

E. MISCELLANEOUS

8.0 ACCESS TO COMPLETED WORKS

The Plumbing Contractor shall inform himself fully regarding the peculiarities and limitations of the space available for the installation of materials under his contract. All devices such as valves, traps, strainers, cleanouts, controls, duct damper regulators, and other such apparatus, which are concealed above the ceilings or in furred spaces, shall be readily accessible.

Where interference's occur, and departures from indicated arrangement are required, the Plumbing Contractor shall consult with the other trades involved and come to an agreement as to changed locations and elevations of the ductwork and/or piping and shall obtain approval from the Architect/Engineer prior to implementing the proposed changes.

Claims for Modifications required to achieve coordination between each of the respective trades will not be entertained.

9.0 PROTECTIVE WEAR

Hard hats, proper eye protection and steel-tipped footwear are to be provided during all phases of this contract.

10.0 BUILDER'S WORKS

All major civil works will be carried out by the Main Contractor. The Pump Contractor shall, however, be responsible for the following:

1. All related Builder's Works such as fixing of pump skids, pipe support racks etc.
2. All other works as described herein or as indicated on the Drawings.

SCOPE OF WORKS

E. MISCELLANEOUS

11.0 PROJECT ENGINEER

All major civil works will be carried out by the Main Contractor.

The Plumbing Contractor shall at all times during the construction of the work, have a suitably qualified representative of "Project Engineer" status who is fully knowledgeable about the works. This representative must be authorised to act on the sub-contractor's behalf in matters pertaining to:-

- a) Coordination with other trades
- b) Site Instructions given by the Services Engineer during site inspections
- c) Organization of such tests as the Engineer may require, and
- d) Updating of drawings to "As Built" status

12.0 MANUFACTURER'S SUBMITTALS

Detailed manufacturer's cut-sheets and specifications shall be made available to the Services Consultant within **two (2) weeks** of the tender submission for the purposes of a separate Technical Evaluation.

The package must include and not be limited to –

- Sanitary ware, fixtures and fittings
- Pipes and fittings
- Hangars and brackets

NOTE: Manufacturer's names, model and/or part numbers must be clearly identified and must be accompanied by the relevant specification documents and/or cut-sheets.

SCOPE OF WORKS

12.0 MANUFACTURER'S SUBMITTALS

On award of the contract, a final equipment package shall be prepared and submitted to the Architect and/or Project Manager for final approval, prior to the ordering and/or purchasing of any equipment.

A full set of shop drawings shall be submitted for approval within **one (1) month** of the above.

13.0 MAINTENANCE & OPERATING MANUALS

Three (3) bound copies of all maintenance and operating manuals, inclusive of all manufacturers' cut sheets shall be provided at the time of the commissioning and hand-over of equipment to the Project manager and or Services Engineer.

The Plumbing Contractor shall make provisions in his pricing for any training and/or orientation sessions required with the Owner's technical representatives.

14.0 'AS BUILT' DRAWINGS

Electronic "as-built" drawings shall be provided to the Project Manager and/or Services Engineer in DWG format no later than one (1) month following hand-over of the installation.

15.0 APPROVALS

One (1) original and two (2) copies of the signed and stamped WASA Final Certificates of Approval shall be submitted to the Project Manager and/or Services Engineer at the time of hand-over of the installations.

16.0 MAINTENANCE CONTRACTS

All third-party maintenance contracts shall be in force at the time of official hand-over and acceptance of the operating systems.

SCOPE OF WORKS

17.0 FORMAT OF PAYMENT CLAIMS

The contract Bill of Quantities must be used in electronic form (Excel) on payment claim, indicating the following –

Contract details

Percentage claimed against each and every item for labour and materials

Amounts claimed against each and every item for labour and materials

This will assist in the rapid and accurate assessment of claims.

Where variations occur, they must also be submitted in electronic form (Excel), indicating each individual item, quantities, unit rates and amount claimed for both labour and materials content.

The exact format must be approved with the Project Manager and/or Services Engineer prior to commencement of works.

18.0 ELECTRICAL SAFETY STANDARDS

All work shall be performed in compliance with the **Occupational Safety and Health Act of 2004** and Construction Safety Act standards.

No person with the exception of the approved Electrical Contractor shall attempt to open and/or repair electrical switchgear, panelboards, equipment etc.

In addition, no defective extension cords, plugs, equipment and/or tools shall be used on the project.

All extension cords, plugs, equipment and/or tools proposed for use shall be inspected and approved by the Project Manager's designated Safety Officer.

SCOPE OF WORKS

18.0 ELECTRICAL SAFETY STANDARDS

Any contractor that causes damage to the site electrical equipment due to defective electrical equipment, tools, cords and/or illegal connections - shall be held fully responsible and shall bear full costs for the repairs etc.

All electrical extension cords shall be UL and/or CSA rated and shall be approved for industrial use – double insulated with a thick protective outer sheath. The contractor shall provide a sample of the above for approval by the Project Manager's designated Safety Officer prior to use.

All power tools and/or equipment shall be equipped with a safety ground conductor as part of the appliance's electrical cord – complete with a three-pin UL approved moulded male plug. Larger three phase equipment shall be provided with an approved ground terminal

Hand tools must only be plugged into the electrical power receptacles provided by the site's Electrical Contractor. No intermediate or other connections will be approved.

SCOPE OF WORKS

The **Electrical Installation** outlined herein refers directly to the works associated with the **Financial Services Commission Building** to be constructed at **Little Bay – Montserrat, W.I.**

The **Electrical Contractor** shall be responsible for the supply and installation of all fixtures, equipment, materials, labour and supervision necessary to carry out the Works, complete in all respects as outlined below.

The Works shall include but shall not be limited to:

- a) **415V 400A-3P** Main Isolator and feeder cables to -
 - ATS
 - ATS to generator
 - Signal cables from ATS to Generator Controller
- b) Main Distribution Panel '**M**' and associated main L.V. cables
- c) **125 KW / 156 KVA** standby generator complete with ATS and weatherproof sound-attenuated standby generator.
- d) Dry-type stepdown transformers –
 - 30 kVA 3-phase (400V – 208/120V)
 - 45 kVA 3-phase K-13 Factor Isolation Type (400V – 230/115V)
- e) Pre-commissioning testing of the transformers.
- f) Main L.V. sub-distribution panels 'AC', 'CS' and 'PS' and associated cables
- g) Sub-panels and associated feeder cables to service general lighting and power receptacles, ICT, AC fan coil units / evaporators, ventilation fans etc.
- h) Grounding of the following:
 - 1. Standby Generator
 - 2. L.V. transformers c/w ground bars
 - 3. Main L.V. panelboard, sub-distribution panels, cable trays, supports etc.
 - 3. Computer splitters and sub-panels.
 - 4. Communications (Voice/Data) and Security systems.
 - 5. Building and roof steel structures.
- i) Supply and installation of all lighting fixtures, power and special purpose outlets, all associated conduit and sub-circuit wiring etc.

The Works shall include but shall not be limited to – continued

- j) Isolators and power cables to air conditioning and ventilation equipment, exhaust fans, step-down transformers etc.
- k) Conduit infrastructure for the following:
 - 1. Fire Detection/Alarm system.
 - 2. Structured (Voice / Data) Cabling system
 - 3. Security (CCTV / Intrusion Alarm / Access Control) system
- l) All related Builder's Works.
- m) Inspections, testing and commissioning of the system.
- n) All other works described herein or as indicated on the Drawings.

PROJECT DESCRIPTION

A GENERAL

The proposed **Financial Services Commission Building** will be serviced by a Utility padmount transformer at **400/230V 3-phase 4-wire 60 Hertz**.

The Electrical contract will include for the supply and installation of the following –

- a) Main **415V 400A-3P** Main Isolator
- b) Cables from Main Isolator to ATS
- c) Cables from ATS to Standby Generator
- d) Signal cables from ATS to Generator Controller – **4C x 1.5mm² X.L.P.E.**
- e) **Main 400/230V Distribution Panel ‘M’** located on Level 1.

The supply, installation and commissioning of the 125kW / 156 kVA fully automatic standby generator will form part of this contract and should be installed and commissioned by a specialist Generator Contractor. The Electrical Contractor is to allow in his pricing for fixing the ATS in final position and all interconnected cabling.

The following voltages will be provided –

400/230V 3-phase 4-wire 60 Hertz – for AC equipment, lighting and special purpose receptacles

208/120V 3-phase 4-wire 60 Hertz – ICT equipment and 115-volt receptacles.

B. GROUNDING

The Electrical Contractor shall provide a grounding system for the above installation in accordance with details contained in this Specification and the Code, and shall be responsible for the following:

1. Grounding of the L.V. step-down transformers 'T1 – T2', inclusive of a ground-bus at each location.
2. Main L.V. panelboards 'M', 'CS' & 'PS', all industrial cable trays, lighting and power wiring trunking / raceways, supports etc.
3. Standby Generator
4. Building steel frame and roof structure.
5. Communications grounding, inclusive of all bus bars, bonding jumpers etc.
6. All trunking, cable trays, lighting fixtures etc.

NOTE: The Electrical Contractor shall supply and install thermal welds (Cad weld™) at all grounding points, with the following exceptions:

- a) The ground lugs supplied with the transformers and generator.

No other exceptions will be permitted and cable-to-ground rod terminations utilizing split-bolt connectors will not be approved.

C. LOW VOLTAGE WORKS

The electrical contractor shall supply and install a **400 Amp Main Isolator, Panel 'M'** and associated main L.V. cables as described overleaf.

Transient voltage surge suppressor (TVSS) units will be installed on Panel 'M'.

Sub-panel cable feeders will be run on industrial cable tray or metal trunking.

The conduit infrastructure for both Communication (Voice / Data) and Security Systems shall be run in a similar manner, to include all steel trunking and basket trays as required.

Provisions will be made for the installation of “clean” circuits for computer ICT outlets

NOTE: Each panel servicing computer, AV and/or electronic loads shall be rated by the manufacturer for “non-linear electrical loads” and shall be supplied with –

C. LOW VOLTAGE WORKS

- a) Isolated ground bus
- b) 200% rated isolated neutral bus
- c) Equipment ground bus bonded to panelboard enclosure

A separate fully enclosed grounded metallic trunking / conduit system must be installed for the routing of all computer power circuits and panel feeder cables.

The Electrical Contractor shall also include for the supply, installation and commissioning of the two (2) L.V. step-down transformers.

This contract is also to include for all power receptacles and cabling to AC fan coil and evaporator units, fans, kitchen outlets, hand dryers etc. - inclusive of serviceman isolators and feeders to air conditioning condensing units and all industrial cable tray and supports.

NOTES:

1. **The power cables to the roof AC condensing units shall be routed on industrial cable tray and terminated on weatherproof serviceman isolators, independently supported – they shall not be mounted on the vertical wall panels.**

The electrical contractor shall supply and install the raceway and conduit / trunking infrastructure for the following:

- a) Structured Cabling – (Voice / Data) system to floor Communications Rooms
- b) Fire Detection / Alarm system
- c) Security system.

Draw wires shall be left in conduits, for the later installation by specialist sub-contractors.

NOTE: The Structured Cabling, Security and Fire Detection systems shall be carried out by approved specialist sub-contractors, to be appointed separately.

The Electrical Contractor shall also include in his pricing for an Infra Red Scan of the main L.V. switchboard and all sub-panels. This inspection shall be carried out **three (3) months** after the building has been officially handed over to the Client.

All defects shall be made good by the electrical contractor and the Inspection Report shall be submitted to the Engineer complete with infra-red photographs.

C. LOW VOLTAGE WORKS

The Electrical Contractor shall also include in his pricing for the following –

- a) Electrical load measurements of all main and sub-panels prior to handover, and individual load sheets shall be submitted for each panelboard - the Electrical Contractor is to ensure that maximum balancing across the phases is achieved.
- b) The main grounding system is measured when the electrical installation has been completed and commissioned, to ensure that the overall resistance $\leq 5 \text{ Ohm}$. In this regard, a ground resistance test shall be carried out at the onset of the contract and the results submitted to the Services Consultant.
- b) All special threaded stainless steel hangers and supports (Hilti or approved equal) for the High Bay aisle lighting.

E. MISCELLANEOUS

Hard hats, proper eye protection and steel-tipped footwear are to be provided during all phases of this contract.

All major civil works will be carried out by the Main Contractor. The Electrical Contractor shall, however, be responsible for the following:

1. All related Builder's Works such as cutting and chasing of walls and/or floors, penetrations, making good, fixing and supporting of all cables, trunking, cable trays and associated supports, conduit, lighting fixtures etc. The trenching and backfilling will be carried out by the Main Contractor.

NOTE: The Electrical Contractor shall allow in his pricing for the supply and installation of all lighting fixture supports as follows –

1. **Recessed troffer fixtures – steel wire supports fastened to each corner and fixed to underside of soffit.**
2. **Downlighters – 6mm (¼ inch) ply back and steel wire supports.**
2. All other works as described herein or as indicated on the Drawings.
3. The Electrical Contractor shall at all times during the construction of the work, have a suitably qualified representative of "Project Engineer" status who is fully knowledgeable about the works. This representative must be authorised to act on the sub-contractor's behalf in matters pertaining to:-
 - a) Coordination with other trades.
 - b) Site Instructions given by the Services Engineer during site inspections.
 - c) Organisation of such tests as the Engineer may require, and
 - d) Updating of drawings to "As Built" status.

E. MISCELLANEOUS

- b) Fireproofing of all cable penetrations through floor slabs and/or walls, emanating from vertical chases, with *U.L. / NFPA* approved sealing (foam) compound.
- 5. Associated power and control cabling to owner-supplied standby generator.

F. MISCELLANEOUS ITEMS

1.0 DRAWINGS & SPECIFICATIONS

The Drawings and Specifications are intended to be complete and considered supplementary to one another. Materials or workmanship indicated, called for, or implied by one and not the other, shall be furnished and installed as though specifically called for by both. Should any discrepancy appear in either, call such discrepancy to attention of the Services Engineer for clarification and correction before executing the works. Failure to address design queries within a reasonable period will not constitute a claim for time extension.

It is the intent of the Drawings and Specifications to obtain a complete and satisfactory installation. The Mechanical and Electrical drawings are descriptive and diagrammatic but are to be followed as closely as the actual construction of the building and the work of other trades will permit.

The drawings are diagrammatic and indicate general arrangement of systems and equipment included in the scope of this project. The Electrical Contractor shall follow drawing in laying out work; check drawings of all trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. The Electrical Contractor must also verify all field dimensions, setbacks and penetrations using the site copy of the architectural drawings provided by the main contractor or any other recognized client's representative.

Where headroom or space conditions appear inadequate, the Project Manager shall be notified before proceeding with the installation. If directed by the Project Manager or Services Engineer, the Electrical Contractor shall, without extra charge, make reasonable modifications in layout as needed to prevent conflict with work of various trades or for proper execution of the work.

Where variances occur between drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in contract price.

The Services Engineer shall decide on the item and manner in which the work shall be installed. Prior to fabrication and/or installation, the Electrical Contractor shall submit detailed shop drawings and calculations as indicated in other sections of the specifications.

2.0 L.V. SWITCHGEAR SPECIFICATION

The Services Engineer has carried out a *Short Circuit / Protective Device Coordination* exercise and specific protective devices have been chosen to achieve proper overcurrent protection and coordination between devices.

The Electrical Contractor is free to choose from alternative manufacturers on condition that –

All protective devices are sourced from one (1) manufacturer.

The desired short circuit ratings and protective device coordination is maintained.

No variance from the above will be considered.

The Short Circuit rating and/or capacity of a panelboard will be determined by the lowest rating of any circuit breaker within the panelboard, which must also be braced to provide the required short circuit withstand.

No mismatching of circuit breakers within a panelboard will be considered and if a different manufacturer than specified is offered for the complete package, it will only be considered if the intended coordination of the protective devices can be demonstrated to the Consultant's satisfaction by the an appropriate *Short Circuit / Protective Device Coordination* study for the complete electrical installation.

3.0 DESIGN QUERIES / CLARIFICATION

Any Design queries or issues which may require further clarification by the Project manager, Architect or Services Engineer shall be called to the attention of the Engineer at least four (4) days prior to the bid submission date.

4.0 TIMELY DELIVERY OF EQUIPMENT

It shall be the Electrical Contractor's responsibility to obtain delivery dates for all of the essential equipment specified and approved to coordinate with project construction schedule so that materials arrive at job site in adequate time for installation.

5.0 COORDINATION OF SERVICES

This Section includes administrative and supervisory requirements necessary for coordinating construction operations on the Project to be collectively fulfilled by the Electrical Contractor.

5.0 COORDINATION OF SERVICES

The Electrical Contractor's responsibility includes, but is not limited to, the following:

- General project coordination and scheduling procedures as directed by the Project manager
- Conservation of all consumables and other materials required to complete the installation works
- Provision of coordination drawings as required
- Providing the necessary Administrative and supervisory personnel as required under the terms and conditions of the contract.
- Cleaning and protection of all finished works prior to handover to the client

Where applicable, the Electrical Contractor shall participate in specified coordination requirements as directed by the project manager. Note that certain areas of responsibility may be assigned to a specific contractor.

The Electrical Contractor through his site and administration representatives shall coordinate all construction activities with those of other prime contractors and other entities involved to assure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations included under different Sections of the Specifications that depend on each other for proper installation, connection, and operation.

The Electrical Contractor, along with all other contractors, and the Architect will work together to provide for the most logical and expeditious assembly and progress, however this will not relieve the Electrical Contractor of his obligations to coordinate with and accommodate the work of others.

The Electrical Contractor shall schedule the construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

Where availability of space is limited, the Electrical Contractor shall coordinate installation of different components with other services contractors to assure maximum accessibility for required maintenance, service, and repair.

The Electrical Contractor shall make adequate provisions to accommodate items scheduled for later installation.

The Electrical Contractor shall coordinate scheduling and timing of all required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and assure orderly progress of the Work.

5.0 COORDINATION OF SERVICES

These activities include, but are not limited to, the following:

1. Preparation of Coordination schedules.
2. Preparation of Coordination drawings
3. Preparation of “As Built” drawings
4. The installation and removal of temporary works and facilities as required.
5. The timely delivery and processing of technical submittals and samples for approval
6. Prompt attendance at all Progress / Site meetings as required
7. Completion of all project closeout activities to the satisfaction of the Project Manager

Note that the works covered under of all other contracts will affect the overall schedule and coordination of the Work of this Contract. Requirements and limitations of work progress as may be required by other contracts shall be binding on the schedule of this Contract. The Electrical Contractor must therefore be totally familiar with the schedule requirements of all other contracts as they may affect the scheduling and progress of this contract.

The Electrical Contractor will be required to under take all integrations and coordination to ensure the seamless integration all associated systems between all services inclusive but not limited to the electrical works, plumbing works, HVAC works, BMS system, fire alarm, security systems and any other trade deemed necessary by the Project Manager.

The Architect / Project manager will note and facilitate the coordination efforts between the various contractors and parties involved in the Project. It shall however remain the sole responsibility of the Electrical Contractor for this Contract to ensure the Work is fully and properly coordinated with the work(s) of all other contracts, contractors, or parties involved in the Project.

No claims for delays or damages will be allowed where such delays or damages could have been avoided or mitigated through coordination or cooperation by and/or between this Contractor and any other contractor, contractors, party, or parties involved in the project.

The Electrical Contractor shall maintain the work in such a condition as to allow the related works of other contracts to be installed. The work of others, which will be covered or built in by this Contract is to be installed prior to proceeding with the "covering or building-in" of such work or work areas.

No cutting and patching of floor slabs, finishes, or other "systems" to allow insertion of the work(s) of others will be permitted without the express permission of the Project Manager.

6.0 EQUIPMENT

All equipment specified herein shall be of the type and capacity shown on the equipment schedules in the drawings. Equipment shall be as manufactured by one of the manufacturers designated on this specification or shall be an equivalent.

Any deviations from the specifications must be submitted under separate cover as an alternate proposal to the contractor's primary bid and will be reviewed by the Services Engineer.

For ease of maintenance and parts replacement, equipment from a single manufacturer shall be used to the maximum extent possible. Plant and equipment shall be delivered to the job site in manufacturer's original unopened containers clearly labeled with manufacturer's name, brand designation and reference specification. Damage sustained by products in transit to job site shall be repaired to the satisfaction of the Services Engineer.

If damage sustained while transporting products to job site is not repairable, the products shall be replaced with new ones at no cost to owner. Equipment will not be accepted unless **“fixed in place”** by the contractor or placed into storage with the proper insurances and security.

The scheduled delivery of plant, equipment and other installation materials to job site must be done in accordance to contractors schedule and must take into account the requirements of job progress so as not to delay the work.

7.0 WARRANTIES & GUARANTEES

The Electrical Contractor shall guarantee that all plant and equipment installed has been selected to the capacity specified and that under normal conditions, will operate without excessive noise or vibration.

The Electrical Contractor shall also furnish the client with a written guarantee covering all workmanship and materials for a period of one (1) year from date of acceptance or substantial completion as determined by the Project manager or Architect.

The warranty shall also include an agreement to repair or replace, at the contractor's expense, including labor and material, all the defects that may appear at the time, which in the opinion of the Architect or Services Engineer are due to defective workmanship and/or material.

8.0 ACCESS TO COMPLETED WORKS

The Electrical Contractor shall inform himself fully regarding the peculiarities and limitations of the space available for the installation of materials under his contract. All devices such as valves, traps, strainers, cleanouts, controls, duct damper regulators, and other such apparatus, which are concealed above the ceilings or in furred spaces, shall be readily accessible.

Where interference's occur, and departures from indicated arrangement are required, the Electrical Contractor shall consult with the other trades involved and come to an agreement as to changed locations and elevations of the ductwork and/or piping and shall obtain approval from the Architect/Engineer prior to implementing the proposed changes. Claims for Modifications required to achieve coordination between each of the respective trades will not be entertained.

9.0 PROTECTIVE WEAR

Hard hats, proper eye protection and steel-tipped footwear are to be provided during all phases of this contract.

10.0 BUILDER'S WORKS

All major civil works will be carried out by the Main Contractor. The Electrical Contractor shall, however, be responsible for the following:

1. All related Builder's Works such as cable duct trenching and backfilling, cutting and chasing of walls and/or floors, penetrations, making good, fixing and supporting of all cables, trunking, cable trays and associated supports, conduit, lighting fixtures etc.
2. All other works as described herein or as indicated on the Drawings.

11.0 PROJECT ENGINEER

All major civil works will be carried out by the Main Contractor.

The Electrical Contractor shall at all times during the construction of the work, have a suitably qualified representative of "Project Engineer" status who is fully knowledgeable about the works. This representative must be authorised to act on the sub-contractor's behalf in matters pertaining to:-

- a. Coordination with other trades
- b. Site Instructions given by the Services Engineer during site inspections
- c. Organisation of such tests as the Engineer may require, and
- d. Updating of drawings to "As Built" status

12.0 MANUFACTURER’S SUBMITTALS

Detailed manufacturer’s cut-sheets and specifications shall be made available to the Services Consultant within **two (2) weeks** of the tender submission for the purposes of a separate Technical Evaluation.

The package must include and not be limited to –

- Main L.V. Isolator
- Standby generator, ATS and weatherproof enclosure
- Main L.V. distribution panelboard circuit breaker
- L.V. distribution and sub-panels
- ATS
- L.V. transformers
- TVSS unit
- Light switches and power outlets
- Serviceman isolators
- Cable Tray, conduit, trunking, supports and fittings
- L.V. cables – multi and/or single core

NOTE: Manufacturer’s names, model and/or part numbers must be clearly identified and must be accompanied by the relevant specification documents and/or cut-sheets.

On award of the contract, a final equipment package shall be prepared and submitted to the Services Consultant for final approval, prior to the ordering and/or purchasing of any equipment.

A full set of shop drawings shall be submitted for approval within **one (1) month** of the above.

13.0 MAINTENANCE & OPERATING MANUALS

Three (3) bound copies of all maintenance and operating manuals, inclusive of all manufacturers’ cut sheets shall be provided at the time of the commissioning and hand-over of equipment to the Project manager and or Services Engineer.

The Electrical Contractor shall make provisions in his pricing for any training and/or orientation sessions required with the Owner’s technical representatives.

14.0 ‘AS BUILT’ DRAWINGS

Electronic “as-built” drawings shall be provided to the Project Manager and/or Services Engineer in **DWG** format no later than one (1) month following hand-over of the installation.

15.0 APPROVALS

One (1) original and two (2) copies of the signed and stamped High Voltage Test Sheets and the H.V. / L.V. Mains Certificates of Approval shall be submitted to the Project Manager and/or Services Engineer at the time of hand-over of the installations.

16.0 MAINTENANCE CONTRACTS

All third-party maintenance contracts shall be in force at the time of official hand-over and acceptance of the operating systems.

17.0 TENDER SUBMISSION FORMAT

Whilst it will be acceptable to submit a hand-written Bill of Quantities, this must be accompanied by an electronic Excel duplicate at the time of tendering.

18.0 FORMAT OF PAYMENT CLAIMS

The contract Bill of Quantities must be used in electronic form (Excel) on payment claim, indicating the following –

Contract details

Percentage claimed against each and every item for labour and materials

Amounts claimed against each and every item for labour and materials

This will assist in the rapid and accurate assessment of claims.

Where variations occur, they must also be submitted in electronic form (Excel), indicating each individual item, quantities, unit rates and amount claimed for both labour and materials content.

The exact format must be approved with the Project Manager and/or Services Engineer prior to commencement of works.

19.0 ELECTRICAL SAFETY STANDARDS

All work shall be performed in compliance with the relevant local **Occupational Safety and Health Act** and Construction Safety Act standards.

No person with the exception of the approved Electrical Contractor shall attempt to open and/or repair electrical switchgear, panelboards, equipment etc.

In addition, no defective extension cords, plugs, equipment and/or tools shall be used on the project.

All extension cords, plugs, equipment and/or tools proposed for use shall be inspected and approved by the Project Manager's designated Safety Officer.

Any contractor that causes damage to the site electrical equipment due to defective electrical equipment, tools, cords and/or illegal connections - shall be held fully responsible and shall bear full costs for the repairs etc.

All electrical extension cords shall be UL and/or CSA rated and shall be approved for industrial use – double insulated with a thick protective outer sheath. The contractor shall provide a sample of the above for approval by the Project Manager's designated Safety Officer prior to use.

All power tools and/or equipment shall be equipped with a safety ground conductor as part of the appliance's electrical cord – complete with a three-pin UL approved moulded male plug. Larger three phase equipment shall be provided with an approved ground terminal

Hand tools must only be plugged into the electrical power receptacles provided by the site's Electrical Contractor. No intermediate or other connections will be approved.

SCOPE OF WORKS

The **Standby Generator Specification** outlined herein refers directly to the Generator Package to be installed at the proposed the **Financial Services Commission Building** to be constructed at **Little Bay – Montserrat, W.I.**

The Specialist Generator Supplier shall be responsible for the supply and installation of all equipment, materials, labour and supervision necessary to carry out the Works, complete in all respects as outlined below. The Works shall include but shall not be limited to:

1. Supply, installation of a new **125 kW / 156 kVA, 400/230-volt, 3-phase, 4-pole 60 Hertz 1800 RPM Generator / 400A ATS** inclusive of -
 - a) **8-hour** diesel storage base tank
 - b) Sound attenuated weatherproof enclosure
 - c) Residential silencer
 - d) Craneage associated with both the removal of the existing set and installation in final position of the new generator.
 - e) Pre-commissioning testing and commissioning of the generator and automatic transfer switches
 - f) All other works described herein or as indicated on the Drawings.

PROJECT DESCRIPTION

A GENERAL

The Standby Generators are at **grade** - craneage must be provided for in costing.

The Generator Contractor will provide a generator package in conformance the Technical Specification.

The Generator Contractor shall also include in his costs for all insurances, craneage etc. required to complete the Works in all respects.

NOTE: The Generator Contractor is to visit the proposed site to familiarize himself with site conditions etc.

B. MISCELLANEOUS

All major civil works will be carried out by the Main Contractor. The Generator Contractor shall, however, be responsible for the following:

- a) The Generator Contractor shall at all times during the construction of the work, have a suitably qualified representative of "Project Engineer" status who is fully knowledgeable about the works. This representative must be authorised to act on the sub-contractor's behalf in matters pertaining to:-
 - 1. Coordination with other trades.
 - 2. Site Instructions given by the Services Engineer during site inspections.
 - 3. Organisation of such tests as the Engineer may require, and
 - 4. Updating of drawings to "As Built" status.
- a) The generator power and control cables will be disconnected from the exiting set, and the new cables will be supplied and installed by the Electrical Contractor for final connection by the Generator Contractor.
- b) The switchover can take place during regular working hours, on a day to be identified by the Client.

C. MISCELLANEOUS

1.0 DRAWINGS & SPECIFICATIONS

The Drawings and Specifications are intended to be complete and considered supplementary to one another. Materials or workmanship indicated, called for, or implied by one and not the other, shall be furnished and installed as though specifically called for by both. Should any discrepancy appear in either, call such discrepancy to attention of the Services Engineer for clarification and correction before executing the works. Failure to address design queries within a reasonable period will not constitute a claim for time extension.

It is the intent of the Drawings and Specifications to obtain a complete and satisfactory installation. The Mechanical and Electrical drawings are descriptive and diagrammatic but are to be followed as closely as the actual construction of the building and the work of other trades will permit.

The drawings are diagrammatic and indicate general arrangement of systems and equipment included in the scope of this project. The Generator Contractor shall follow drawing in laying out work; check drawings of all trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. The Generator Contractor must also verify all field dimensions, setbacks and penetrations using the site copy of the architectural drawings provided by the main contractor or any other recognized client's representative.

Where headroom or space conditions appear inadequate, the Project Manager shall be notified before proceeding with the installation. If directed by the Project Manager or Services Engineer, the Generator Contractor shall, without extra charge, make reasonable modifications in layout as needed to prevent conflict with work of various trades or for proper execution of the work.

Where variances occur between drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in contract price.

The Services Engineer shall decide on the item and manner in which the work shall be installed. Prior to fabrication and/or installation, the Generator Contractor shall submit detailed shop drawings and calculations as indicated in other sections of the specifications.

2.0 DESIGN QUERIES / CLARIFICATION

Any Design queries or issues which may require further clarification by the Project manager, Architect or Services Engineer shall be called to the attention of the Engineer at least four (4) days prior to the bid submission date.

3.0 TIMELY DELIVERY OF EQUIPMENT

It shall be the Generator Contractor's responsibility to obtain delivery dates for all of the essential equipment specified and approved to coordinate with project construction schedule so that materials arrive at job site in adequate time for installation.

4.0 COORDINATION OF SERVICES

This Section includes administrative and supervisory requirements necessary for coordinating construction operations on the Project to be collectively fulfilled by the Generator Contractor.

The Generator Contractor's responsibility includes, but is not limited to, the following:

- General project coordination and scheduling procedures as directed by the Project manager
- Conservation of all consumables and other materials required to complete the installation works
- Provision of coordination drawings as required
- Providing the necessary Administrative and supervisory personnel as required under the terms and conditions of the contract.
- Cleaning and protection of all finished works prior to handover to the client

Where applicable, the Generator Contractor shall participate in specified coordination requirements as directed by the project manager. Note that certain areas of responsibility may be assigned to a specific contractor.

The Generator Contractor through his site and administration representatives shall coordinate all construction activities with those of other prime contractors and other entities involved to assure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations included under different Sections of the Specifications that depend on each other for proper installation, connection, and operation.

The Generator Contractor, along with all other contractors, and the Architect will work together to provide for the most logical and expeditious assembly and progress, however this will not relieve the Electrical Contractor of his obligations to coordinate with and accommodate the work of others.

The Generator Contractor shall schedule the construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

Where availability of space is limited, the Generator Contractor shall coordinate installation of different components with other services contractors to assure maximum accessibility for required maintenance, service, and repair.

4.0 COORDINATION OF SERVICES

The Generator Contractor shall make adequate provisions to accommodate items scheduled for later installation. The Generator Contractor shall coordinate scheduling and timing of all required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and assure orderly progress of the Work.

These activities include, but are not limited to, the following:

1. Preparation of coordination schedules.
2. Preparation of coordination drawings i.e. switchgear, main transformer and electrical room(s) detailed equipment layouts for the Services Engineer approval
3. Preparation of “As Built” drawings
4. The installation and removal of temporary works and facilities as required.
5. The timely delivery and processing of technical submittals and samples for approval
6. Prompt attendance at all Progress / Site meetings as required
7. Completion of all project closeout activities to the satisfaction of the Project Manager

Note that the works covered under of all other contracts will affect the overall schedule and coordination of the Work of this Contract. Requirements and limitations of work progress as may be required by other contracts shall be binding on the schedule of this Contract. The Electrical Contractor must therefore be totally familiar with the schedule requirements of all other contracts as they may affect the scheduling and progress of this contract.

The Generator Contractor will be required to undertake all integrations and coordination to ensure the seamless integration all associated systems between all services inclusive but not limited to the electrical works, plumbing works, HVAC works, BMS system, fire alarm, security systems and any other trade deemed necessary by the Project Manager.

The Architect / Project manager will note and facilitate the coordination efforts between the various contractors and parties involved in the Project. It shall however remain the sole responsibility of the Generator Contractor for this Contract to ensure the Work is fully and properly coordinated with the work(s) of all other contracts, contractors, or parties involved in the Project.

No claims for delays or damages will be allowed where such delays or damages could have been avoided or mitigated through coordination or cooperation by and/or between this Contractor and any other contractor, contractors, party, or parties involved in the project.

The Generator Contractor shall maintain the work in such a condition as to allow the related works of other contracts to be installed. The work of others, which will be covered or built in by this Contract is to be installed prior to proceeding with the "covering or building-in" of such work or work areas.

4.0 COORDINATION OF SERVICES

No cutting and patching of floor slabs, finishes, or other "systems" to allow insertion of the work(s) of others will be permitted without the express permission of the Project Manager.

5.0 EQUIPMENT

All equipment specified herein shall be of the type and capacity shown on the equipment schedules in the drawings. Equipment shall be as manufactured by one of the manufacturers designated on this specification or shall be an equivalent.

Any deviations from the specifications must be submitted under separate cover as an alternate proposal to the contractor's primary bid and will be reviewed by the Services Engineer.

For ease of maintenance and parts replacement, equipment from a single manufacturer shall be used to the maximum extent possible. Plant and equipment shall be delivered to the job site in manufacturer's original unopened containers clearly labeled with manufacturer's name, brand designation and reference specification. Damage sustained by products in transit to job site shall be repaired to the satisfaction of the Services Engineer.

If damage sustained while transporting products to job site is not repairable, the products shall be replaced with new ones at no cost to owner. Equipment will not be accepted unless **"fixed in place"** by the contractor or placed into storage with the proper insurances and security.

The scheduled delivery of plant, equipment and other installation materials to job site must be done in accordance to contractors schedule and must take into account the requirements of job progress so as not to delay the work.

6.0 WARRANTIES & GUARANTEES

The Generator Contractor shall guarantee that all plant and equipment installed has been selected to the capacity specified and that under normal conditions, will operate without excessive noise or vibration.

The Generator Contractor shall also furnish the client with a written guarantee covering all workmanship and materials for a period of one (1) year from date of acceptance or substantial completion as determined by the Project manager or Architect.

The warranty shall also include an agreement to repair or replace, at the contractor's expense, including labor and material, all the defects that may appear at the time, which in the opinion of the Architect or Services Engineer are due to defective workmanship and/or material.

7.0 PROTECTIVE WEAR

Hard hats, proper eye protection and steel-tipped footwear are to be provided during all phases of this contract.

8.0 BUILDER'S WORKS

All major civil works will be carried out by the Main Contractor.

9.0 PROJECT ENGINEER

The Generator Contractor shall at all times during the construction of the work, have a suitably qualified representative of "Project Engineer" status who is fully knowledgeable about the works. This representative must be authorized to act on the sub-contractor's behalf in matters pertaining to:-

- a. Coordination with other trades
- b. Site Instructions given by the Services Engineer during site inspections
- c. Organization of such tests as the Engineer may require, and
- d. Updating of drawings to "As Built" status

10.0 MANUFACTURER'S SUBMITTALS

Detailed manufacturer's cut-sheets and specifications shall be made available to the Services Consultant within **two (2) weeks** of the tender submission for the purposes of a separate Technical Evaluation.

The package must include and not be limited to –

- Standby Generator
- Automatic Transfer Switch
- Weather-Proof / Sound Attenuated Enclosure
- Controls & Devices

NOTE: Manufacturer's names, model and/or part numbers must be clearly identified and must be accompanied by the relevant specification documents and/or cut-sheets.

On award of the contract, a final equipment package shall be prepared and submitted to the Services Consultant for final approval, prior to the ordering and/or purchasing of any equipment.

A full set of shop drawings (PDF & DWG) shall be submitted for approval within **one (1) month** of the above.

11.0 MAINTENANCE & OPERATING MANUALS

Three (3) bound copies of all maintenance and operating manuals, inclusive of all manufacturers' cut sheets shall be provided at the time of the commissioning and hand-over of equipment to the Project manager and/or Services Engineer.

The Generator Contractor shall make provisions in his pricing for any training and/or orientation sessions required with the Owner's technical representatives.

12.0 APPROVALS

One (1) original and two (2) copies of the signed and stamped Generator Startup and Commissioning Reports shall be submitted to the Project Manager and/or Services Engineer at the time of hand-over of the installations.

The Generator Contractor shall also be responsible for, prior to commencement of the works, submit all plans, specifications and/or cut-sheets to the local approving agencies.

13.0 MAINTENANCE CONTRACTS

All third-party maintenance contracts shall be in force at the time of official hand-over and acceptance of the operating systems.

14.0 TENDER SUBMISSION FORMAT

Whilst it will be acceptable to submit a hand-written Bill of Quantities, this must be accompanied by an electronic Excel duplicate at the time of tendering.

15.0 FORMAT OF PAYMENT CLAIMS

The contract Bill of Quantities must be used in electronic form (Excel) on payment claim, indicating the following –

- Contract details
- Percentage claimed against each and every item for labour and materials
- Amounts claimed against each and every item for labour and materials

This will assist in the rapid and accurate assessment of claims.

15.0 FORMAT OF PAYMENT CLAIMS

Where variations occur, they must also be submitted in electronic form (Excel), indicating each individual item, quantities, unit rates and amount claimed for both labour and materials content.

The exact format must be approved with the Project Manager and/or Services Engineer prior to commencement of works.

16.0 ELECTRICAL SAFETY STANDARDS

No person with the exception of the approved Generator Contractor shall attempt to open and/or repair the generators and/or switchgear.

In addition, no defective extension cords, plugs, equipment and/or tools shall be used on the project.

All extension cords, plugs, equipment and/or tools proposed for use shall be inspected and approved by the Project Manager's designated Safety Officer.

Any contractor that causes damage to the site electrical equipment due to defective electrical equipment, tools, cords and/or illegal connections - shall be held fully responsible and shall bear full costs for the repairs etc.

All electrical extension cords shall be UL and/or CSA rated and shall be approved for industrial use – double insulated with a thick protective outer sheath. The contractor shall provide a sample of the above for approval by the Project Manager's designated Safety Officer prior to use.

All power tools and/or equipment shall be equipped with a safety ground conductor as part of the appliance's electrical cord – complete with a three-pin UL approved moulded male plug. Larger three phase equipment shall be provided with an approved ground terminal

Hand tools must only be plugged into the electrical power receptacles provided by the site's Electrical Contractor. No intermediate or other connections will be approved.

HVAC INSTALLATION

SCOPE OF WORKS AND SYSTEM DESCRIPTION

1.1 SCOPE OF WORKS

The **Air Conditioning Installation** outlined herein refers directly to the HVAC works to be installed at the proposed **Financial Services Commission Building** to be constructed in Little Bay, Monsterrat, W.I.

The **Air Conditioning Contractor** shall be responsible for the supply and installation of all materials (where specified), labor and supervision necessary to carry out the Works, complete in all respects as outlined below.

1.2 SCOPE OF WORKS

1.2.1 General Provisions

The General provisions require that the HVAC contractor provide all labor, materials, necessary equipment and service to complete the mechanical work and related work, as indicated on the drawings, as specified herein, or both, including, but not necessarily limited to, the Supply and Installation (S&I) of the following:

- Supply, delivery, locating in final position and installation and commissioning of all equipment and accessories as listed in the Bill of Quantities or as indicated on the Drawings and covered under the base building contract
- S&I of Mitsubishi Heavy Industries Thermal Systems KXZ VRF Air Conditioning Systems (or approved equal) comprising a VRF condenser and coupled to multiple fan coil units as outlined in the attached specifications.
- S&I of the air distribution duct work systems and ductwork accessories including airflow station, supply & return terminals
- S&I of suitable insulated condensate drains from condensate pumps on all indoor fan coil units and connected to connect to the building drainage system.
- S&I of air handling units with starters, contactors, safety controls and all specified accessories has been covered under the base building contract
- S&I of all exhaust and ventilation fans and blowers as well as the supply and installation of supports and/or curbs for A/C units, exhaust and ventilation fans
- S&I of all specified air filtration equipment/ devices and accessories
- S&I of all electrical devices required for proper operations of equipment, including motors, starters, control devices, contactors, etc.

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- S&I of Volume Control Dampers (VCD's) and related devices and accessories.
- S&I of all thermally insulated ductwork, piping, and equipment insulation for additional A/C systems as specified and shown in the design drawings
- S&I of all vibration isolation equipment, devices and accessories as specified or as required by the equipment manufacturer to ensure the quite operation of the equipment.
- S&I of Refrigerant piping along with all other associated proprietary accessories such as REFNET joints and REFNET Headers, connection points, flow switches, temperature sensor wells and sockets and flow meters, pipe valve and equipment identification
- Start-up and adjusting of HVAC distribution system to the Project Managers / Services Engineer's satisfaction prior to hand over to the owner's representative
- Provision of all essential equipment operational manuals (O&M), schematic charts and instructions, guarantees and warranties
- Supply and installation of supports, brackets and trays for refrigerant piping, A/C equipment drains etc
- Clearing away of all debris arising from the Works
- Inspections, testing and commissioning of the systems
- All necessary Builders' Works, including trenching, ducting, cutting and chasing of walls or floors, penetrations, making good etc
- All other works described herein or as indicated on the Drawings
- All other items, appurtenances, accessories, controls etc. all as specified or required to ensure proper operation of the installation.
- Provision of Warranty and maintenance for one (1) year on all new equipment following commissioning and certification by the Engineer
- All of the above must be done in accordance with the Codes and Standards and the Technical Specifications which follow in this document.
- The equipment shall be supplied with a supplier / manufacturer's warranty for all defects for a period of five (5) years.

1.2.2 Drawings & Specifications

The Drawings and Specifications are intended to be complete and considered supplementary to one another. Materials or workmanship indicated, called for, or implied by one and not the other, shall be furnished and installed as though specifically called for by both.

Should any discrepancy appear in either, call such discrepancy to attention of the Design Engineer for clarification and correction before executing the works. Failure to address design queries within a reasonable period will not constitute a claim for time extension.

It is the intent of the Drawings and Specifications to obtain a complete and satisfactory installation. The Mechanical and Electrical drawings are descriptive and diagrammatic but are to be followed as closely as the actual construction of the building and the work of other trades will permit.

The drawings are diagrammatic and indicate general arrangement of systems and equipment included in the scope of this project. The HVAC Contractor shall follow drawing in laying out work; check drawings of all trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. The HVAC Contractor must also verify all field dimensions, setbacks and penetrations using the site copy of the architectural drawings provided by the main contractor or any other recognized client's representative.

Where headroom or space conditions appear inadequate, the Project Manager shall be notified before proceeding with installation. If directed by the Project Manager or Services Engineer, the HVAC Contractor shall, without extra charge, make reasonable modifications in layout as needed to prevent conflict with work of various trades or for proper execution of the work.

Where variances occur between drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in contract price.

The Services Engineer shall decide on the item and manner in which the work shall be installed. Prior to fabrication and/or installation, the HVAC Contractor shall submit detailed shop drawings and calculations as indicated in other sections of the specifications.

1.2.3 HVAC Design Queries/Clarification

Any Design queries or issues which may require further clarification by the Project manager, Architect or Services Engineer shall be called to the attention of the Engineer at least **seven (7) days** prior to the bid submission date.

1.2.4 Timely Delivery of Equipment

It shall be the HVAC Contractor's responsibility to obtain delivery dates for all of the essential equipment specified and approved to coordinate with project construction schedule so that materials arrive at job site in adequate time for installation.

1.2.5 Coordination of services

This Section includes administrative and supervisory requirements necessary for coordinating construction operations on the Project to be collectively fulfilled by the HVAC Contractor.

The HVAC contractor's responsibility includes, but is not limited to, the following:

- The overall project coordination responsibility and scheduling procedures as directed by the Project manager
- Conservation of all consumables and other materials required to affect the installation works.
- Provision of all Coordination drawings and other necessary documentation as required to ensure that equipment and plant is properly coordinated with all other trades.
- Providing the necessary Administrative and supervisory personnel as required under the terms and conditions of the contract.
- Cleaning and protection of all finished works prior to handover to the client
- Contract closeout as determined by the Contract document and/or the designated Project manager as well as the submission of all closeout documentation and hand over to the client.

Where applicable, the HVAC contractor shall participate in specified coordination requirements as directed by the project manager. Note that certain areas of responsibility may be assigned to a specific contractor.

The HVAC contractor through his site and administration representatives shall coordinate all construction activities with those of other prime contractors and other entities involved to assure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations included under different Sections of the Specifications that depend on each other for proper installation, connection, and operation.

The HVAC Contractor, along with all other contractors, and the Architect will work together to provide for the most logical and expeditious assembly and progress, however this will not relieve the HVAC Contractor of his obligations to coordinate with and accommodate the work of others.

The HVAC contractor shall schedule the construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation. Where availability of space is limited, the HVAC contractor shall coordinate installation of different components with other services contractors to assure maximum accessibility for required maintenance, service, and repair. The HVAC contractor shall make adequate provisions to accommodate items scheduled for later installation.

1.2.5 Coordination of services

The HVAC contractor shall coordinate scheduling and timing of all required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and assure orderly progress of the Work.

These activities include, but are not limited to, the following:

- 1.** Preparation of Coordination schedules.
- 2.** Preparation of Coordination drawings
- 3.** Preparation of "As Built" drawings
- 4.** The installation and removal of temporary works and facilities as required.
- 5.** The timely delivery and processing of technical submittals and samples for approval
- 6.** Prompt attendance at all Progress / Site meetings as required
- 7.** Completion of all Project closeout activities to the satisfaction of the Project manager

Note that the works covered under of all other contracts will affect the overall project master schedule and coordination of the Work of this Contract. Requirements and limitations of work progress as may be required by other contracts shall be binding on the schedule of this Contract. The HVAC contractor must therefore be totally familiar with the project master schedule requirements of all other contracts as they may affect the scheduling and progress of this contract.

The HVAC contractor will be required to under take all integrations and coordination to ensure the seamless integration all associated systems between all services inclusive but not limited to the electrical works, the plumbing works, BMS system, fire alarm, security systems and any other trade deemed necessary by the project manager.

The Architect / Project manager will note and facilitate the coordination efforts between the various contractors and parties involved in the Project. It shall however remain the sole responsibility of the HVAC Contractor for this Contract to ensure the Work is fully and properly coordinated with the work(s) of all other contracts, contractors, or parties involved in the Project. No claims for delays or damages will be allowed where such delays or damages could have been avoided or mitigated through coordination or cooperation by and/or between this Contractor and any other contractor, contractors, party, or parties involved in the Project.

The HVAC Contractor shall maintain the work in such a condition as to allow the related works of other contracts to be installed. The work of others, which will be covered or built in by this Contract is to be installed prior to proceeding with the "covering or building-in" of such work or work areas. No cutting and patching of floor slabs, finishes, or other "systems" to allow insertion of the work(s) of others will be permitted without the express permission of the Project manager

1.2.6 Equipment

All equipment specified herein shall be of the type and capacity shown on the equipment schedules in the drawings. Equipment shall be as manufactured by one of the manufacturers designated on this specification or shall be an equivalent. Any deviations from the specifications must be submitted under separate cover as an Alternate proposal to the contractor's primary bid and will be reviewed by the Services Engineer.

For ease of maintenance and parts replacement, equipment from a single manufacturer shall be used to the maximum extent possible. Plant and equipment shall be delivered to the job site in manufacturer's original unopened containers clearly labeled with manufacturer's name, brand designation and reference specification. Damage sustained by products in transit to job site shall be repaired to the satisfaction of the Services Engineer.

If damage sustained while transporting products to job site is not repairable, the products shall be replaced with new ones at no cost to owner. Equipment will not be accepted unless **“fixed in place”** by the contractor or placed into storage with the proper insurances and security.

The scheduled delivery of plant, equipment and other installation materials to job site must be done in accordance to contractors schedule and must take into account the requirements of job progress so as not to delay the work.

1.2.7 Warranty & Guarantees

The HVAC Contractor shall guarantee that all plant and equipment installed has been selected to the capacity specified and that under normal conditions, will operate without excessive noise or vibration.

The HVAC Contractor shall also furnish the client with a written guarantee covering all workmanship and materials for a period of one (1) year from date of acceptance or substantial completion as determined by the Project manager or Architect. The warranty shall also include an agreement to repair or replace, at the contractor's expense, including labor and material, all the defects that may appear at the time, which in the opinion of the Architect or Services Engineer are due to defective workmanship and/or material.

1.2.8 Access to Completed works

The HVAC Contractor shall inform himself fully regarding the peculiarities and limitations of the space available for the installation of materials under his contract. All devices such as valves, traps, strainers, cleanouts, controls, duct damper regulators, and other such apparatus, which are concealed above the ceilings or in furred spaces, shall be readily accessible.

Where interference's occur, and departures from indicated arrangement are required, the HVAC Contractor shall consult with the other trades involved and come to an agreement as to changed locations and elevations of the ductwork and/or piping and shall obtain approval from the Architect/Engineer prior to implementing the proposed changes. Claims for modifications required to achieve coordination between each of the respective trades will not be entertained.

2.0 MISCELLANEOUS

The following works shall form part of this contract:

1. Final connection of the control wiring
2. Supply and installation of all condensate lines with related traps, all to be coordinated with the HVAC Contractor.
3. Supply and installation of any steel supports or curbs required for the suspension or support of equipment.
4. Details of designs and specifications of all plinths, supports, curbs, etc. required for plant and equipment are to be provided by the HVAC Contractor.
5. Wiring schematics (power and control) shall be included with this submission for the air conditioning equipment.
6. The HVAC Contractor shall at all times during the construction of the work, have a suitably qualified representative of **“Project Engineer”** status who is fully knowledgeable about the works.

The HVAC Contractor must provide the Project manger, Project Architect and Services Engineers a minimum of two modes of contact (i.e. Cell phone AND Email Address) for the aforementioned **“Project Engineer.”**

7. This representative must empowered and fully authorized to act on the sub-contractor’s behalf in matters pertaining to:-
 - Coordination with other trades.
 - Problem solving and troubling shooting all technical “on site” issues as well as any other issues as required under the contract.
 - Site instructions given by the Services Engineer during site inspections.
 - Organization of such tests as the Engineer may require.
 - Updating of drawings to “As Built” status.
 - ANY VARIATION CONTAINED IN THE TENDER SUBMISSION CONTRARY TO TENDER SPECIFICATIONS CAN RESULT IN AUTOMATIC DISQUALIFICATION.
8. The maintenance period of one (1) year will include for both defects liability and four (4) routine service-maintenance checks.
9. Fireproofing of all pipe penetrations through floor slabs and/or walls, in accordance with ***U.L. / NFPA*** approved sealing (foam) compound.

3.0 PRELIMINARY SYSTEM DESCRIPTION

Air Conditioning & Ventilation

Air conditioning shall be provided to the following areas to achieve internal temperatures of **72 to 74 °F** dry bulb.

The **VRF Condensing Units** will be located on an equipment plinth at grade just outside the **North Eastern** side of the building. There will be designated groups of **VRV Condensing Units** for each floor. The service areas provided for these purposes shall have adequate ventilation to allow dissipation of heat from the condenser units and may also be acoustically treated to minimize the noise nuisance.

It is the intention that the operation of the new building services systems shall not increase the existing background noise levels of the site. In this regard, both the external and internal units shall be selected for low noise output to prevent acoustic nuisance to occupants.

The **Condensing Units** shall be selected at design noise levels no greater than **65 dB (A)** measured at one (1) meter from the front of the unit. The equipment manufacturer must confirm the equipment sound level performance.

The general office internal design noise levels shall be selected at design noise levels no greater than **45 dB (A)** measured at 1 meter from the front of the unit.

a) Air Conditioning – Level 1

Air conditioning within the **Senior Officer Rooms** shall be achieved by **Cassette Units Fan Coil Units** mounted in the ceilings as indicated on the design drawings. Air conditioning within the **Kitchen/ Lunch Room, Storage Rooms 1 & 2, Interview Rooms 1 & 2, Server Room, FSC Archives Room and L.V Electrical Room** shall be achieved by **High Wall Mounted Fan Coil Units** mounted on the walls as indicated on the design drawings. Air conditioning within the **Junior Officers Room and Big Hall** shall be achieved by a **Ceiling Concealed Fan Coil Units** mounted within the ceiling void of the space as indicated on the design drawings. Each fan coil unit shall have a wireless combined on/off/fan speed/temperature controller, located in a wall mounted 'holster'. The discharge air from the ceiling concealed fan coil unit shall be delivered via insulated and vapor sealed ductwork to supply diffusers. These units are to be served by a condensing unit installed on the North Eastern side of the building.

b) Air Conditioning – Level 2

Air conditioning within the **FSC Commissioner Office, Library/ Training Room and Conference Room** shall be achieved by **Cassette Units Fan Coil Units** mounted in the ceilings as indicated on the design drawings. Air conditioning within the **Electrical & Server Room, IP & CO Filing Room, FSC Filing Room and Kitchen** shall be achieved by **High Wall Mounted Fan Coil Units** mounted on the walls as indicated on the design drawings. Air conditioning within the **FSC Main Office, Lobby & DA Meeting Room and**

Hall shall be achieved by a **Ceiling Concealed Fan Coil Units** mounted within the ceiling void of the space as indicated on the design drawings. Each fan coil unit shall have a wireless combined on/off/fan speed/temperature controller, located in a wall mounted 'holster'. The discharge air from the ceiling concealed fan coil unit shall be delivered via insulated and vapor sealed ductwork to supply diffusers. These units are to be served by a condensing unit installed on the North Eastern side of the building.

c) Air Conditioning – Level 3

Air conditioning within the **Auditor General Office, Dep. Auditor Office, and Library** shall be achieved by **Cassette Units Fan Coil Units** mounted in the ceilings as indicated on the design drawings. Air conditioning within the **Server Room, Telecom/ Electrical Room, Filing Room and Kitchen** shall be achieved by **High Wall Mounted Fan Coil Units** mounted on the walls as indicated on the design drawings. Air conditioning within the **Audit Main Floor, Lobby and Hall** shall be achieved by a **Ceiling Concealed Fan Coil Units** mounted within the ceiling void of the space as indicated on the design drawings. Each fan coil unit shall have a wireless combined on/off/fan speed/temperature controller, located in a wall mounted 'holster'. The discharge air from the ceiling concealed fan coil unit shall be delivered via insulated and vapor sealed ductwork to supply diffusers. These units are to be served by a condensing unit installed on the North Eastern side of the building.

d) Outside Air Processing System

An **Outside Air Processing System** will be utilized to provide conditioned outside air to the building. The **Outside Air Processing Concealed Fan Coil Units** shall be located within the ceiling void of the **FSC Archives Room on Level 1**, the **FSC Filing Room on Level 2**, and the **Filing Room on Level 3**. Each of the **Outside Air Processing Concealed Fan Coil Units** shall be connected to an outside air louver installed on an external wall of the building and connected to the designated **VRV Condensing Unit** for the **Outside Air Processing System**, located on the North Eastern side of the building as indicated on the drawings. The service areas provided for these purposes shall have adequate ventilation to allow dissipation of heat from the condenser units and may also be acoustically treated to minimize the noise nuisance.

e) Ventilation

The **Male & Female Washrooms on Level 1** will be exhausted using **Two (2) Xpelair XID 100 Inline Exhaust Fans** and will be switched with the lights. The exhausted air will be transferred through ceiling mounted exhaust grilles located at each toilet and connected by sheet metal ductwork to the inline fan. The exhausted air will be discharged to outside by an architect detailed outside grille located on an exterior wall of the building as indicated on the drawings.

The **FSC Commissioner Washroom, DA Washroom and Male & Female Washrooms on Level 2** will be exhausted using **Four (4) Xpelair XID 100 Inline Exhaust Fans** and will be switched with the lights. The exhausted air will be transferred through ceiling mounted exhaust grilles located at each toilet and connected by sheet metal ductwork to the inline fan. The exhausted air will be discharged to outside by an architect detailed outside grille located

on an exterior wall of the building as indicated on the drawings.

The **Server Room** will be exhausted using **One (1) Xpelair GX-6 Wall Mounted Fan** into the **Electrical Room** to provide some cooling to the space and will be independently switched. The exhausted air will be transferred through the exhaust grille located within the **Electrical Room**.

The **Auditor General Washroom, DA Washroom and Male & Female Washrooms on Level 3** will be exhausted using **Four (4) Xpelair XID 100 Inline Exhaust Fans** and will be switched with the lights. The exhausted air will be transferred through ceiling mounted exhaust grilles located at each toilet and connected by sheet metal ductwork to the inline fan. The exhausted air will be discharged to outside by an architect detailed outside grille located on an exterior wall of the building as indicated on the drawings.

ALL Kitchens/ Lunch Rooms on each **Level** will be exhausted using **Three (3) Xpelair GX-6 Wall Mounted Fans** and will be independently switched. The exhausted air will be transferred through the exhaust grilles located on exterior walls of the building.

NOTE: The **HVAC Contractor** will be responsible for the installation of fans as well as all associated duct work, supports for duct work, grilles, starters and accessories required to commission the entire system.

EQUIPMENT SCHEDULE

Comfort cooling & Ventilation shall be provided by VRF cooling only systems and exhaust fans installed in the positions indicated on the drawings and in accordance with the following schedule:

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mitsubishi heavy industries thermal systems kxz vrf fan coil units – level 1

Area	Description	Actual A/C (btu/h)	Quantity	Type of Unit	Actual Mitsubishi Capacity (btu/h)	Mitsubishi Fan Coil Units
1	Senior Officers	11,419	1	Cassette	12,283	FDT36KXZE1
2	Kitchen/ Lunch Room	6,576	1	High Wall	7,506	FDK22KXZE1
3	Storage Room	5,178	1	High Wall	5,120	FDK15KXZE1
4	Junior Officers	37,817	1	Ceiling Concealed	38,215	FDU112KXE6F
5	Interview 1	9,716	1	High Wall	12,283	FDK36KXZE1
6	Interview 2	10,075	1	High Wall	12,283	FDK36KXZE1
7	Senior Officer	9,556	1	Cassette	9,554	FDT28KXZE1
8	Storage Room 2	2,933	1	High Wall	5,120	FDK15KXZE1
9	Server Room	1,920	1	High Wall	5,120	FDK15KXZE1
10	Big Hall	21,695	1	Ceiling Concealed	24,226	FDU90KXE6F
11	FSC Archives	10,618	1	High Wall	12,283	FDK36KXZE1
12	L.V Electrical Room	6,830	1	High Wall	7,506	FDK22KXZE1

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mitsubishi heavy industries thermal systems kxz vrf fan coil units – level 2

Area	Description	Actual A/C (btu/h)	Quantity	Type of Unit	Actual Mitsubishi Capacity (btu/h)	Mitsubishi Fan Coil Units
1	FSC Commissioner	15,251	1	Cassette	15,354	FDTC45KXZE1
2	Library/ Training Room	18,851	1	Cassette	19,107	FDTC56KXZE1
3	Conference Room	24,388	1	Cassette	24,226	FDTC71KXZE1
4	FSC Main Office	87,917	1	Ceiling Concealed	95,539	FDU280KXZE1
5	Electrical & Server Room	2,532	1	High Wall	5,120	FDK15KXZE1
6	Lobby & DA Meeting Room	23,627	1	Ceiling Concealed	24,226	FDU90KXE6F
7	IP & CO Filing	9,153	1	High Wall	9,554	FDK28KXZE1
8	FSC Filing	10,974	1	High Wall	12,283	FDK36KXZE1
9	Hall	10,706	1	Ceiling Concealed	12,283	FDUM36KXE6F
10	Kitchen	9,285	1	High Wall	9,554	FDK28KXZE1

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mitsubishi heavy industries thermal systems kxz vrf fan coil units – level 3

Area	Description	Actual A/C (btu/h)	Quantity	Type of Unit	Actual Mitsubishi Capacity (btu/h)	Mitsubishi Fan Coil Units
1	Auditor General	16,303	1	Cassette	19,107	FDTC56KXZE1
2	Dep. Auditor	15,630	1	Cassette	15,354	FDTC45KXZE1
3	Library	19,508	1	Cassette	19,107	FDTC56KXZE1
4	Audit Main Floor	88,894	1	Ceiling Concealed	95,539	FDU280KXZE1
5	Server Room	2,411	1	High Wall	5,120	FDK15KXZE1
6	Telecom/ Electrical Room	5,560	1	High Wall	5,120	FDK15KXZE1
7	Lobby	37,436	1	Ceiling Concealed	38,215	FDU112KXE6F
8	Filing	12,922	1	High Wall	12,283	FDK36KXZE1
9	Hall	9,556	1	Ceiling Concealed	9,554	FDUM28KXE6F
10	Kitchen	9,118	1	High Wall	9,554	FDK28KXZE1

mitsubishi heavy industries thermal systems kxz vrf condensing units

Area	Description	Quantity	Type of Unit	Actual Capacity (btu/h)	Mitsubishi Condensing Units
1	Level 1	1	VRF Condensing Unit	153,546	FDC450KXZE1
2	Level 2	1	VRF Condensing Unit	228,614	FDC670KXZE1
3	Level 3	1	VRF Condensing Unit	228,614	FDC670KXZE1

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MITSUBISHI MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS KXZ VRF OUTSIDE AIR SYSTEM

Area Served	Description	Quantity	Type of Unit	Actual Capacity (cfm)	Mitsubishi Units
Level 1	Outside Air Fan Coil Unit	1	Ducted Ceiling Outside Air Fan Coil Unit	388	FDU650FKXZE1
Level 2	Outside Air Fan Coil Unit	1	Ducted Ceiling Outside Air Fan Coil Unit	388	FDU650FKXZE1
Level 3	Outside Air Fan Coil Unit	1	Ducted Ceiling Outside Air Fan Coil Unit	388	FDU650FKXZE1
Levels 1-3	Outside Air Condensing Unit	1	VRF Condensing Unit		FDC280KXE6G

FAN SCHEDULE

Area Served	Description	Quantity	Voltage	Control System	Ventilation system
Level 1 – Male Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 1 – Female Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 1 – Kitchen/ Lunch Room	XPELAIR XID-GX6 Wall Mounted Exhaust Fan	1	230/1/60	Independently Switched	Ceiling Inline Fan
Level 2 – FSC Commissioner Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 2 – DA Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan

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Level 2 – Male Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 2 – Female Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 2 – Kitchen	XPELAIR XID-GX6 Wall Mounted Exhaust Fan	1	230/1/60	Independently Switched	Ceiling Inline Fan
Level 2 – Electrical/ Server Room	XPELAIR XID-GX6 Wall Mounted Exhaust Fan	1	230/1/60	Independently Switched	Ceiling Inline Fan
Level 3 – Auditor General Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 3 – DA Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 3 – Male Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 3 – Female Washroom	XPELAIR XID-100 INLINE Exhaust Fan	1	230/1/60	Interlocked with lights	Ceiling Inline Fan
Level 3 – Kitchen	XPELAIR XID-GX6 Wall Mounted Exhaust Fan	1	230/1/60	Independently Switched	Ceiling Inline Fan

4.0 GENERAL INFORMATION

4.1 General

Install in the positions ***MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS KXX VRF*** air conditioning systems utilizing R410a refrigerant comprising fan coil units and refrigeration pipework distribution systems connected to condensing unit(s) located in the positions indicated.

The contractor shall be responsible for the design review of the system(s) and the correct matching of the air-cooled condensers to the fan coil units serving the zones determined by the engineer.

4.2 Condensing Unit

Install in the position indicated VRF air-cooled condensing unit serving the building shall be charged with R401a refrigerant and shall be complete with all necessary controls including solenoid control valves.

It is intended to install the condensing units behind on an equipment plinth located outside the western side of the building at grade. Care shall be taken in the final selection to ensure satisfactory operation and adequate heat dissipation.

- The above condensers shall be suitable for a salt-laden atmosphere.
- See also General Notes above.
- All as manufactured by Mitsubishi Heavy Industries

Condensing units shall incorporate the following:

1. Inverter capacity control and Electronic Expansion Valve
2. Hermetically Sealed Scroll Type R401a compressor
3. DC Fan Motor
4. Safety Features to include; High Pressure Switch, Fan Over Load protector, Over Current Relay, Inverter Overload Protector and Fusible Plugs
5. Night quiet mode
6. Anti-corrosion treatment of heat exchanger for salt laden atmosphere
7. Drain connection
8. Anti-vibration mountings

Spaces used for these purposes shall have adequate ventilation to allow dissipation of heat from the condenser units and be acoustically treated to prevent noise nuisance. The operation of the new building services systems shall not increase the existing background noise levels of the site.

4.3 VRF Fan Coil Units

Fan coil units shall incorporate the following:

1. Return air filter
2. Wireless remote controller
3. Drain complete with integral Condensate Pump
4. Condensate pump

Each fan coil unit shall have a wireless combined on/off/fan speed/temperature controller, located in a wall mounted 'holster'. The discharge air from the fan coil unit shall be delivered via insulated and vapor sealed ductwork to the supply grille.

4.4 Electrical requirements

The proposed **Financial Services Commission Building** will be serviced by a Utility padmount transformer at **400/230V 3-phase 4-wire 60 Hertz**.

The following voltages will be provided –

- **400/230V 3-phase 4-wire 60 Hertz** – for HVAC equipment, lighting and special purpose receptacles.
- **208/120V 3-phase 4-wire 60 Hertz** – ICT equipment and 115-volt receptacles.

The main L.V. distribution panel '**M**' will be located on Level 1 in the **L.V. Electrical Room** to the south eastern side of the building. The main air conditioning equipment is located on the north eastern side of the building.

4.5 Refrigeration Piping

Refrigeration pipework shall be installed generally along the routes indicated on the drawings. Pipework shall be secured to galvanized steel cable tray along the entire route using proprietary pipe clips. The use of cable ties shall not be permitted.

All refrigerant pipework shall be manufactured from refrigerant grade "**Type L**" – **seamless copper pipe**, sized to meet and/or exceed the design load. In this regard, consideration shall be given to the vertical distance between indoor and outdoor units, and the type of expansion valve used.

All refrigerant pipework shall be insulated with "Rubbertex" insulation and shall be fully labeled in accordance with current BS guidelines.

The HVAC contractor shall include for all necessary valves, i.e. shut off, thermostatic, solenoid, and shall pressure test all joints in accordance with this specification.

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The pipework shall be designed so that oil in the refrigerant leaving the compressor (and passing any oil separator fitted) shall be carried through the system and back to the compressor at the lowest stage of capacity unloading, including reduced capacity (staged) operation.

The contractor must make provisions for the addition of additional compressor lubricating oil to each system as necessary to maintain correct lubricant levels in each compressor. The following accessories shall be provided in the refrigerant piping system:

- 1) Liquid/moisture indicating sight glass.
- 2) Liquid line filter/dryer.
- 3) $\frac{3}{4}$ " wall thickness closed cell foam insulation with integral vapour barrier on suction lines, sealed at joints with weather-proof adhesive or tape not subject to peeling with prolonged sunlight.
- 4) Suction line traps as necessary at the Air Handler Units or as indicated on the drawings.

Pipework shall be firmly supported and secured to minimise vibration. Vibration eliminators shall be fitted to the compressor suction and discharge pipes to minimise transmission of vibration or noise. After completion, the refrigerant pipework shall be pressure tested.

In addition to the above specifications all proposed equipment must meet the requirements as described in the Technical Specifications which follow in this document.

4.6 Equipment Noise Levels

Design noise levels shall be (at the design output):-

- | | |
|--------------------------|-------------------|
| • <i>Study Rooms</i> | <i>NC 30 - 40</i> |
| • <i>Offices</i> | <i>NC 30 - 40</i> |
| • <i>Conference Room</i> | <i>NC 30 - 40</i> |
| • <i>Corridors</i> | <i>NC 35 - 45</i> |

NOTE: These NC levels also refer to associated ventilation equipment.

4.7 Ductwork

a) Low Pressure Sheet Metal Ductwork - Rectangular:

Unless otherwise specified ductwork shall be in accordance with the "*Low Velocity and Duct Construction Standards*" issued by the *Sheet Metal Air Conditioning Contractors National Association, P.O. Box 3506, Washington D.C. 20007, U.S.A.* hereinafter

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referred to as Low Velocity Standards.

All galvanized duct shall be made up substantially as indicated on the drawings including plenums, casings, splitters, deflectors, dampers, etc., of zinc coated steel sheets in the following (or heavier) gauges.

If sheets are used which are manufactured in a system of sizing other than *US Standard Gauge*, the thickness used in each case shall be equal to or greater than the thickness of the US Standard Gauge stated.

All sheet metal panels **305 mm** and larger which are not insulated either inside or outside shall be cross broken.

All laps shall be in the direction of air flow. No sheet metal screws shall be used in the duct where it is possible to use rivets and bolts. All edges and slips shall be hammered down so as to leave a smooth finished surface inside the ducts.

Allowable duct leakage will be limited to **10%** of the total **CFM** handled. Duct leakage shall be the difference between the measured CFM at filter sections and ascertained by the total measured CFM at supply air diffusers and registers.

All longitudinal seams shall be Pittsburgh double locked and hammered flat.

Transverse seams shall be as required by conditions but in general shall conform to the following tabulation. These various types of joints are illustrated and described in the Low Velocity Standards

<i>Largest Duct Dimension Reinforcement Dimension (mm) (mm)</i>	<i>Metal Gauge (mm / gauge)</i>	<i>Maximum Longitudinal Spacing</i>
Up to 305	0.56 mm/26 ga	none
330 - 457	0.71 mm/24 ga	none
482-762	0.71 mm/24 ga	25x25x3 @ 1524
787 - 1067	0.86 mm/22 ga	25x25x3 @ 1524
1092 - 1 219	0.86 mm/22 ga	38x38x3 @ 1524
1245 - 1372	0.86 mm/22 ga	38x38x3 @ 1219
1397 - 1524	1.0 mm/20 ga	38x38x3 @ 1219
1549 - 2134	1.0 mm/20 ga	38x38x3 @ 609
2159 - 2438	1.32 mm/18 ga	38x38x5 @ 609
2464 - 3048	1.32 mm/18 ga	50x50x6 @ 609
3073 and up	1.32 mm/18 ga	50x50x6 @ 609

With tie rods along angle.

Unless otherwise specified, the maximum acute angle between the non-parallel sides of any diverging sections in ductwork shall not exceed 20° and 30° respectively. If, because of space limitations, these (maxima) have to be exceeded, then splitters shall be installed in the ductwork.

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All sheet metal tees, bends or elbows shall be made with a centerline radius of not less than the width of the duct where space conditions permit. Where this is not possible **Duro-Dyne** or equal square elbows shall be used fitted with turning vanes. Transforming sections shall have slope **1 in 7** for expansion and **1 in 4** for contraction.

Flexible connections shall be used at outlet from air handling equipment and where shown on the drawings shall be **U.L** Approved, **Duro-Dyne Durolon** or equal, approximately **6"** long.

All ducts shall be protected during fabrication and erection to prevent dirt and debris from entering.

b) Duct Insulation

1. *General* - Supply and install thermal insulation to all ductwork unless specifically excluded below.
2. All insulation to be **U.L.** Approved and minimum **1 1/2"** thick Fiberglass Duct wrap or approved equal.
3. *Duct Liner* - Line ducts where used or indicated on drawings with **1"** thick **Owens Corning Acroflex Duct Liner Type 200** or equal. Adhere to duct using **100%** coverage of fire resistant adhesive and additionally secured with approved metal fasteners on **12"** centers. Add nosing to all leading edges.

5.0 NOTES

The **HVAC Contractor** will be responsible for the installation of equipment as well as all associated duct work, Grilles, Starters and accessories required to commission the entire system.

The **HVAC Contractor** is to closely coordinate with the **Plumbing and Electrical Contractors** regarding the installation and precise locations of all refrigerant piping, fixing supports etc.

6.0 MISCELLANEOUS

The following works shall form part of this contract:

- Final connection of the control wiring.
- Supply and installation of all condensate lines with related traps, all to be coordinated with the Plumbing Contractor.
- Supply and installation of any steel supports or curbs required for the suspension or support of equipment.

- Details of designs and specifications of all plinths, supports, curbs, etc. required for plant and equipment are to be provided by the HVAC Contractor.
- Details of the maximum anticipated equipment operating amperage and KVA demand are to be included with this submission, which shall include:
 - Compressor: RLA/LRA
 - Condensing fan(s): FLA
 - Evaporator Fan(s): FLA
- Wiring schematics (power and control) shall be included with this submission for the air conditioning equipment.
- All power and control wiring connection to the units – final power connections will be made by the HVAC Contractor under the Electrical Contractor’s supervision. The Electrical Contractor will be responsible for the supply and installation of all electrical power and control wiring.

7.0 PROJECT MANAGEMENT

The HVAC Contractor shall at all times during the construction of the work, have a suitably qualified representative of “Project Engineer” status who is fully knowledgeable about the works.

This representative must be authorized to act on the sub-contractor’s behalf in matters pertaining to:-

1. Coordination with other trades.
2. Site instructions given by the Services Engineer during site inspections.
3. Organization of such tests as the Engineer may require, and
4. Updating of drawings to “As Built” status.

ANY VARIATION CONTAINED IN THE TENDER SUBMISSION CONTRARY TO TENDER SPECIFICATIONS CAN RESULT IN AUTOMATIC DISQUALIFICATION.

The maintenance period of one (1) year will include for both defects liability and four (4) routine service-maintenance checks.

In addition to the above, it is the contractors’ responsibility to ensure that all power tool(s) extension cords used in safe operational condition. Defective equipment or materials must NOT under any circumstances be used.

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Hard hats, proper eye protection and steel-tipped footwear are to be provided to of the contractor's employees during all phases of this contract.

The HVAC Contractor is to provide Labour rates for the following:

Workman's Trade	Hourly Rate (TT\$)
Supervisor	-----
Technician	-----
Laborer	-----

8.0 DRAWINGS

The following drawings shall form part of this specification and the HVAC Contractor is to refer to:

Drawing No.	Drawing Title
19-010 - AC-01	HVAC Site Plan
19-010 - AC-02	Level 1 HVAC Layout
19-010 - AC-03	Level 2 HVAC Layout
19-010 - AC-04	Level 3 HVAC Layout
19-010 - AC-05	Level 1 VRF Piping Layout
19-010 - AC-06	Level 2 VRF Piping Layout
19-010 - AC-04	Level 3 VRF Piping Layout
19-010 - AC-05	HVAC Piping Details
19-010 - AC-06	HVAC Ductwork Details

SCOPE OF WORKS

The **Fire Alarm Installation** outlined herein refers to the works associated with the **Financial Services Commission Building** to be constructed at **Little Bay – Montserrat, W.I.**

The **Fire Alarm Contractor** shall be responsible for the supply, installation and commissioning of all equipment and accessories, materials, labour and supervision necessary to carry out the Works, which shall include but not be limited to –

- a) A fully addressable Fire Detection / Alarm system
- b) All associated hardware and cabling associated with the above
- c) Inspections, testing, commissioning and certification of the system
- d) Preparation of final “AS-BUILT” drawings
- e) All other works described herein or as indicated on the Drawings

PROJECT DESCRIPTION

A GENERAL

The proposed **Financial Services Commission Building** Fire Alarm System will be serviced at **208/120-volts 3-phase 4-wire 60 Hertz** for combined lighting and power.

Total emergency power will be provided by a fully automatic standby generator, which will service all of the above loads.

PROJECT DESCRIPTION

The Fire Alarm drawings indicate that the following detector types shall be installed –

Offices & Storage Rooms - **Intelligent Multi-Sensor Smoke Detectors**

Mechanical Rooms - **Intelligent Multi-Sensor Smoke Detectors**

Kitchens – **Intelligent Combination Thermal / Rate of Rise Detectors**

The Fire Alarm Contractor shall provide a price for a fully addressable Fire Alarm System in accordance with **NFPA 72**.

The Main Fire Alarm Controller / Voice Evacuation Module will be located on the Ground Floor.

Remote annunciators will have to be located external to the building for Fire Prevention. The Fire Alarm Contractor shall also include in his pricing for all design approvals from Fire Prevention.

B. MISCELLANEOUS

All major civil works will be carried out by the Main Contractor. The Fire Alarm Contractor shall, however, be responsible for the following:

- a) All fixing and supporting of all detectors, control panel etc. – inclusive of scaffolding etc.
- b) All other works as described herein or as indicated on the Drawings.
- c) The conduit for the Fire Alarm systems will be installed by the Electrical Contractor under this contractor's supervision.

C. MISCELLANEOUS

1.0 DRAWINGS & SPECIFICATIONS

The Drawings and Specifications are intended to be complete and considered supplementary to one another. Materials or workmanship indicated, called for, or implied by one and not the other, shall be furnished and installed as though specifically called for by both. Should any discrepancy appear in either, call such discrepancy to attention of the Services Engineer for clarification and correction before executing the works. Failure to address design queries within a reasonable period will not constitute a claim for time extension.

It is the intent of the Drawings and Specifications to obtain a complete and satisfactory installation. The Fire Detection / Alarm drawings are descriptive and diagrammatic but are to be followed as closely as the actual construction of the building and the work of other trades will permit.

The drawings are diagrammatic and indicate general arrangement of systems and equipment included in the scope of this project. The Fire Alarm Contractor shall follow drawing in laying out work; check drawings of all trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points. The Fire Alarm Contractor must also verify all field dimensions, setbacks and penetrations using the site copy of the architectural drawings provided by the main contractor or any other recognized client's representative.

Where headroom or space conditions appear inadequate, the Project Manager shall be notified before proceeding with the installation. If directed by the Project Manager or Services Engineer, the Fire Alarm Contractor shall, without extra charge, make reasonable modifications in layout as needed to prevent conflict with work of various trades or for proper execution of the work.

Where variances occur between drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in contract price.

The Services Engineer shall decide on the item and manner in which the work shall be installed. Prior to fabrication and/or installation, the Fire Alarm Contractor shall submit detailed shop drawings and calculations as indicated in other sections of the specifications.

2.0 FIRE ALARM SPECIFICATION

The Fire Alarm Contractor is free to choose from alternative manufacturers on condition that –

All devices are sourced from one (1) manufacturer.

No variance from the above will be considered.

3.0 DESIGN QUERIES / CLARIFICATION

Any Design queries or issues which may require further clarification by the Project manager, Architect or Services Engineer shall be called to the attention of the Engineer at least four (4) days prior to the bid submission date.

4.0 TIMELY DELIVERY OF EQUIPMENT

It shall be the Fire Alarm Contractor's responsibility to obtain delivery dates for all of the essential equipment specified and approved to coordinate with project construction schedule so that materials arrive at job site in adequate time for installation.

5.0 COORDINATION OF SERVICES

This Section includes administrative and supervisory requirements necessary for coordinating construction operations on the Project to be collectively fulfilled by the Fire Alarm Contractor.

The Fire Alarm Contractor's responsibility includes, but is not limited to, the following:

- General project coordination and scheduling procedures as directed by the Project manager
- Conservation of all consumables and other materials required to complete the installation works
- Provision of coordination drawings as required
- Providing the necessary Administrative and supervisory personnel as required under the terms and conditions of the contract.
- Cleaning and protection of all finished works prior to handover to the client

Where applicable, the Fire Alarm Contractor shall participate in specified coordination requirements as directed by the project manager. Note that certain areas of responsibility may be assigned to a specific contractor.

The Fire Alarm Contractor through his site and administration representatives shall coordinate all construction activities with those of other prime contractors and other entities involved to assure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations included under different Sections of the Specifications that depend on each other for proper installation, connection, and operation.

The Fire Alarm Contractor, along with all other contractors, and the Architect will work together to provide for the most logical and expeditious assembly and progress, however this will not relieve the Fire Alarm Contractor of his obligations to coordinate with and accommodate the work of others.

The Fire Alarm Contractor shall schedule the construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

5.0 COORDINATION OF SERVICES

Where availability of space is limited, the Fire Alarm Contractor shall coordinate installation of different components with other services contractors to assure maximum accessibility for required maintenance, service, and repair.

The Fire Alarm Contractor shall make adequate provisions to accommodate items scheduled for later installation.

The Fire Alarm Contractor shall coordinate scheduling and timing of all required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and assure orderly progress of the Work.

These activities include, but are not limited to, the following:

1. Preparation of coordination schedules.
2. Preparation of coordination drawings i.e. detailed equipment layouts for the Services Engineer approval
3. Preparation of “As Built” drawings
4. The installation and removal of temporary works and facilities as required.
5. The timely delivery and processing of technical submittals and samples for approval
6. Prompt attendance at all Progress / Site meetings as required
7. Completion of all project closeout activities to the satisfaction of the Project Manager

Note that the works covered under of all other contracts will affect the overall schedule and coordination of the Work of this Contract. Requirements and limitations of work progress as may be required by other contracts shall be binding on the schedule of this Contract. The Fire Alarm Contractor must therefore be totally familiar with the schedule requirements of all other contracts as they may affect the scheduling and progress of this contract.

The Fire Alarm Contractor will be required to undertake all integrations and coordination to ensure the seamless integration all associated systems between all services inclusive but not limited to the electrical works, plumbing works, HVAC works, BMS system, fire alarm, security systems and any other trade deemed necessary by the Project Manager.

The Architect / Project manager will note and facilitate the coordination efforts between the various contractors and parties involved in the Project. It shall however remain the sole responsibility of the Fire Alarm Contractor for this Contract to ensure the Work is fully and properly coordinated with the work(s) of all other contracts, contractors, or parties involved in the Project.

No claims for delays or damages will be allowed where such delays or damages could have been avoided or mitigated through coordination or cooperation by and/or between this Contractor and any other contractor, contractors, party, or parties involved in the project.

5.0 COORDINATION OF SERVICES

The Fire Alarm Contractor shall maintain the work in such a condition as to allow the related works of other contracts to be installed. The work of others, which will be covered or built in by this Contract is to be installed prior to proceeding with the "covering or building-in" of such work or work areas.

No cutting and patching of floor slabs, finishes, or other "systems" to allow insertion of the work(s) of others will be permitted without the express permission of the Project Manager.

6.0 EQUIPMENT

All equipment specified herein shall be of the type and capacity shown on the equipment schedules in the drawings. Equipment shall be as manufactured by one of the manufacturers designated on this specification or shall be an equivalent.

Any deviations from the specifications must be submitted under separate cover as an alternate proposal to the contractor's primary bid and will be reviewed by the Services Engineer.

For ease of maintenance and parts replacement, equipment from a single manufacturer shall be used to the maximum extent possible. Plant and equipment shall be delivered to the job site in manufacturer's original unopened containers clearly labeled with manufacturer's name, brand designation and reference specification. Damage sustained by products in transit to job site shall be repaired to the satisfaction of the Services Engineer.

If damage sustained while transporting products to job site is not repairable, the products shall be replaced with new ones at no cost to owner. Equipment will not be accepted unless **"fixed in place"** by the contractor or placed into storage with the proper insurances and security.

The scheduled delivery of plant, equipment and other installation materials to job site must be done in accordance to contractors schedule and must take into account the requirements of job progress so as not to delay the work.

7.0 WARRANTIES & GUARANTEES

The Fire Alarm Contractor shall guarantee that all plant and equipment installed has been selected to the capacity specified and that under normal conditions, will operate without excessive noise or vibration.

The Fire Alarm Contractor shall also furnish the client with a written guarantee covering all workmanship and materials for a period of one (1) year from date of acceptance or substantial completion as determined by the Project manager or Architect.

7.0 WARRANTIES & GUARANTEES

The warranty shall also include an agreement to repair or replace, at the contractor's expense, including labor and material, all the defects that may appear at the time, which in the opinion of the Architect or Services Engineer are due to defective workmanship and/or material.

8.0 ACCESS TO COMPLETED WORKS

The Fire Alarm Contractor shall inform himself fully regarding the peculiarities and limitations of the space available for the installation of materials under his contract. All devices such as valves, traps, strainers, cleanouts, controls, duct damper regulators, and other such apparatus, which are concealed above the ceilings or in furred spaces, shall be readily accessible.

Where interference's occur, and departures from indicated arrangement are required, the Fire Alarm Contractor shall consult with the other trades involved and come to an agreement as to changed locations and elevations of the ductwork and/or piping and shall obtain approval from the Architect/Engineer prior to implementing the proposed changes.

Claims for Modifications required to achieve coordination between each of the respective trades will not be entertained.

9.0 PROTECTIVE WEAR

Hard hats, proper eye protection and steel-tipped footwear are to be provided during all phases of this contract.

10.0 BUILDER'S WORKS

All major civil works will be carried out by the Main Contractor. The Fire Alarm Contractor shall, however, be responsible for the following:

1. All related Builder's Works such as cutting and chasing of walls, penetrations, making good etc.
2. All other works as described herein or as indicated on the Drawings.

11.0 PROJECT ENGINEER

All major civil works will be carried out by the Main Contractor.

The Fire Alarm Contractor shall at all times during the construction of the work, have a suitably qualified representative of "Project Engineer" status who is fully knowledgeable about the works. This representative must be authorised to act on the sub-contractor's behalf in matters pertaining to:-

- a. Coordination with other trades
- b. Site Instructions given by the Services Engineer during site inspections
- c. Organisation of such tests as the Engineer may require, and
- d. Updating of drawings to "As Built" status

12.0 MANUFACTURER’S SUBMITTALS

Detailed manufacturer’s cut-sheets and specifications shall be made available to the Services Consultant within **two (2) weeks** of the tender submission for the purposes of a separate Technical Evaluation.

The package must include and not be limited to –

- Main Fire Alarm Control
- Detectors
- Annunciators
- Pull Stations / Alarm Bells
- Other Devices
- Cabling

NOTE: Manufacturer’s names, model and/or part numbers must be clearly identified and must be accompanied by the relevant specification documents and/or cut-sheets.

On award of the contract, a final equipment package shall be prepared and submitted to the Services Consultant for final approval, prior to the ordering and/or purchasing of any equipment.

A full set of shop drawings shall be submitted for approval within **one (1) month** of the above.

13.0 MAINTENANCE & OPERATING MANUALS

Three (3) bound copies of all maintenance and operating manuals, inclusive of all manufacturers’ cut sheets shall be provided at the time of the commissioning and hand-over of equipment to the Project manager and or Services Engineer.

The Fire Alarm Contractor shall make provisions in his pricing for any training and/or orientation sessions required with the Owner’s technical representatives.

14.0 ‘AS BUILT’ DRAWINGS

Electronic “as-built” drawings shall be provided to the Project Manager and/or Services Engineer in AutoCad format no later than one (1) month following hand-over of the installation.

15.0 APPROVALS

One (1) original and two (2) copies of the signed and stamped Certificate of Approval from the **Fire Authority – Antigua** shall be submitted to the Project Manager and/or Services Engineer at the time of hand-over of the installations.

The Fire Alarm Contractor shall also be responsible for, prior to commencement of the works, submit all plans, specifications and/or cut-sheets to the local approving agencies.

16.0 MAINTENANCE CONTRACTS

All third-party maintenance contracts shall be in force at the time of official hand-over and acceptance of the operating systems.

17.0 TENDER SUBMISSION FORMAT

Whilst it will be acceptable to submit a hand-written Bill of Quantities, this must be accompanied by an electronic Excel duplicate at the time of tendering.

18.0 FORMAT OF PAYMENT CLAIMS

The contract Bill of Quantities must be used in electronic form (Excel) on payment claim, indicating the following –

Contract details

Percentage claimed against each and every item for labour and materials

Amounts claimed against each and every item for labour and materials

This will assist in the rapid and accurate assessment of claims.

Where variations occur, they must also be submitted in electronic form (Excel), indicating each individual item, quantities, unit rates and amount claimed for both labour and materials content.

The exact format must be approved with the Project Manager and/or Services Engineer prior to commencement of works.

19.0 ELECTRICAL SAFETY STANDARDS

No person with the exception of the approved Electrical Contractor shall attempt to open and/or repair electrical switchgear, panelboards, equipment etc.

In addition, no defective extension cords, plugs, equipment and/or tools shall be used on the project.

All extension cords, plugs, equipment and/or tools proposed for use shall be inspected and approved by the Project Manager's designated Safety Officer.

Any contractor that causes damage to the site electrical equipment due to defective electrical equipment, tools, cords and/or illegal connections - shall be held fully responsible and shall bear full costs for the repairs etc.

All electrical extension cords shall be UL and/or CSA rated and shall be approved for industrial use – double insulated with a thick protective outer sheath. The contractor shall provide a sample of the above for approval by the Project Manager's designated Safety Officer prior to use.

19.0 ELECTRICAL SAFETY STANDARDS

All power tools and/or equipment shall be equipped with a safety ground conductor as part of the appliance's electrical cord – complete with a three-pin UL approved moulded male plug. Larger three phase equipment shall be provided with an approved ground terminal

Hand tools must only be plugged into the electrical power receptacles provided by the site's Electrical Contractor. No intermediate or other connections will be approved.

20.0 FIRE ALARM SCHEMATIC

The Fire Alarm Contractor shall supply, at the time of tendering, a detailed Fire Alarm Block Schematic indicating the main components of the system, inclusive of detectors, power supplies, annunciators, sounders and interface modules complete with manufacturer's catalogues numbers.

**Financial Services Commission Building
Addressable Fire Detection Alarm System Specification**

**PERFORMANCE SPECIFICATION
INTELLIGENT REPORTING FIRE DETECTION SYSTEM**

PART 1.0 - GENERAL

1.1. DESCRIPTION:

- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system.
- B. The fire alarm system shall comply with requirements of **NFPA Standard 72 (Latest Version)** for Protected Premises Signalling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- C. Alarm and trouble signals from each transponder shall be digitally encoded by listed electronic devices onto the looped multiplex communication system.
- D. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto the Signalling Line Circuits.
- E. The system shall be an active/interrogative type system where each transponder is repetitively scanned; causing a signal to be transmitted to the local fire alarm control panel node indicating that the transponder and its associated initiating device and notification appliance circuit wiring is functional. Loss of this signal at the local FACP shall result in a trouble indication on both the FACP display and at the network display, as specified hereinafter for the particular input.
- F. The system shall be arranged such that not less than 20 percent additional transponders may be inserted into any network communication loop.
- G. The fire alarm manufacturer shall be of the highest calibre and insist on the highest quality. The system shall be manufactured by an **ISO 9001** certified company and meet the requirements of **BS EN9001: ANSI/ASQC Q9001-1994**.
- H. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).
- I. The system and its components shall be **Underwriters Laboratories, Inc.** listed under the appropriate UL testing standard as listed herein for fire alarm applications and shall be in compliance with the UL listing.
- J. The installing company shall employ **NICET (minimum Level II Fire Alarm Technology)** technicians on site to guide the final check-out and to ensure the systems integrity.

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Addressable Fire Detection Alarm System Specification

1.2. SCOPE:

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on **NFPA Style 6 (Class A) Signalling Line Circuits (SLC)**.
2. Initiation Device Circuits (IDC) shall be wired **Class A (NFPA Style D)** as part of an addressable device connected to the by the SLC circuit.
3. Notification Appliance Circuits (NAC) shall be wired **Class A (NFPA Style Z)** as part of an addressable device connected by the SLC circuit or a panel circuit.
4. Alarm signals arriving at the main FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
5. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone, which ever is greater.
6. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
7. Two-way telephone communication circuits shall be supervised for open and short circuit conditions.

C. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the FACP shall flash.
2. A local piezo electric signal in the control panel shall sound.
3. The display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location.
4. Printing on the FACP and history storage equipment shall log the information, along with time and date of occurrence.
5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs shall be activated.

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Addressable Fire Detection Alarm System Specification**

1.3. SUBMITTALS

A. General:

1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

1.4. GUARANTEE:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labour and materials required to correct any defect during this one year period shall be included in the submittal bid.

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1.5. APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall comply with the latest standards.

A. National Fire Protection Association (NFPA) - USA:

No. 12	High Pressure CO2 Extinguishing Systems
No. 12B	Halon 1211 Extinguishing Systems
No. 13	Sprinkler Systems
No. 13A	Halon 1301 Extinguishing Systems
No. 15	Water Spray Systems
No. 16	Foam/Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
	Clean Agent Extinguishing Systems
No. 72-1993	National Fire Alarm Code
No. 101	Life Safety Code

B. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signalling Systems
No. 864	Control Units for Fire Protective Signalling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective
No. 464	Audible Signalling Appliances
No. 38	Manually Actuated Signalling Boxes
No. 346	Waterflow Indicators for Fire Protective Signalling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signalling Systems
No. 1971	Visual Notification Appliances

C. Local Building Codes

D. All requirements of the Local Authority Having Jurisdiction (LAHJ).

E. The Video Display Terminal (VDT) shall comply with Swedish magnetic emission and X-radiation guidelines **MPR 1990:10.**

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1.6. APPROVALS:

- A. The system shall have proper listing and/or approval from the following recognized agencies:

UL Underwriters Laboratories Inc

FM Factory Mutual

ULC Underwriters Laboratories Canada

MEA Material Equipment Acceptance (NYC)

CSFM California State Fire Marshal

Trinidad & Tobago Fire Services – Fire Prevention

- B. The fire alarm control panel shall meet **UL Standard 864 (Control Units)** and **UL Standard 1076 (Proprietary Burglar Alarm Systems)**.
- C. The system shall be listed by the national agencies as suitable for extinguishing release applications.

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PART 2.0 PRODUCTS

2.1. EQUIPMENT AND MATERIAL, GENERAL:

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signalling system, meeting the National Fire Alarm Code.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations.

2.2. CONDUIT AND WIRING:

A. Conduit:

- 1. Conduit shall be in accordance with the **National Electrical Code (NEC)**, local and the local **Electrical Inspectorate**.
- 2. Where possible, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
- 3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per **NEC Article 760-29**.
- 4. Conduit shall be 3/4 inch (19.1 mm) minimum.

B. Wiring:

- 1. All fire alarm system wiring shall be new.
- 2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system.
- 3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signalling system.
- 5. All field wiring shall be completely supervised.
- 6. Speaker wire will not be acceptable – solid conductor **#18 AWG 4-core (Belden FPLR Non-Plenum Catalogue 0720** or equal approved

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2.2. CONDUIT AND WIRING:

C. Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signalling line circuits connected to intelligent reporting devices.

E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes.

2.3. MAIN FIRE ALARM CONTROL PANEL:

A. The FACP shall be completely microprocessor based.

B. Basic System Operator Controls:

1. Acknowledge Switch: Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON.

2. Alarm Silence Switch: Activation of the alarm silence switch shall cause all programmed devices to return to the normal condition after an alarm.

3. System Reset Switch: Activation of the System Reset switch shall cause all devices and circuits, to return to their normal condition.

4. Lamp Test: The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

C. System Capacity and General Operation

1. The control panel shall provide, or be capable of expansion to 1500 Intelligent/addressable devices and/or conventional circuits.

2. The system shall include Form-C alarm and trouble relays rated at a minimum of 3.0 amps @ 30 VDC.

3. The fire alarm control panel shall include a full featured operator interface and backlit 80 character Liquid Crystal Display (LCD).

4. The system shall be fully field programmable.

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Addressable Fire Detection Alarm System Specification**

2.3. MAIN FIRE ALARM CONTROL PANEL:

5. The FACP shall provide the minimum following features:
 - a. Drift compensation to extend detector accuracy over life.
 - b. Detector sensitivity test, per NFPA 72, Ch 7.
 - c. Maintenance alert, to warn of excessive smoke detector dirt or dust accumulation.
 - d. Multiple sensitivity levels for alarm, selected by detector.
 - e. System status reports to display or printer.
 - f. Alarm verification, with verification counters.
 - g. Cross zoning with the capability of counting two detectors in alarm.
 - h. Walk test.
 - i. UL-1076 security monitor points.
 - j. Control-by-time with holiday schedules.
 - k. Day/night automatic adjustment of detector sensitivity.
 - l. Device blink control for sleeping areas.
 - m. Releasing capability.
 - n. Pre-Alarm
 - o. Selectable sensitivity levels, three minimum.
 - p. History Storage, with a minimum of 400 events.
 - q. Point Enable/Disable.
 - r. Point Read (status and level of obscuration).

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Addressable Fire Detection Alarm System Specification**

2.3. MAIN FIRE ALARM CONTROL PANEL:

D. Central Microprocessor

1. The microprocessor shall be a state-of-the-art, high speed, and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

E. Display:

1. The display shall include an 80-character back-lit Liquid Crystal Display (LCD). It shall also provide Light-Emitting-Diodes (LEDs) for standard fire alarm indications.
2. The display keypad shall be an easy to use type keypad. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Multiple password levels shall be provided.

F. Signalling Line Circuits (SLC)

1. The system shall include 10 SLC circuits. Each SLC interface shall provide power to and communicate with intelligent detectors (ionization, photoelectric or thermal) and intelligent modules (monitor or control).

Each SLC loop shall be wired NFPA 72 Style 6 (Class A).

G. Serial Interface

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals. One serial port shall support a printer, the other a CRT.
2. The system shall include an EIA-485 port for the serial connection of annunciators and remote LCD displays.

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Addressable Fire Detection Alarm System Specification

2.3. MAIN FIRE ALARM CONTROL PANEL:

H. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.

I. Voice Command Centre (VCC)

The Voice Command Centre (VCC) shall contain equipment required for all audio control, telephone system control, signalling and supervisory functions. This shall include amplifiers, tone generators, digital voice units, a microphone and a main telephone handset.

J. Power Supply:

1. The main power supply for the fire alarm control panel shall provide available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies or field mounted power supplies.
3. Over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger.
4. The main power supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.
5. All circuits shall be power-limited, per 1995 UL864 requirements and include earth fault detection.
6. The main power supply shall provide meters to indicate battery voltage and charging current.

K. Auxiliary Field Power Supply - Addressable

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.

Financial Services Commission Building
Addressable Fire Detection Alarm System Specification

2.3. MAIN FIRE ALARM CONTROL PANEL:

2. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signalling Line Circuit (SLC) or other multiplexed means. Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
9. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
10. The addressable power supply mounts in either the FACP backbox or its own dedicated surface mounted backbox with cover.
11. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.

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2.3. MAIN FIRE ALARM CONTROL PANEL:

12. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of an end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
13. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
14. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
15. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

L. Field Charging Power Supply:

The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
3. The FCPS shall include an attractive surface mount backbox.
4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per 1993 NFPA requirements.
5. The FCPS include power limited circuitry, per 1995 UL standards.

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2.3. MAIN FIRE ALARM CONTROL PANEL:

M. Stand Alone Voice Evacuation Control Panel

1. A stand-alone Voice Evacuation Control Panel shall be available from the same manufacturer of the main fire alarm system.
2. This Voice Control Panel shall work stand alone or as a slave to the Main Control Panel.
3. Shall have as minimum requirements:
 - a. Integral 25 Watt, 25 Vrms audio amplifier.
 - b. Speaker circuit that can be wired both Class A or B.
 - c. Integral Digital Message Generator with a capacity of up to 60 seconds. The Digital Message Generator shall be capable of primary and secondary messages (30 seconds each). These messages shall field programmable without the use of additional equipment.
 - d. Built in alert tone generators with steady, slow woop, high/low and chime tone field programmable.
 - e. Integral Diagnostic LEDs for Power, System Trouble, Message Generator Trouble, Tone Generator Trouble, and Alarm.
4. The Voice Control Panel shall be fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generators.
5. Speaker outputs shall be fully power-limited.

N. Audio Amplifiers:

1. The audio amplifiers will provide audio power (@ 25 Volts RMS) for distribution to the speaker circuits.
2. The amplifier shall include audio input and amplified output supervision, back-up input, and automatic switch-over to back up (if primary amplifier should fail).
3. Amplifiers shall be backed up in groups (one amplifier backs up several).

O. Pre-recorded Voice - Audio Message Generator

1. The voice communication system shall be capable of transmitting a pre-recorded voice message to all speakers in the building, or to any programmed group of speakers.
2. A built-in microphone shall be provided to allow paging through speaker circuits and shall have priority over the alarm message.

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2.3. MAIN FIRE ALARM CONTROL PANEL:

P. Multi Channel Audio Transponder

1. Transponders shall be listed under UL -Listed as a critical component in a multiplex fire alarm system. Transponders shall be located where shown on the plans. The transponder shall serve as the interface between Intelligent Addressable initiating devices, controlled signalling devices, and the FACP. The supervised multiplex communication port shall be an integral part of the transponder. The transponder shall be designed exclusively for multi channel voice (simultaneous messaging) applications where four different voice/tone messages are played at the same time to different areas of the building. This design is required to facilitate an orderly facility evacuation.
2. The transponder shall include the ability to generate evacuation and alert tones, programmable from a list of 27 different selections.
3. Each Transponder shall be powered from a local Power Supply, and shall provide all power necessary for its own operation, including standby power.
4. Transponders shall communicate with, and be controlled by, the host Fire Alarm Control Panel via a 2-wire Signalling Line Circuit (SLC). This SLC Loop shall operate as a NFPA Style 6 Loop. Systems that require a non-multiplex type interface (relay matrix or other) are not considered suitable substitutes.
5. The SLC interface shall also include a local Signalling Line output. The local output shall be designed for failsafe operation. Should the SLC riser be destroyed prior to the transponder due to fire, bombing or other unforeseen conditions, the local SLC shall operate in a failsafe mode where the transponder reverts to a local general alarm mode.
6. Transponder cabinets shall be used to house and mount amplifiers, batteries and power supplies to allow a true distributed processing and amplification. Plug-in amplifiers shall be used to facilitate flexibility, ease of installation and service.
7. Each transponder shall have the following LED indicators and operator Controls:

General Trouble - Yellow
AC Fail - Yellow Battery Trouble - Yellow
Charger Trouble- Yellow
Telephone - Riser Trouble - Yellow
Telephone Circuit Trouble (for Circuits 1 to 4) - Yellow
Speaker Circuit Trouble (for circuits 1 to 4) - Yellow
Earth Fault - Yellow
AC Mains On Line - Green
Boost On Battery Test - Green
SLC On Line - Green
Amplifier Trouble (one per amplifier) - Yellow
Amplifier Primary or Backup - Green
Audio Channel Trouble (up to four) - Yellow

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Earth Fault Detection - Enable / Disable
Phone Circuits Class A / B
Background Music Volume
Rotary Switches for Addressing
Download Enable - Disable
7-Segment LED SLC Address Display - Red

8. Each transponder shall include Four Class B (Style Y) speaker circuits with a Class A (Style Z) option. Each circuit shall support up to 25 watts of 25 Vrms audio.
9. Transponders shall also include Four Class B (Style Y) or Two Class A (Style Y) Notification Appliance Circuits (NAC) circuits. The NAC circuits shall support either 24 VDC Visual devices or Fire Fighters Telephones (selected per transponder - not per circuit).
10. Fire Fighters phone circuits shall include a ring tone. The fire fighters telephone riser shall support up to seven telephones communicating simultaneously before signal degradation.
11. If selected for NAC operation, visual circuits shall support up to 2 Amps per circuit and 6 Amps per transponder.
12. Back-up amplifiers shall be available in the unlikely event that a main amplifier fails.
13. The Voice Transponder shall support a remote microphone that shall be used for local paging.
14. A building music input circuit shall be located on the voice transponder. The music input shall be listed as such and a third party interface shall not be required. A means to adjust the music volume shall be available. The transponder software shall prioritize all messaging. In no event shall a non-alarm message (background music, etc.) take priority over an evacuation message.
15. For ease of installation and serviceability, the voice transponder shall include removable terminal blocks which accept up to 12 AWG wire and a Windows based programming utility. All matrix/control by event programming shall be internal to each transponder and downloaded through a serial connection from a PC compatible personal computer.

2.3. MAIN FIRE ALARM CONTROL PANEL:

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Q. Specific System Operations

1. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
2. Point Read: The system shall be able to display or print the point status diagnostic functions.
3. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
4. Waterflow Operation: An alarm from a waterflow detection device shall activate the appropriate alarm message on the 80 character display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
5. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the 80 character display.
6. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

2.4. SYSTEM COMPONENTS:

A. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as show on plans.

B. Speakers:

1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.5 to 2.0 Watts.
2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

2.4. SYSTEM COMPONENTS:

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C. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

D. Audible/Visual Combination Devices:

1. Shall meet the applicable requirements of Section A listed above for audibility.
2. Shall meet the requirements of Section B listed above for visibility.

E. Manual Fire Alarm Stations

1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
4. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

F. Conventional Photoelectric Area Smoke Detectors

1. Photoelectric smoke detectors shall be a 24 VDC, two wire, ceiling-mounted, light scattering type using an LED light source.
2. Each detector shall contain a remote LED output and a built-in test switch.
3. Detector shall be provided on a twist-lock base.
4. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall flash every 10 seconds, indicating that power is applied to the detector.

2.4. SYSTEM COMPONENTS:

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6. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet (914.4 m) per minute.
7. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
8. All field wire connections shall be made to the base through the use of a clamping plate and screw.

G. Conventional Ionization Type Area Smoke Detectors

1. Ionization type smoke detectors shall be a two wire, 24 VDC type using a dual unipolar chamber.
2. Each detector shall contain a remote LED output and a built-in test switch.
3. Detector shall be provided on a twist-lock base.
4. It shall be possible to perform a calibration sensitivity and performance test on the detector without the need for the generation of smoke.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs) over 360 degrees, on the detector, which may be seen from ground level. This LED shall flash every 10 seconds, indicating that power is applied to the detector.
6. The detector shall not alarm when exposed to air velocities of up to 1,200 feet (365.76 m) per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
7. All field wire connections shall be made to the base through the use of a clamping plate and screw.

H. Duct Smoke Detectors:

Duct smoke detectors shall be a 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

I. Projected Beam Detectors

1. The projected beam type shall be a 4-wire 24 VDC device.
2. The detector shall be listed to UL 268 and shall consist of a separate transmitter and receiver capable of being powered separately or together
3. The detector shall operate in either a short range (30' - 100') or long range (100' - 330') mode.

2.4. SYSTEM COMPONENTS:

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4. The temperature range of the device shall be -22 degrees F to 131 degrees F.
5. The detector shall feature a bank of four alignment LEDs on both the receiver and the transmitter that are used to ensure proper alignment of unit without special tools.
6. Beam detector shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses.
7. The unit shall be both ceiling and wall mountable.
8. The detector shall have the ability to be tested using calibrated test filters or magnet activated remote test station.

J. Automatic Conventional Heat Detectors

1. Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 135 degrees Fahrenheit (57.2 Celsius) for areas where ambient temperatures do not exceed 100 degrees (37.7 Celsius), and 200 degrees (93.33 Celsius) for areas where the temperature does not exceed 150 degrees (65.5 Celsius).
2. Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation.
3. The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.
4. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.
5. Automatic heat detectors shall have a smooth ceiling rating of 2500 square feet (762 square meters).

K. Waterflow Indicator:

1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.

2.4. SYSTEM COMPONENTS:

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4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

L. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

2.4. SYSTEM COMPONENTS:

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M. Serially Connected Annunciator

1. The annunciator shall communicate with the fire alarm control panel via a two wire EIA 485 (multi-drop) communications loop.
 2. The annunciator shall require no more than four wires for operation. Annunciation shall include: intelligent addressable points, system software zones, control relays, and notification appliance circuits. The following operations shall also be provided:
 - a. This unit shall provide for each zone: alarm indications, using a red alarm and yellow trouble long-life LEDs and control switches for the control of fire alarm control panel functions.
 - b. The annunciator shall include a single electrical keyswitch to disable all switch functions.
- N. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.
1. The system shall offer an interface to a graphic style annunciator and provide each of the features listed above.

O. LCD Alphanumeric Display Annunciator:

1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions from either the network node or complete network, via the INA.
3. Up to 32 LCD annunciators may be connected to a specific (terminal mode) EIA 485 interface. LCD annunciators shall not reduce the annunciation capacity of the system. Each LCD shall include vital system wide functions such as, system acknowledge, silence and reset.
4. LCD display annunciators shall mimic the local control panel 80-character display or network annunciator and shall not require special programming.

2.4. SYSTEM COMPONENTS:

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P. Portable Emergency Telephone Handset Jack

1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on the plans.
2. Insertion of a portable handset plug into a jack shall send a signal to the fire command centre, which shall audibly and visually indicate the on-line condition, and shall sound a "ring" indication in the handset.
3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

Q. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labelled as "Emergency Telephone." The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection so that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. On activating the remote phone, the phone earpiece shall sound a telephone ring signal until the master handset is lifted.
4. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

R. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

S. An optional module shall be provided for NFPA 72, Chapter 4 transmitters as well as a Digital Alarm Communicator Transmitter (DACT). The DACT shall be an optional plug-in module which supports up to 9 different transmission methods. The UDACT shall have the ability to annunciate each and every addressable point at the central station receiver.

T. Printer: The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. Power to the printer shall be 120 VAC @ 60 Hz.

The system shall have a strip printer capable of being mounted directly in one of the system enclosures. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

2.4. SYSTEM COMPONENTS:

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- U. Video Display Terminal (VDT):
1. The video display terminal shall provide a visual display and an audible alert of all changes in status of the system and shall annotate such displays with the current time-of-day and date.
 2. A detachable keyboard shall be provided with the VDT which may be used for programming, testing, and control of the system.
 3. The video display terminal shall include a count of all alarms and troubles in the system as well as a count of all alarms and troubles requiring acknowledgment.

2.5. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall use simple to install and maintain type address switches.
2. Detectors shall be intelligent (analogue) and addressable, and shall connect with two wires to the fire alarm control panel signalling line circuits.
3. Addressable smoke and thermal detectors shall provide alarm and power/polling LEDs. LED(s) shall flash under normal conditions and LED(s) shall be placed into steady illumination by the control panel, indicating an alarm condition.
4. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system.
5. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
7. Detectors will operate in an analogue fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analogue value of each detector.
8. LEDs shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.

2.5. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

B. Addressable Pull Box (manual station)

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1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analogue level of smoke density.

D. Intelligent Ionization Smoke Detector

1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analogue level of products of combustion.

E. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signalling line circuit.

F. Intelligent Duct Smoke Detector

1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analogue monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

2.5. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

G. Addressable Dry Contact Monitor Module

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1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

H. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The two-wire monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or with an optional surface backbox.
3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

I. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
2. The control module shall mount in a standard 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

2.5. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

4. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised, UL listed remote power supply.

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5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

J. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

L. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.5. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

M. HVAC/Smoke Control System Operation:

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1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic annunciators if the project requires such.

2.6. BATTERIES:

- A. The batteries shall be sealed Gel Cell type, 12 volt nominal (two required).
- B. The battery shall have sufficient capacity to power the fire alarm system for not less than **72 hours** plus **15 minutes** of alarm upon a normal AC power failure.

PART 3.0 - EXECUTION

3.1. INSTALLATION:

Financial Services Commission Building
Addressable Fire Detection Alarm System Specification

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.
- C. Manual pull stations shall be suitable for semi flush mounting on standard single gang box, and shall be installed not less than 42 inches or more than 48 inches above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.

3.3. FINAL INSPECTION:

- A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."