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## GENERAL

### The Site

The site composed of renovation works for International Commerce Centre (ICC) 51/F, Unit 5105 and International Gateway Centre (IGC) Tower 1, 21/F, Units 04-06.

Tenderers are strongly advised to visit the site and check conditions and locations of existing services.

On submitting this tender, the tenderer must satisfy himself that he is familiar with the site conditions and he has made due allowance in his sum for every special working condition.

### General Specifications

All the materials, installation and workmanship shall comply with the General Specifications.

SCOPE OF WORK

The Contractor shall be responsible for the supply of the whole of the materials and labour necessary to form a complete mechanical ventilation and air-conditioning installation as described in this Particular Specifications and the relevant drawings. This contract shall include not only the major items for equipment shown or specified but also all the incident sundry components necessary for the complete execution of the works and for the operation of the installation, including necessary labour, whether or not these sundry components are mentioned in detail on the drawings and Specification. In case any discrepancy between the drawings and this Particular Specifications, this Particular Specifications shall take precedence.

In general this shall include but not be limited to the following main items:

1. Dismantle the obsolete existing air-conditioning and mechanical ventilation, etc. complete with dismantle and reinstate false ceiling & FRR enclosure.

2. Clearing up all areas and cart away all rubbish, etc. and remove out from the site.

3. Supply and installation of New VAV boxes with controls, wiring and all necessary accessories.

4. Relocation of Existing VAV boxes with controls, wiring and all necessary accessories.

5. Supply and installation of New air diffusers as per tender drawings

6. Relocation of existing air diffusers as per tender drawings

7. All the work must be in FULL compliance Building Energy Code of latest edition issued by Electrical & Mechanical Services Department.

8. Submission of WR1A of the electrical installation installed by this contractor.

9. Painting labeling.

10. Testing and Commissioning

11. Provision of training to the employer staff on the system operation

12. Provision of sample board, shop drawings, as-fitted drawings and O&M manual.

13. One Years Free Maintenance within Defects Liability Period.

14. Liaison with Building Management for executes work in common area. Sufficient protection and cleaning of work site afterward shall be provided to their satisfaction.

15. Checking and perform condition survey of existing installation and prepare report on the findings.

16. Dismantle and reinstate existing false ceiling and fire rated enclosure for work execution.

17. Properly terminate and plug-off existing installation being retained.

18. Night work for execute the scope of work that will affect the building operation.

## AIR HANDLING EQUIPMENT

### Fans

This section specifies the manufacture and installation of fans as shown in the Drawings and equipment schedules.

#### General Requirement

Provide fans with quantity and duty shown on the Drawings and Equipment Schedule.
Protect the complete Set of fans during transportation and store the fans well covered and protected until for installation.
Protect the fans from mechanical or corrosive damages during construction.
The fan resistances given in the Equipment Schedules / Drawings have been calculated on assumed resistance figure for equipment and are for guidance only. The final resistance based on the actual duct run and the offered equipment shall be carefully checked and re-assessed before ordering the equipment. Any additional cost on the modification of the system (fan, motor, switchgear, cables, etc) necessary to meet the scheduled duties and space conditions shall not be entertained.
Allowances shall be made for the effects on fan performance of all installation conditions including coils, eliminators, attenuator plenum enclosures and inlet and discharge arrangements so that actual installed fan performance meets actual conditions.

#### Submittals

All fans shall be performance tested to BS848: Part 1 and Part 2
Materials shall comply with statutory, FSD requirements and the relevant British Standards.
Submit shop drawing showing plans, elevations, dimensions of equipment, electrical wiring diagram, control, operating weights, ductwork connections and flange details, fixing and mounting details.
Submit Manufacturer's data and chart rates against total static pressure, fan efficiency curves indicating total kW loads, air flow efficiency, sound power ratings.
Certified performance curves for each fan shall be plotted over the entire range from shut-off to free delivery with static pressure in Pa, total efficiency in percentages and operating in kW, against the air flow in m3/s at the specified speed and shall clearly indicate the operating point for each fan operating separately, and additionally, in the case of parallel operation fans, the parallel operation characteristics and operating points.
Plotted curves or tables of the Octave band sound-power-level at static pressure corresponding to specified capacity with decibels (db re 10-12 watt) versus octave-band center frequency from 63Hz to 8,000Hz.
Mounting and fixing details shall include details and dimensions of fan connections, vibration isolators, hangers and any other builder's work requirement.

Product

General

Fans shall have non-overloading characteristic over their entire operating range and the characteristic curves must be such that the fan operating point falls between the no flow static pressure and the maximum mechanical efficiency, and 15% increase in static pressure over that specified does not affect the stability of fan operation.

Each complete fan unit including motor and drive shall be supplied from a single manufacturer and all guarantees, test certificates, etc shall be deemed to apply to the entire assembly.

All fans shall be constructed to a fully developed design and shall be capable of withstanding the pressures and stresses developed during continuous operation at the selected duty. Additionally, all belt driven fans shall be capable of running continuously at 10% in excess of the selected duty speed.

All fans shall be statically and dynamically balanced

All fans and motors offered shall be of minimum vibration and noise level during operation; should these be excessive and not within normal acceptable standards, adequate or additional vibration isolation and sound attenuation shall be provided without extra cost to the satisfaction of Architect.

In-line Duct Fans

Casing shall be of hot rolled sheet steel (galvanized or epoxy coated) with structural steel framework.

Impellers shall be constructed of galvanized steel and of multi-blade centrifugal or mixed flow blades type.

Impellers shall be of non-overloading and silent running type.

The fans installed at any angle shall not affect the fan performance.

Mounting feet shall be provided where necessary for bolting to a base or supports.

Fan casing shall be fitted with flanges on the suction and discharge side for connection of flexible joints and ducting.

An access panel with purpose made air seal shall be provided on the fan casing and shall be sized and so positioned as to facilitate maintenance.

Fans shall be completed with accessories for 100% speed controllable and regulating.

Acoustic treatment shall be provided to meet the designed noise level of served area.

Fans shall be operated through an “ON/OFF” switch.

Execution

Properly guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts so that a person can safely come in close proximity thereto.
Fit fans to the space provided and make readily serviceable.
Provide support beams, support legs, platforms, hangers and anchor bolts required for the proper installation of equipment as shown on the drawings or recommended by the manufacturer.
Provide factory inlet bells and other accessories for fan units and shown on Drawings or otherwise required for a complete and efficient assembly.
Electrical connection refers to the Clause of “Material and Workmanship Standard for Electrical Installation”.
Where corrosion can occur, appropriate corrosion resistance materials and assembly methods must be used including isolation of dissimilar metals against galvanic interaction.
Thoroughly clean the entire system before operating the fans.
Starting method of motor fans shall be in accordance with the Supply Company’s supply rules and this specification.
Means of protection against over current in the motor to be incorporated into the control equipment.

Air Filters

This Section specifies the manufacture and installation of permanent air filters.

General Requirement

Filter shall be adequately stored in dry area and protected during shipping and construction.
Filter shall not be fitted into the filter frames until necessary for commissioning.
All supply air systems shall be provided with a filtering system unless specifically notes on the Drawing.
Filter assemblies shall operate with at least the efficiencies specified in this Section.
Filter shall be completed with robust enclosure, holding frames and housing constructed of non-corrosive metal or if of mild steel galvanized shall be further treated in accordance with the relevant clauses of “Painting and Labeling” Section.
The enclosure shall be constructed and assembled in such a manner that a rigid and durable enclosure for the filter pack is affected.
The periphery of the filter pack shall be continuously bonded to the inside of the enclosing frame thus eliminating the possibility of air bypass.
Holding frames shall be factory fabricated and shall be equipped with gaskets and sealing fasteners.
The gaskets shall be able to prevent air bypass between the filter and frame, between the adjacent frames and between the frames and housing. The fasteners shall be capable of being attached or removed without the use of tools.
The housing shall be factory fabricated and assembled. They shall incorporate access doors, extruded aluminum tracks and holding frames designed to accommodate standard size efficiency and construction rating specified for the installation.

Quality Assurance
All filters shall be fire-resistant and conform to requirements of NFPA and Hong Kong F.S.D.

Submittals
Submit complete catalogue, information and shop drawings for material and equipment, showing dimensions, weights, ductwork connections and flange details, mounting and fixing details, complete material specification and filtering efficiency.
Submit independent laboratory test report on sample testing for every type of filter for proof of performance complying with this Specification.
Submit copies of operation and maintenance manuals for all type of filters.
Submit samples of all types of filter for approval.

## STEEL FRAME WORKS FOR A/C EQUIPMENT

The units shall be fixed with stainless steel bolts and nuts; further, the whole outdoor INSTALLATION shall be securely tied up with steel ropes to guard against strong wind.

## ELECTRICAL WORKS

### Local Motor Control Panel (LMCP)

#### General

The electrical schematic diagrams for the equipment to be installed as shown in the Drawings are for guidance only. All of the electrical equipment provided, including switchgear, motor starters, interconnecting power cables, and busbars, shall be compatible in every respect with the electrical characteristics of the motors provided, and shall be designed to suit the starting, normal and abnormal operating conditions of the motor, and under fault conditions. Any extra cost due to the modification of the LMCPs and the interconnecting power cables necessary to meet the scheduled duties, and the requirements of the Wiring Regulations and the power company will not be entertained.

The LMCPs shall be of the self-contained wall mounted or floor standing extensible multi-cubicle type, built up from compartments housing the circuit breakers, fused switchgear, relays, busbars, controls etc. as shown on the schematic wiring diagrams contained in the Drawings and as specified hereinafter. The LMCPs shall be suitable for the service conditions specified in this Specification.

#### Particular Requirements on Quality Assurance

The LMCPs shall be partially type-tested assemblies (PTTA) as defined in EN60439-1, manufactured, factory assembled and tested by a specialist switchboard manufacturer.

The equipment within the LMCPs, including switchgear, controlgear and busbar assemblies shall be certified for the category of duty specified. Relevant technical information and literature in English and copies of type- test certificates, drawings and test reports shall be made available for examination during factory tests to verify that the above requirement has been met

Schedule of standards

The whole of the LMCPs shall be designed and constructed in accordance with the latest revision of the following standards.

| | |
|---|---|
| BS88, EN60269, IEC60269 | Cartridge fuses |
| BS89, EN60051, IEC6051 | Electrical indicating instruments |
| BS142, IEC60255 | Electrical protective relays |
| BS1433 | Copper for electrical purpose |
| BS2757, IEC6085 | Classification of insulating materials |
| BS3871, EN60898, IEC60898 | Miniature air-break circuit breakers |
| BS5685, IEC60521 | Electricity meters |
| BS6004, IEC60227 | PVC insulated cables, non-armoured, for power and lighting |
| BS6231, IEC60189-5 | PVC insulated cables for switchgear and control gear wiring |
| EN60622, IEC60622 | Sealed nickel-cadmium prismatic rechargeable single cells |
| BS7430 | Code of practice for earthing |
| BS7671, IEC60364 | Wiring regulations for electrical installations for buildings |
| BS7626, 1EC60185 | Current transformers |
| EN55014 | EMC Requirements for Household Tools and Similar Apparatus |
| EN60439, IEC60439 | Type-tested and partially type-tested assemblies |
| EN60947, IEC60947 | Low-voltage switchgear and control gear |

Construction

The LMCPs shall be steel construction, self-supporting, with modular top, side and back panels and doors of sheet steel built up on substantial framing with all necessary stiffeners, supports and return edges to provide a rigid construction and clear accessibility to all internal components within the panel. The thickness of the sheet steel shall be at least 1.6mm.

Provide non-magnetic removable gland plates of not less than 2.0mm thick at the top and bottom of the LMCPs with suitable cutouts for cables terminations.

The degree of protection of enclosures shall be to IP44 for indoor application to EN60529 and IEC60529. All doors shall have hinges and be provided with dust-excluding gasket.

The LMCPs shall be of uniform height, and uniform depth front-to-back, throughout its length and shall present a neat and tidy appearance. Arrange all control and indication components mounted on or within the LMCPs between 500mm and 1800mm above the finished floor level.

Provide a base frame for the floor standing type LMCP. The base frame shall be made up of steel channel with a minimum height of 100mm of substantial strength at the bottom of the LMCP.
All switchgear shall be provided with mechanical interlocks so that their doors, covers, and the like can only be opened when the switchgear are in the off position and it is not possible to close the switchgear while the doors, covers, and the like are opened. The interlock shall automatically be restored on re-closing the doors, covers and the like.
Gasket shall be provided to all detachable panels and swing panels.
The complete LMCP shall comply with Form 3b segregation for the non- essential section and Form 4 for the essential section.
All parts which are subject to wear or damage by dust shall be totally enclosed in dust-proof housings.
Insulators shall be non-hygroscopic and non-deteriorating.

Finishes
All steelwork shall be thoroughly cleaned of all dust, oil, grease, dirt, scale, rust and other contaminants by shot or grit blasting, and shall be epoxy powder coated immediately at the manufacturer's works. The epoxy powder coating shall be not less than 50 microns thick.
The exterior of the LMCP shall be finished to manufacturer’s standard colour, unless otherwise specified. The end plates and heads of any external fixing bolts and set screws shall be of non-corrosive type and finished to match with the colour of the LMCP

## DUCTWORK

### Ductwork and Air Distribution Accessories

This Ductwork and Air Distribution Accessories
This section specifies the manufacture and installation of ductwork, diffusers, registers, grilles, dampers and accessories.

### General Requirement

All ductwork and distribution accessories delivered to Site shall be new.
Provide all ductwork, diffusers, registers, dampers, grilles etc. in accordance with this technical specification and/or Drawings and all others to ensure the system can be working as design.
All materials used including ductwork, insulation, adhesives, flexible connections, gaskets, sealants, fibreglass boards, etc. shall fully comply with all requirements of the HKFSD and Building (Ventilation Systems) Regulation, Hong Kong.
All ductwork shall be constructed as recommended in DW/l44, HVCA specification for sheet Metal Ductwork and approved by Architect.
Ductwork leakage test shall comply with DW/143 and leakage rate shall not exceed the recommendation as specified in DW/144.
The internal side of the ductwork facing grilles / louvres / registers / diffusers / wire-mesh or just exposed to view shall be painted black for aesthetic aspect.

### Submittal

Submit shop drawings including plans, sections, elevations, schematics, schedules and details of all system and shall show locations of all dampers, splitters, hangers, supports, grilles. diffusers, louvres, flexible joints & testing points for approval.
Submit construction and mounting details for hangers, dampers, diffusers, louvres, grilles, hoods for approval.
Submit guaranteed performance figures for each size of supply grille, ceiling diffuser offered. The performance figures shall include:
Face velocity
Static pressure drop
Throw in meters for terminal velocity of 0.25m/s.
Sound power level data.
Submit samples and manufacturers of all grilles, diffusers, louvres, hangers, sheet metals, fire dampers & flexible connectors for approval prior to ordering.

### Products

Sheet Metal Ductwork
All sheet metal ducting shall be constructed to the recommendations of DWl44 HVCA Specification for Sheet Metal Ductwork and approved by the Architect.
Unless otherwise specified, ductwork shall be constructed of galvanized steel sheets of minimum thickness complying with the standards and pressure classification of DW144. The galvanized steel sheets shall comply with Z275
Provide splitter dampers, complete with adjusting handle or similar device to all branches off the supply air ducts to regulate air flows along

the main duct and the branch ducts, whether they are specifically shown in the Drawings or not.
Provide opposed blade type volume dampers to branch ducts.
All manual operated dampers shall comply with DW144 and be constructed of G.I. steel.
Provide flexible connectors of not less than 50mm long between all fans and the related ductwork whether they are specifically shown in the Drawings or not to prevent transmission of vibration to adjacent elements. Also provide flexible connectors at expansion joints in buildings designated on the Drawings.
The material used for the flexible connections shall withstand the specified conditions of temperature and air pressure, and shall comply with the standards of air-tightness, and shall be coated. The material must be fire resistant and must comply with the HKFSD's requirements. All flexible connectors for duct work shall be of flanged joint.
Outdoor flexible connector shall be covered with prime quality G.I. steel sheet or weather shields arranged to form a weatherproof jacket.
Provide access doors in ducts where required to gain access to dampers, filters or controls.
Access doors and panels in ductworks shall be quick release pattern. Multiple screw fixings shall not be accepted.
Provide flanged joints to plant and elsewhere as necessary to facilitate maintenance.
All flanged joints in duct work shall be made up with rubber gaskets or suitable mastic materials.
Apply sealants, adhesives, tapes to joints for sealing. All such materials shall comply with the requirements of DW/144 & FSD.
Kitchen exhaust air ductwork for restaurant shall be constructed from
1.6mm thick stainless steel sheet, comply to BS EN10029:1991, BS EN10048:1997, BS EN10051:1992, BS EN10095:1999, BS
EN10258:1997 and BS EN10259: 1997 and with tin soldering joint.

<u>Flexible Air Ducts</u>
In conditioned space, all flexible air ducts shall be insulated with a vapour-proof type of 25mm thick, 24kg/m3 and wrapped with aluminum foil.
In other areas, flexible air ducts shall be made of flexible corrugated metal tubing of stainless steel, aluminum, tin plated or aluminum coated steel.
All flexible air ducts shall conform to class '0' fire rating and comply with FSD's requirement.
All flexible air ducts shall not more than 4m run as per FSD's requirement.

Fire Dampers

Provide fire dampers in air ducts in the following locations

(1) Wherever a duct passes through a floor slab or a fire resisting wall which is expressly built for the purpose of preventing the spread of fire.

(2) Other locations as required by the latest edition of the Building (Ventilation systems) Regulation, Hong Kong. (3) Other locations as required on the drawing.

Fire dampers shall fully comply with the requirement of FSD in respect to damper blade overlapping allowed clearance between blades and casing.

Fire dampers shall be constructed generally to the same standards of air tightness as the rest of the system.

Fire damper casing and blades shall be constructed of mild steel of 6mm thick, painted two coats of primer paints and provided with a mild steel angle frame each side of a wall or floor.

Fire damper casing shall also be constructed to damper standard and shall be flanged to suit the ductwork into which they are fitted and the cross sectional area shall not be less than that of the ductwork.

Blade and fusible link shall be accessible for servicing through air-tight inspection doors.

Provide approved fusible link set at not more than 69OC to all fire dampers unless otherwise stated.

Indicate all details and position of all fire dampers on shop drawings.

Provide all necessary fixing framework for the installation of fire dampers

Provide fire rated material to seal off the clearance between the fire damper and wall.

For multi-blade dampers, controlled by two linage tie rods where the damper is longer than 1m.

Provide counter weight assuring positive closure and arranged so that normal air flow direction will tend to hold the damper in closed position.

Folded continuous interlocked blade fire dampers shall be :-

Provided for high pressure air ducts and for vertical air duct passing through a number of floor with fire damper in series,

Of proprietary made, with construction and mounting method approval by a recognized testing authority, giving the required

F.R.P. value equivalent to the structure it protects. Acceptable standards include B.S. 476: Part 20 for integrity only and UL555.

Provided with stainless steel spring closure mechanism, where installed in vertical duct.

Constructed of inherently corrosion resistant material or otherwise protected to inhibit corrosion.

Anchored securely to fire partition.

With clear passage to air flow in the open position.

Smoke Fire Dampers

Comply with all relevant requirements of fire dampers and shall be of very low leakage non-heat degradable type with friction free metal-to- metal seals and dead air space seal formed at blade joining. Frames and other components shall be of hot dipped galvanized steel to BSEN 10142 and conform to the high temperature ratings,

Approved by the local Fire Services Department and shall meet UL555S.

Installed in accordance with the manufacturer's UL installation instructions.

Combined fire smoke dampers and smoke dampers shall either be "power open-spring closed" or "Power closed-spring open" as required achieving fail-safe operation.

Smoke fire dampers shall be multi-blade type dampers as specified in clause “FIRE DAMPERS".

Each damper shall be provided with a recyclable link to UL33 and be actuated by smoke detector.

A limit switch shall be provided to give remote status indication.

Leakage rating shall comply with class II or better under IBC 716.3.2.

Each fire smoke damper shall be provided with a reusable thermal link rated at 69 deg.C and tested to UL33.

Volume Control Dampers

Volume control dampers shall be of the opposed blade, multi-leaf type with overlapped blades and constructed of G.I.

All dampers shall be constructed with no vibration or rattling under all operating conditions and shall comply with DW/144.

The setting of the damper shall be clearly indicated and marked permanently after the system has been regulated. The lever shall be aligned with the damper.

Provide suitable seals between damper spindles and casing.

Square Ceiling Diffusers

Supply Air Grilles, Bar Grilles and Registers

Double deflection supply air grilles/registers shall be tapped from side or bottom of ducts with provision for tamper-proof adjustment of air pattern spread along width. Adjusting tool shall be provided.

Furnish grilles/registers to meet the size and capacities shown on the Drawings. Provide gaskets to obviate air leakage.

Provide transitions to connect ducts to grilles and registers.

Grilles and registers shall be factory furnished with opposed blade volume control dampers operable through the grille face.

All grilles and registers shall be of extruded aluminium anodized to an approved colour.

All grilles shall be capable of being removed easily from the ductwork for access to dampers etc.

Paint black of the duct internal when exposed to front view through grilles and registers.

Return/Exhaust Grilles and Registers

Same as those of supply air grilles and registers.
Grilles shall be with the appearance in line with that of supply air grilles.

Return Air Diffusers

Return air diffusers shall match the supply diffusers in appearance and shall be constructed of the same material and same finish and shall be anodized to an approved colour.
Diffuser inner vane core shall be removable without tools so as to access to the return air filter. They shall either be clipped to the grille or framed inside the ductwork.
Paint black of the duct internal when exposed to front view.

Linear Air Disffusers

Each diffuser shall be of multi-slotted vertical/horizontal discharge, ceiling mounted type fitted into a feed insulated “boot” with spigot for receiving supply duct as detailed on the Drawings.
Diffuser of extruded aluminium shall be anodized to a colour approved by the Architect. Adjustable vanes providing 180 deg.C pattern for discharge direction control and flow rate control shall be black.
Number of slots and lengths of diffuser and capacity shall be as indicated.
Provide air boot to the diffusers as shown on the drawings. Boot casing shall be constructed of 0.6 mm thick galvanized steel with internal lined with 48kg/m3, 20mm thick glass fibre. Insulation and boot shall be extended to cover the collar of diffuser.
Exterior surface of boots shall be painted and finished to an approved colour.
The flanges of the grilles shall be required to support ‘drop in’ ceiling panels.
Provide 1 mm thick GI sheet painted black at the front view to seal off the dummy part of diffuser.

Fire Resistance Board

All fire resistance board shall comply with FSD’s requirement and with FSD approval and constructed according with manufacturer’s recommendation.

Ductwork with Fire rated Coating

The fire rated coating shall be non-hydroscopic and be tested with exposure to UV and condensation cycling, with no adverse effect on the life of fire rating of the duct for at least 20 years.
All fire rated ductwork must be manufactured and erected in line with the tested and assessed Certification to BS476 Part 24 and ISO6944.
The fire duct shall be manufactured, and be pressure tested to DW144 standard, in line with the pressure classification of the duct being installed.

The fire duct support system shall be located at a maximum of 1500mm centres, the size of the hangers and bearers upgraded to account for reduction in tensile strength of steel, due to a 2-hour fire from 430 Newton/$mm^2$ to 10 Newton/$mm^2$.
Hangers for all Fire Rated Ductwork shall be minimum M10 and adjusted so that the tensile strength in the Rod does not exceed 10N/sq.mm for fire resistance periods upto 2 hours and 6N/sq.mm for fire resistance periods upto 4 hours.
Bearers for all Fire Rated Ductwork shall be minimum 50x50x5mm Rolled Steel Angle and adjusted so that the bending stress in the angles/channels do not exceed 10N/sq.mm for fire resistance periods upto 2 hours and 6N/sq.mm for fire resistance periods upto 4 hours.
All gaskets and sealants shall be non-combustible, fire resistant and installed as fire tested to BS476 Part 24:1987 (ISO 6994-1985) for Fire Inside (TYPE B) and Fire Outside (TYPE A)
For the connection to the fans, fire rated flexible connections shall be used. Flexible connectors shall be made of glass fabric, coated on both sides with flame retardant silver grey polyurethane rubber, tested to BS476 Part 20.
Fire rated ductwork to have passed impact test to BS5669 Part 1 and Appendix A of BS5588 Part 5.
All fire rated ductwork shall be manufactured and erected in line with the tested and assessed Certification to BS476 Part 24 and ISO6944.
Fire rated ductwork shall have been tested to UL Standard 723 “Test on surface burning characteristics of Building Materials “ASTM E-84”.
Duct shall be tested / assessed to BS476 Part 24 for all sizes up to 25 metres x 3 metres cross-sectional area.
All fire rated ductwork shall be subject to approval by local Fire Services Department.

Execution

Ductwork Installation

Provide all labour and materials to form complete ductwork systems and shall leave the installation adjusted to the designed flow rates.
Check all design intent Drawings in regard to structural requirements and other finishes before detailing the ducting system.
Submit all ductwork detail drawings for approval before fabrication commences.
Duct sizes given on the Drawings are clear internal dimensions and allowance must be made for insulation where applicable.
Protect ductwork, equipment and their openings from dirt, foreign objects and damage during the construction period.
Replace damaged ductwork and other equipment at no additional cost to the Employer.
All ductwork to be rigidly and adequately supported at intervals to ductwork standards.

Provide hangers for the proper installation of ducts in accordance with DW/144. Hangers shall be of 7mm, 10mm, or 13mm diameter mild steel rods, depending on size of duct. All such hangers shall be provided with screwed lengths on lower end for adjustment of duct level. All nuts shall be provided with washers and with lock-nuts, and projecting ends of bolts shall be cut off.
Install dampers and splitters in an adjustable and accessible manner.
Adjust moving parts to move freely without binding.
Caulk dampers airtight around frames.
Adjust dampers and splitter adjusting rods for operating freely between the open and closed positions.
Install flexible connections in accordance with DW/144.
All ductwork shall be manufactured with their dimensions and routings suit the site conditions. Provision shall be allowed to accommodate any discrepancies between the Drawings and the site dimensions.
Internal roughness, sharp edges on obstructions to air flow shall not be allowed.
External edges and corners formed from cleated joints shall be neatly dressed down and made air tight.
Provide at least 75mm clearance from ductwork to walls, ceiling and obstructions.

Diffusers, Registers and Grilles Installation

Install diffusers, registers and grilles so that they can be key adjusted from the face directly without special tools.
Unless otherwise specified, install vanes, volume control dampers and multiple-blade extractors so that they can be removed through the diffuser and registers for access to the duct.
Install diffusers, grilles, registers and louvres upon a substantial frame connected to the ductwork and provide soft rubber gaskets inserted under the frame or otherwise so arranged such as to avoid air leaks around the diffusers and grilles.

Cleaning of Air System

Clean air systems by means of industrial type vacuum cleaners which shall effectively remove dust and foreign material from surfaces swept by the air stream. Cleaning shall be carried out in sections as the installation progress.
Clean exposed ductwork and leave in satisfactory condition, free from grease, oil or foreign material for application of insulation or finish painting.

## CONTROL INSTRUMENTS

### FAN TRIPPING SYSTEM

According to the latest HKFSD's regulations on Air-Cond/Ventilation control system, please refer to the Code of Practice for Minimum Fire Service Installations and Equipment (Clause 5.25 – Ventilation / Air-Conditioniong Control Systems (Override control of mechanical ventilation systems in the Event of Fire). Method 'C' of the override control will all be adopted for the ventilation system control for the areas mentioned in section 14 of this specification. The override control can be arranged to completely shut down all the fans in the building fire alarm system. The contractor shall supply and install all G.I. conduit wirings to the dry contacts of relays in the manual override control panel at the F.S. control room at G/F for building fire alarm and emergency stop of all ventilation fans operation in case of fire.

The contractor should prepare and submit the necessary drawings and documents to the Fire Services Department for their comment, approval and onward inspection. Those drawings/ documents should be submitted to the Architects / E&M consultant for approval prior to any submission to F.S.D.

ACOUSTIC TREATMENT AND VIBRATION ISOLATION

Anti-vibration Controls

The Contractor shall ensure that the equipment offered shall not create any offensive noise to the neighbouring areas.

Anti-vibration mountings and flexible connectors shall be provided for all packaged liquid chillers, cooling towers, water pumps, and other heavy A/C units.

All mechanical equipment shall be mounted on 25mm deflection springs, equivalent to Mason SLF, SLR or W30N or other technical equivalent unless otherwise specified. Approval of the springs to be used must be obtained from the Engineers.

Types and models of anti-vibration mountings for various equipment mentioned are for guidance only. The selection of which shall be based on the actual equipment to be installed the noise and vibration isolation requirements as put down in this particular specification shall be and in accordance to the manufacturer's recommendation and printed technical instructions.

Vibration Eliminator Selection General :

In the selection of spring mounts, the contractor shall be guided by the rules that the natural frequency of the mounted equipment shall not exceed one-third of the disturbing frequency of the equipment. This shall give minimum 90% isolation efficient for vibration transmission.

Wherever rotational speed is mentioned as the disturbing frequency, the lowest such speed in the system shall be used. All isolation devices shall be selected for uniform static deflections according to distribution of weight.

Select vibration isolators in accordance with the weight distribution so as to produce reasonably uniform deflection.

Spring type isolators shall be free standing and laterally stable with any housing and complete with 6mm neoprene acoustical friction pads between the base plate and the support.

Vibration Eliminator Selection

All mountings shall have leveling bolts that must be rigidly bolted to the equipment.

The following minimum requirements shall be followed for the selection of vibration eliminators.

| Equipment | Isolator Type | Vibration Min. Static Deflection |
|---|---|---|
| Ventilation and Exhaust Air Centrifugal Fans | SLF | 25mm |
| Pipe Hangers/Supports (Inside plant room and branch off from vertical pipe risers) | SLF | 25mm |

The vibration isolation type is products of Mason Industries Inc. Products capable of providing similar effect from other manufacturer may be accepted subject to the acoustic consultant's approval as.

Pipe and Duct Hangers - Double deflection neoprene-in- shear of fibreglass hangers. Units shall be completely protected with neoprene bushing to prevent steel-to-steel contact between hanger box and hanger rod.

Duct Connections at suction and delivery outlets on all fans and apparatus shall be made with synthetic neoprene held by 3.2mm x 25mm mild steel bands secured to ducts by bolts and nuts not more than 75mm. apart.

Flexible connection and fixing shall cater for the design static pressure of the air flow.

Flexible pipe connections at suction and discharge of all moving equipment and apparatus shall be Packless Bellow type and shall have stainless steel bellows of smooth curvilinear contour hydraulically formed from tubes containing only longitudinal weld and shall be free of surface scale. The bellows shall be externally reinforced by means of snug fitting rings of material and design appropriate to the service conditions. All flexible connections shall be provided with stainless steel slip type internal guide sleeves. Sizes of 75mm and above shall be flanged.

All insulation and acoustic materials used shall be approved by the Hong Kong Fire Services Department.

## LABELLING

All plant and equipment should be labelled in both English and Chinese.

Labels shall be of white Traffolyte with black engraved lettering not less than 20mm high or as otherwise required and approved by the Architect.

Manufacturers' nameplate, serial, model numbers and date of manufacture should be provided for all plant, equipment, ductwork and pipeworks.

Label shall be screwed or rivetted to sheet metal. Adhesive fixing is not acceptable.

Plant & equipment shall include but not be limited to:

Air-Conditioner, fans, etc.

Distribution boards, starters and the like shall be labelled to indicate the circuit number, phase and item controlled.

## SHOP DRAWINGS AND AS BUILT DRAWINGS

Shop drawings shall be submitted by the Contractor as required by the Architect for approval of installation details based on actual dimensions of materials/equipment used. These shall be submitted at least 2 weeks before commencement for the installation work and shall include the followings :

Layout of piping, ductwork and equipment layout, including all relevant details.

Surfaced and Concealed conduit routing.

Cable & trunking routing.

The number of copies required are as follows :

1 copy of shop drawing to be submitted for approval.

1 copy of approval shop drawing.

1 copy of As-built drawing, maintenance manual, photocopy of certificate and warranty card.

1 electronic copies of computerized as-built drawings prepared by latest version of Auto CAD. Such drawings and electronic copies shall comply with all requirements of presentation format shall be specified by the Employer, if any.

1 set of duly endorsed Test and Commissioning Reports, shall be required.

## FREE SERVICE & MAINTENANCE

The Contractor shall provide service and maintenance to the entire installation without charge to the Employer for a period of not less than 12 months. The service and maintenance work shall include systematic examination, adjustment and lubrication of the equipment, and also the repairing and replacement of the part etc. whenever it is required. Immediate attendance shall be provided on a 24 hours on call basis upon notification of breakdown or hazardous situation or condition with respect to the plant and equipment. The free maintenance period shall commence from the date of practical completion of the Main Contract Works certified by the Architect and shall expire after expiration of Defects Liability Period or issue of the Certificate of Completion of Making Good Defects whichever is the later.

At the end of the above stated period, a further test will be carried out on the equipment by the Architect. Any defects shall be rectified by the Contractor at his own expense.

## GENERAL

### The Site

The site composed of renovation works for International Commerce Centre (ICC) 51/F, Unit 5105 and International Gateway Centre (IGC) Tower 1, 21/F, Units 04-06.

Tenderers are strongly advised to visit the site and check conditions and locations of existing services.

On submitting this tender, the tenderer must satisfy himself that he is familiar with the site conditions and he has made due allowance in his sum for every special working condition.

### General Specifications

All the materials, installation and workmanship shall comply with the General Specifications.

## SCOPE OF WORK

The Contractor shall be responsible for the supply of the whole of the materials and labour necessary to form a complete electrical installation as described in this Particular Specification and the relevant drawings. This contract shall include not only the major items for equipment shown or specified but also all the incident sundry components necessary for the complete execution of the works and for the operation of the installation, including necessary labour, whether or not these sundry components are mentioned in detail on the drawings and Specification. In case any discrepancy between the drawings and this Particular Specification, this particular Specification shall take precedence.

In general this shall include but not be limited to the following main items:

1. Dismantle of all existing obsolete electrical installation complete wiring, conduit, lighting fitting, socket outlet, etc. complete with dismantle and reinstate false ceiling & FRR enclosure

2. Clearing up all area and cart away all rubbish, etc. and remove out from the site.

3. Supply and installation of sub-main distribution complete with cables, cable containment, , MCB board, MCCB unit, MCB unit, fuse switch, isolator, etc.

4. Supply and installation of sub-main cable complete with cables, cable containment, MCCB board, MCB board, MCCB unit, MCB unit, fuse switch, isolator, etc. for electricity supply to ventilation system.

5. Supply & installation of cable containment such as metal trunking and conduit to all sub-mains and final circuit cables.

6. Supply and installation of final circuit conduit wiring and MCB/MCCB to socket, fused spur unit, isolator, etc. c/w conduit, switches, socket, etc. include all necessary accessories.

7. Supply & installation of lighting fitting complete with wiring & control switch.

8. Supply & installation of lighting control system with wiring, power supply, lighting control modules as per tender drawings

9. Earthing and Lightning Protection System complete with supply and install new lightning air terminal, earth pit and connection and modification to existing lightning and earthing system, cable junction box, earth pit, etc.

10. Supply and install cable containment for ELV system

11. Sleeved openings/holes, filling/patch up of all gaps.

12. Dismantle and reinstate existing false ceiling and fire rated enclosure for work execution.

13. Submission of Form WR1 endorsed by Registered Electrical Worker upon work completion. Main Contractor should be noted as Registered Electrical Contractor for the endorsement & statutory submission of WR1.

14. Drawings and forms submission to government departments and utility companies have jurisdiction in associated with the contract work and follow up for obtain early approval. Liaise and attend government departments and Utilities Company during installation and inspection at completion of contract work shall also include by this contractor.

15. All the work must be in FULL compliance Building Energy Code of latest edition issued by Electrical & Mechanical Services Department.

16. Painting and labeling.

17. Testing and Commissioning

18. Provision of training to the employer staff on the system operation

19. Provision of sample board, shop drawings, as-fitted drawings and O&M manual.

20. One Years Free Maintenance within Defects Liability Period.

21. Liaison with Building Management for executes work in common area. Sufficient protection and cleaning of work site afterward shall be provided to their satisfaction.

22. Modification of existing E&M installation to suit the interfacing connection of new and existing installation.

23. Night work for execute the scope of work that will affect the building operation.

## CABLE

### General

Cable shall include:-
PVC insulated steel wire armoured, PVC sheathed copper cable (PVC/SWA/PVC), PVC insulated cable, PVC insulated PVC sheathed cable,
Crosslinked polyethylene insulated, steel wire armoured PVC sheathed cable (XLPE/SWA/PVC),
Low smoke, halogen free (LSZH) crosslinked polyethylene insulated armoured cable meeting category CWZ of BS 6387,
Mineral insulated copper covered sheathed, PVC sheathed (MICS/PVC), Flexible cables,
Flexible cord,
Elastomer insulated cable, Heat resisting cable.

All cable shall comply with the relevant BS requirement, be provided with BASEC licence and be used for appropriate application as defined in the I.E.E. Wiring Regulations.

'Loop-in' system is utilized and hence no joints in the cable run shall be permitted.

Cables shall be terminated in the endorsed form i.e. compression cable lug, tinned copper cable socket, cable gland, etc.

### PVC Insulated, Steel Wire Armoured, PVC Sheathed(PVC/SWA/PVC CABLE)

PVC/SWA/PVC cable shall comply with BS 6346 : 1997 and be rated at 600/1000V grade.

PVC/SWA/PVC copper cable shall have stranded annealed conductor with PVC insulation properly colour coded along the cable. Armour shall be steel wire armoured covered by PVC sheath.

The cable shall be suitable for U/G installation and minimum bending radius is 8 times overall diameter.

Cable gland complete with internal conical seating, armour clamp and PVC shroud shall be provided for proper cable termination of cable onto switchgears or cable end boxes. Watertight seal is required between cable gland and the PVC insulation of conductor.

The cable shall be provided with BASEC licence.

XLPE Insulated, Steel Wire Armoured, PVC Sheathed(CLPE/SWA/PVC CABLE)

XLPE/SWA/PVC cable shall comply with table 11 to 18 of BS 6724 : 1997 and be rated at 600/1000V grade.

XLPE/SWA/PVC copper cable shall have stranded annealed conductor with XLPE insulation properly colour coded along the cable. Armour shall be steel wire armoured covered by PVC sheath. The cable shall be low smoke, halogen free with conductor operating temperature not exceeding 90oC.

XLPE insulated cable compound shall comply with BS6899:1991 and the thickness shall comply with BS 5467:1997.

For fire rated resistant cable, it shall meet category CWZ of BS 6387 for enhanced circuit integrity under fire conditions.

Suitable for U/G installation and minimum bending radius is 8 times overall diameter.

Cable gland complete with internal conical seating, armour clamp and PVC shroud shall be provided for proper cable termination of cable onto switchgears or cable end boxes. Watertight seal is required between cable gland and the XLPE insulation of conductor.

The cable shall be provided with BASEC licence.

PVC Insulated

PVC insulated cable shall comply with BS 6004: 2000 or 6346: 1997, 450/750V grade.

The cable shall be either single or stranded annealed copper or solid-stranded aluminium insulated by PVC.

The cable shall be single core cable suitable for running in conduit or trunking system. The proper colour coated cable shall be used.

Minimum cable size allowable is 1.5 mm2 copper for lighting circuit and 2.5 mm2 copper for power. Minimum permitted aluminium cable size is 16 mm2.

The cable shall be provided with BASEC licence.

PVC Insulated/PVC Sheathed

PVC/PVC cable shall comply with BS 6004: 2000 or 6346: 1997 450/750V grade.b) Cable shall be single or stranded annealed copper conductoror solid- stranded aluminium conducted PVC insulated and sheathed by PVC.

The cable shall be single, twin or multicore and is suitable for running in trunking, surface wiring and meter centre.

The cable shall be provided with BASEC licence.

Mineral Insulated Copper (MICS CABLES)

Cable shall comply with BS 6207 - 1: 1995 suitable for 450/750V grade.

M.I.C.S. cable shall have annealed copper conductor surrounded by magnesium oxide insulation enclosed in copper tubing as cover. PVC sheathe shall be used.

Cable shall be single twin or multicore with bending radius six times overall diameter of cable.

Special design cable sealant (cold compound) gland nut and termination gland nut, compression ring, gland body, pot, disc and sleeves shall be employed for cable termination in accordance with manufacturer's standard and utilizing special tools.

Where mineral insulated copper sheathed cables (MICS cables) pass through walls, and floor, they shall be protected with a piece of conduit bushes at each end and built into the wall.

Where mineral insulated copper sheathed cables (MICS cables) passes through floors in areas outside pipe duct or meter room, they shall be protected for a distance of minimum 1 meter from floor level with galvanized metal sleeves secured with clamp type saddles.

Where mineral insulated copper sheathed cables (MICS cables) are fixed directly to the structure, provide non-ferrous spacer clips for multiple runs (up to Four cables) fixed directly to the structure as following:-
Brass round head screws of minimum length 25mm employing rawl plugs as necessary,
Spacer clips securing single cables shall be of one fixing screw pattern,
Two screw patterns shall be used for multiple cable runs and,
Spacing of cable fixings shall be in accordance with manufacturer's recommendations.

PVC saddle shall be used if PVC sheath MICS cable is used. All cables shall be kept entirely separate from pipework associated with other services.

Flexible Cable

Flexible cable shall comply with BS 6007: 2006 for 450/750V grade.

Cable conductor shall be multi-strand copper wire insulated by vulcanised rubber and tough rubber sheath. Cable shall be twin with or without earth continuity conductor and multicore. Proper colour code (brown, blue and green/yellow) shall be provided.

Flexible cable shall be limited to be used in connection to plugs and electrical applicances.

Flexible Cord

Flexible cord shall comply with BS 6500: 2000 at 450/750V grade.

Flexible cord shall be of multi-strand copper conductor insulated by vulcanized rubber, PVC, butyl rubber, ethylene propylene rubber (epv), silicone rubber or glass fibre. Cord shall be twin or three core with colour code brown for line, blue for neutral and green/yellow for earth complete with PVC or CSP (chlorosulphorated polyethene) sheath.

Cord shall have cross-section area of not less than 0.75 mm2 and shall be held firmly by cord grips provided in plugs. Maximum mass supported shall not exceed limits stated in IEE Wiring Regulation.

Cords shall be used for pendant fixtures, portable lamps, portable appliances and stationary equipment. Cord shall not be permanently fastened to building surfaces and shall not pass through holes in wall, ceiling, floor, door-way and window.

Elastomer Insulated

Elastomer insulated cable shall conform to BS 6007, 450/750V grade.

Cable shall be single or stranded copper insulated with butyl rubber or ethylene propylene rubber (epr) or silicone rubber.

XLPE/PVC Cable

XLPE insulated PVC sheathed copper cables (XLPE/PVC) shall be of single core or multi-core with full neutral and shall be 600/1000V grade complying with BS 5467. The cores of these cables shall be high annealed copper conductors complying with BS 6360. Multicore conductors above 16mm$^2$ shall be shaped to reduce overall dimension and to give a smoother profile. The PVC insulated cores shall be coloured coded and sheathed with an extruded layer of two or more tapes of PVC bedding. A separator of PETP or polypropylene film shall be applied before the PVC is applied. The cables shall be oversheathed with an extruded black PVC layer embossed with the voltage designation and the manufacturer's identification.

The XLPE insulation shall be able to operate continuously at a conductor temperature of 90$^o$C.

The minimum bending radius shall be not less than eight times the overall cable diameter.

XLPE/PVC Cable with Branched XLPE/PVC Copper Cable

The cable specification for this type of cable is the same as XLPE/PVC copper cable plus the following particular requirement.

The cable T-off/joint shall be factory prefabricated for 1/C XLPE/PVC copper cable. Injection mold with PVC shall be adopted for insulating the branch off portion. Factory test shall be adopted for insulating the branch off portion, and the water tightness of the PVC moulding. Type test certificates to verify the short time rating and short-circuit capacity of the cable joint to be not less than that of the main cable riser issued by ASTA or other internationally recognised testing Authorities as approved by the Architect shall be submitted for the Architect’s approval.

## CABLE CONTAINMENT

### Ceiling Trunking

Metal cable trunking shall be manufactured from galvanised steel sheet of minimum thickness 1.2 mm, to BS 4678, Part 1, standard manufacturer's fittings, including bends, tee, end caps, etc. shall be utilized.

In jointing 2 adjacent lengths, sleeve type coupling and external copper earth bonding link, which is not less than 12 mm x 1.5 mm, shall be utilized.

Every part of trunking shall be equipped with removable cover, held in position by captive screw, spring-cap or other endorsed means. Loose screw shall not be permitted.

Trunking internal surfaces including edges shall be smooth and free from any projection or sharp objects.

Space factor shall comply with IEE Wiring Regulation and cables shall be retained by retaining bars of non-hygroscopic insulating material.

The trunking support shall be constructed of angled-iron section capable of carrying weight of trunking and cable inside with no visual sag. Spacing shall not be more than 1.8 m.

Cable of different voltages shall be housed in separate trunking or properly compartmented trunking.

Openings in trunking where cables pass through shall be provided with rubber grommet to BS 1767.

Bolt-on type flange end shall be provided when trunking terminates at switches, busbar chamber or distribution boards.

### Rigid Steel Conduit and Accessories

All conduits and fittings shall be galvanized iron to BS 4568: Part 1 and 2. Conduit shall be of heavy gauge screwed and longitudinally welded and protected against corrosion to Class 4 (heavy protection). Both inside and outside shall be hot dipped galvanized to BS 729.

Fittings shall be to Class 4 protection against corrosion - hot dipped galvanized both inside and outside.

Conduit boxes shall all be hot dipped galvanized both inside and outside to Class
4. 35 mm and 47 mm deep boxes shall be used for wiring accessories.

Minimum size of conduit shall be 20 mm outside diameter. Solid or inspection tee pieces or elbows shall not be allowed to be used in any conduit installation.

BESA box shall comply with BS 31. Special purpose BESA box shall be used for specific application. Extension ring shall be provided should finishes exceed 13 mm thick.
When crossing construction or expansion joint, endorsed type expansion joint

shall be employed.

Space factor for conduit shall comply with the latest edition of IEE Wiring Regulation.

Conduit system shall be electrically and mechanically continuous and permanently earthed.

Cables of different voltage shall be contained in separate conduits.

An earth connection shall be provided for every accessory box in fully compliance with IEE Wiring Regulations.

Cables for lighting, power and control circuits operated at different voltage shall be installed in separate conduits. For three phase circuits, all three phase and neutral conductors shall be contained in the same conduit.

Continuity of all conduits shall be required to obtain the resistance between any points shall not exceed 1 ohm, and shall comply with the requirements of IEE Wiring Regulations in all respects. This Contractor shall be required to carry out the continuity test for the conduit installation and submit the test result to the Architect.

Conduits shall be kept away as far as possible from cold water, hot water and gas pipes, etc..

Conduit shall be supported at interval not greater than 1.2 m on horizontal runs and 1.5 m on vertical runs. Where bends and sets occur, the conduit shall be fixed at a distance of 150 mm.

No more than 2 nos. 90 deg. angle bends shall be installed in any run of conduit without conduit box.

Conduit buried in concrete shall have a minimum of 25 mm depth of cover over its entire length. Conduit buried in plaster shall have a 5 mm minimum depth of cover over its entire length.

Flexible Conduit

Flexible galvanized steel conduits shall conform to BS 731, Part 1 and shall be:- Of the metallic watertight pattern,
PVC oversheathed but not applicable to ventilated ceiling area,
With a separate earth wire enclosed for earth continuity,
Minimum outside diameter of 20 mm,
To be terminated by brass adaptor on both ends.

## METHOD OF WIRINGS

The method of wirings installation in the areas will be as follows :

Surface conduit wirings: (G.I. conduit System)

E&M rooms
All area within false ceiling

Concealed conduit wirings: (G.I. conduit System)

All area under false ceiling

## L.V. DISTRIBUTION SYSTEM

The electrical contractor shall supply & install complete L.V. distribution power cables, cable risers as shown on the schematic wiring diagram and layout plan.

The power cables shall be installed and supported by perforated cable trays with hangers.

The electrical contractor shall also supply and install busbar chambers, MCCB, all the distribution boards and timer switches, as indicated on the drawings.

All armoured cables run on walls or cable tray shall be fixed by 2-bolt fixing cable cleats as B.I.C.C. List No. BF70217 series, or equivalent and approved shall be fixed on wall by means of metal iron support frame work depending on actual site conditions at not more than 1m intervals.

Electrical cables installed in vertical trunking shall be supported at least at intervals of every one meter suitable means that will take the weight of the cables. The contractor shall submit a sample of the support adopted for this project for approval prior to installation.

Fire-resistant barriers are to be fitted into the trunking in positions where the trunking passes through floor slabs and fire rated compartment walls.

## POWER SUPPLIES TO HVAC, FS, PLUMBING, DRAINAGE, BMS SYSTEM

The electrical contractor shall supply and install the power supply to associated equipment of individual system as shown on the drawings.

The electrical contractor shall liaise with their work and agree with the individual trade contractor the exact location of the connector units, isolating and double pole switched fuse spur unit of the connector units or isolating switches before commencement of the conduit wiring work.

## FINAL CIRCUIT WIRINGS SYSTEM

The electrical contractor shall supply and install a complete final sub-circuit conduit wirings system with lighting and power points as indicated on the layout plan.

The electrical contractor shall supply and install the lighting control switch for each and every circuiting for the controlling all the public lighting point. Unless otherwise indicated on the Drawings, those lighting circuit without switches on layout drawing shall be provided with grid switch and grouped together at a switch panel and installed at designated location as shown on drawing or agree with Architect/E&M Consultant.

The position of each lighting fittings as shown on the Drawings are for guidance only, the electrical contractor shall check the Architectural Drawings (or Reflected Ceiling Plan) for the exact location of each lighting fittings before the conduit wirings.

All the electrical accessories, such as lighting switches, sockets, etc., must be of the same colour throughout and be of the product of the same manufacturers.

## LIGHTING INSTALLATION

The electrical contractor shall supply, install and connect the specified lighting fittings as indicated on the drawings

The position of the lighting fittings as shown on the Drawing is for tender purposes, the electrical contractor shall check the Details of Reflected Ceiling Plan before the installation of lighting fitting.

Appropriate catalogue, technical data, and details of lighting fittings shall be submitted at the time of tendering.

Samples are to be submitted for approval before bulk supplies and delivered to the site. Samples of each type of fitting are to be provided free of charge by the contractor.

## ELV SYSTEM

The electrical contractor shall provide metal trunking, surface/concealed galvanized steel conduit and accessories. for the facilities of signal wiring as shown on the drawings.

Tee-off surface/concealed galvanized steel conduit with draw-wires from the nearest trunking to each security, telephone and data point as required.

## EARTHING SYSTEM

The electrical contractor shall supply and install a complete earthing system as indicated on the drawings and as specified in Technical Specification.

The electrical contractor shall be provide a earthing cable from main earth terminal inside main switch room to main MCB Board at new rehabilitation centre.

All electrical installation must comply with the Supply Company's Rules and the latest Edition of the I.E.E. Regulations for Electrical Installations.

## EQUIPOTENTIAL BONDING SYSTEM

The electrical contractor shall supply and install the main equipotential and supplementary bonding system as required and specified in the latest Edition of
I.E.E. Regulations of Electrical Installation.

Regulation 413 - Protection against Indirect Contact. Regulation 547 - Protective Bonding Conductors.

Main Equipotential bonding conductors connect to the main water pipes to the main earthing terminal and, as indicated by Regulation 547-02-02, the connection should be made as near as practicable to the point of entry of the non-electrical services into the premises concerned. Other service pipes and ducting, and exposed metallic parts of the building structure are also required to be connected to the main earthing terminal and the conductors used for this purpose are also main equipotential bonding conductors.

All the bonding conductors shall be concealed whatever possible.

### Supplementary Bonding Conductor

### Conductor Material

Unless otherwise specified, supplementary bonding conductors shall be of copper.

### Application in Other Areas

Supplementary bonding of extraneous conductive parts will be required whenever such conductive parts are likely to be accessible simultaneously with other extraneous conductive parts or exposed conductive parts, and are not electrically connected to the main equipotential bonding by means of permanent and reliable metal-to-metal joints of negligible impedance.

## Bonding Method

The supplementary bonding conductors shall be solidly and effectively connected to the extraneous or exposed conductive parts by means of a copper connector-clamp of an approved type suitable for the application. All contact surfaces shall be clean and free from non- conducting materials, such as grease or paint, before the connector-clamp is installed.

The supplementary bonding conductors shall be terminated at, via a telephone cord outlet plate, a copper earthing terminal fitted inside a BS 4662 metal box forming an integral part of the conduit installation. The BS 4662 metal conduit box shall be located as near as possible to the bonding position and the exposed part of the supplementary bonding conductor shall be made as short as possible.

## HANGER AND SUPPORT

All angle iron, hangers, screws, bolt and nut and supporting structure shall be stainless steel and stainless steel bolts and nuts.

## LABELLING

All plant and equipment should be labelled in both English and Chinese.

Labels shall be of white Traffolyte with black engraved lettering not less than 20mm high or as otherwise required and approved by the Architect.

Manufacturers' nameplate, serial, model numbers and date of manufacture should be provided for all plant and equipment.

Label shall be screwed or rivetted to sheet metal. Adhesive fixing is not acceptable.

Plant & equipment shall include but not be limited to:

Switchboard, fans, distribution boards, contactors, cable terminals in switchboards, circuit breakers.

Distribution boards, starters and the like shall be labelled to indicate the circuit number, phase and item controlled.

## SHOP DRAWINGS AND AS BUILT DRAWINGS

Shop drawings shall be submitted by the Contractor as required by the Architect for approval of installation details based on actual dimensions of materials/equipment used. These shall be submitted at least 2 weeks before commencement for the installation work and shall include the followings:

Layout of MCB, including all relevant details.

Surfaced and Concealed conduit routing.

Cable & trunking routing.

The number of copies required are as follows :

1 copy of shop drawing to be submitted for approval.

1 copy of approval shop drawing.

1 copy of As-built drawing, maintenance manual, photocopy of certificate and warranty card

1 electronic copy of computerized as-built drawings prepared by latest version of Auto CAD. Such drawings and electronic copies shall comply with all requirements of presentation format shall be specified by the Employer, if any.

1 set of duly endorsed Test and Commissioning Reports shall be required.

## FREE SERVICE & MAINTENANCE

The Contractor shall provide service and maintenance to the entire installation without charge to the Employer for a period of not less than 12 months. The service and maintenance work shall include systematic examination, adjustment and lubrication of the equipment, and also the repairing and replacement of the part etc. whenever it is required. Immediate attendance shall be provided on a 24 hours on call basis upon notification of breakdown or hazardous situation or condition with respect to the plant and equipment. The free maintenance period shall commence from the date of practical completion of the Main Contract Works certified by the Architect and shall expire after expiration of Defects Liability Period or issue of the Certificate of Completion of Making Good Defects whichever is the later.

At the end of the above stated period, a further test will be carried out on the equipment by the Architect. Any defects shall be rectified by the Contractor at his own expense.

A certificate WR1 is required to issue by this Contractor to the owner before expiry of Free Maintenance Period including FS251 for emergency lighting and exit sign.

# GENERAL

## The Site

The site composed of renovation works for International Commerce Centre (ICC) 51/F, Unit 5105 and International Gateway Centre (IGC) Tower 1, 21/F, Units 04-06.

Tenderers are strongly advised to visit the site and check conditions and locations of existing services.

On submitting this tender, the tenderer must satisfy himself that he is familiar with the site conditions and he has made due allowance in his sum for every special working condition.

## General Specifications

All the materials, installation and workmanship shall comply with the General Specifications.

## SCOPE OF WORK

The Contractor shall be responsible for the supply of the whole of the materials and labour necessary to form a complete fire services installation as described in this Particular Specification and the relevant drawings. This contract shall include not only the major items for equipment shown or specified but also all the incident sundry components necessary for the complete execution of the works and for the operation of the installation, including necessary labour, whether or not these sundry components are mentioned in detail on the drawings and Specification. In case any discrepancy between the drawings and this Particular Specification, this particular Specification shall take precedence.

In general this shall include but not be limited to the following main items:

1. Dismantle of all existing obsolete fire services installation complete wiring, conduit, piping, plug-off existing piping, equipment, etc.

2. Clearing up all area and cart away all rubbish, etc. to dumping area.

3. Supply and install sprinkler system complete with all associated equipment and materials such as water pipeworks, sprinkler heads, master control valves, valves and fittings, controls for proper operation of the system including cable and conduit, etc..

4. Supply and install automatic and manual fire alarm systems

5. Supply and install fire alarm system including dry contact for MVAC system

6. Supply and install potable hand operated appliances including fire extinguishers, fire blankets as shown on the Drawings.

7. Drain-off and refilling of fire hydrant and sprinkler system for work execution.

8. Modification of existing fire alarm panel complete with adding zone extension card and re-programme of the panel to suit the scope of work.

9. Submission of all relevant forms and drawings to F.S.D., application arrangement for inspection to effect the satisfactory testing by the F.S.D.

10. Issuance of F.S. 314/F.S. 251 submission to FSD on Practical Completion and at the end of Defect Liability Period

11. Making openings to wall or slab and make good works for work execution.

12. Submission of Form WR1A endorsed by Registered Electrical Worker upon work completion.

13. Properly terminate and plug-off existing installation being retained.

14. Drawings and forms submission to government departments and utility companies have jurisdiction in associated with the contract work and follow up for obtain early approval. Liaise and attend government departments and Utilities Company during installation and inspection at completion of contract work shall also include by this contractor.

15. Checking of existing fire services installation that will be retained according to the check list in Code of Practice of Minimum Fire Services Installation and Equipment issued by Fire Services Department and prepare a report mentioning its existing condition and specifications. Photo record shall be provided as evidence of defects being identified together with remedial proposal to resume its normal operation.

16. Supply and installation of pipe sleeves and puddle flanges through structural walls, beams, slabs and non-structural walls, equipment holding down bolts and subsequent sealing up the gap between pipe and sleeve with approved material to achieve fire resistant, waterproof, air tight and/or acoustic barrier as appropriate. The Contractor is responsible for checking correct size and location before concrete casting and brick laying.

17. Submission of FS251 and FS314a to cover the new fire services installation including the associated modification work.

18. Painting labeling.

19. Testing and Commissioning

20. Provision of training to the employer staff on the system operation

21. Provision of sample board, shop drawings, as-fitted drawings and O&M manual.

22. One Year Free Maintenance including existing installation retained.

23. Dismantle and reinstate existing false ceiling and fire rated enclosure for work execution

24. Modification of existing E&M installation to suit the interfacing connection of new and existing installation.

25. Night work for execute the scope of work that will affect the building operation

## PIPEWORK, VALVES & FITTINGS

### Flange Fittings

Flange fittings must be provided for pipework according to the General Specifications unless otherwise shown on the drawings.

### Pipe Hanger and support

All angle iron, hangers, screws and supporting structure shall be stainless steel and stainless steel bolts and nuts.

### Labelling of Pipework

Labelling of pipework shall be by this Contractor.

### Painting of Pipework and Equipment

The Contractor is responsible for the primer for all pipings/fittings of material, and finishing coats.

## AUTOMATIC SPRINKLER SYSTEM

### General

The building shall be protected by a wet pipe sprinkler system conforming to BS EN 12845:2003 and designed according to HIGH HAZARD.

All public areas indicated on the drawings shall be protected by sprinkler system; exceptional areas are the main switch room, pump rooms and other areas as indicated on the Drawings.

### Sprinklers

Bulb type sprinklers shall be used throughout in all areas. Escutcheons shall be used with false ceiling. Sprinklers within concealed ceiling void shall also be bulb type. The Contractor shall be responsible for the necessary final adjustment of sprinklers to match false ceilings as instructed by the Architect. Type of finishes for sprinklers and escutcheons shall be approved by the Architect. Escutcheons shall be of metal.

Types of sprinklers used, temperature rating of sprinklers, nominal bore and orifice sizes of sprinklers shall be according to the relevant class of hazard.

Discharge characteristics of sprinklers with different nominal and orifice sizes must be submitted. Sprinklers used must be approved and listed by BS EN 12845:2003

Lower Layer Sprinkler Heads

This Contractor shall allow lower layer sprinkler head at any areas where applicable and shown on the Drawings.

The Contractor shall allow in the cost & time with his contract to re-adjust/double handle the sprinkler head installation if required to correspond with the false ceiling installation.

All 100mm dia., 80mm dia. & 65mm dia. tee-off positions as shown on the drawings are reserved for the installation of lower layer sprinkler system.

Concealed type sprinkler shall be used with false ceiling as shown on the drawing. Quantities of lower layer sprinkler heads are to be provided for each areas indicated on the drawings with exact location suiting the architectural ceiling layout.

Cabinet for Control Valves & Sprinkler Inlets

All cabinet and doors for housing of the sprinkler control valves and sprinkler inlets shall be supplied and installed by the Main Contractor.
The contractor shall supply and install temporary signage for all the mentioned for both
F.S. and O.P. inspection.

Draining & Testing

Test pipes at remote branch lines of the sprinkler system shall be provided as shown on the Drawings and as stipulated in the Technical Specifications.

Sprinkler System Components

Sprinkler system components defined in BS EN 12845:2003 as being “Suitable for fire protection service” shall be FSD approved and listed in current FSD specifier’s guide. List of approved fire and security products and services or amendments.

## FIRE HYDRANT / HOSE REEL SYSTEM

Cabinet for F.S. Inlets & Hose Reels

All cabinets and doors for housing of fire services inlets and hose reels shall be supplied and installed by the Main Contractor.
The contractor shall supply and install temporary signages for all the mentioned for both
F.S. and O.P. inspection.

Hose Reels

All hose reels shall either be of fixed type or swing type as indicated on the Drawings.
Each hose reel shall be completed with a hose of length 30m. and bore as shown on the Drawings.

The discharge nozzles shall be of chrome plated brass with a 4.5mm. orifice or as approved by the Architect.
All hose reel discharge nozzle of the hose reel in open areas shall be housed inside a metal box completed with glass front and kept under lock.

A permanent label for operation instruction of the hose reel shall be provided and installed for each hose reel.

Fire Hydrant Outlets

Fire hydrant outlets shall be of single outlet type comply with F.S.D. requirements.

## TEMPORARY F.S. PROTECTION SYSTEM DURING CONSTRUCTION PERIOD

This Contractor shall supply and install the whole temporary F.S. protection system including pipework, electrical pumps and their associated fittings for the whole development including the handling costs of the whole system from G/F to the location as required by the F.S. officer under construction period according to the F.S.D. Circular Letter No. 4/96 Part X para.-7 "Fire Protection in construction site".

The temporary F.S. protection system should include the supply and installation of electrical pumps on floors which being determined by practical tests conducted jointly by the F.S. Contractor, Contractor and Fire Services Officers. The number and capacity of pumps will be at the discretion of the former provided the pumps are fitted with standard 65mm instantaneous coupling inlets/outlets and capable of delivering 900 litre of water per minute.

This Contractor shall allow F.S. pumps block for the temporary F.S. protection system of this development during construction. The pumps and their associated fitting, wirings, etc. shall be taken away by this Contractor after the issuance of F.S. certificate.

This Contractor must take responsible on liaison with F.S. Department for the detail of temporary F.S. protection system under construction period.

This Contractor shall supply and install the temporary electrical supply cables and starter sets from G/F Temporary Electrical Panel to the temporary pumps at the location as required by the F.S. officer.

The Contractor shall provide an isolator near each temporary pump and rating shall suit the temporary F.S. pump.

## FIRE ALARM SYSTEM

### Manual Alarm

The manual break glass alarm shall be incorporated with automatic actuation of F.H. pumps. Break glass units, when actuated, shall automatically start the F.H pump as indicated on the Drawings.

The operation of the break glass units of the building shall actuate alarm bells and visual alarms in the building in zones as indicated on the Drawings.

The visual fire alarm shall be in the form of red light labelled “Fire Alarm” (in both English and Chinese) and located at a prominent location in places which are intended to be accessible to the public.

Visual fire alarm shall be F.S.D. approved type where the flash rate shall not exceed three flash as per second nor be less than one flash every three second. The maximum pulse duration shall be 0.2second with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal. The visual fire alarm shall be 15 candela (Cd) minimum and measured from outside of the diffuser.

The visual fire alarm system shall comply to N.F.P.A. and Design Manual-Barrier Free Access 1997 requirements.

### Automatic Fire Alarm System

Fire detection system shall be provided as indicated on the drawings.

Heat/Smoke detection system shall be provided for electrical and mechanical rooms, or all areas not protected by sprinkler system, otherwise specified.

### Fire Service Control Panel & Automatic Fire Alarm Panel

All new fire services installation shall be connect to New Fire Alarm Control Panel and interfaced with the existing master Fire Alarm Control Panel at G/F F.S. Control Room complete with adding new zone control card compatible with existing system.

The fire service control/indication panels shall include usual facilities such as mains on, system on, fire alarm, accept, reset, test, buzzer, etc. There shall be indication for each zone of sprinkler, F.H./H.R. and automatic fire alarm protection system. There shall also be indication for circuitry fault for each zone.

Power failure indication shall be provided for all F.S. and sprinkler pump as stipulated in Section 6 of this Particular Specification.

Zoning of the various fire service control/indication panel shall be as shown on the Drawings.

### Dry contacts for F.S. Alarm Signal

This Contractor shall provide adequate numbers of volt-free day contacts (N/C & N/O) at position as agreed with Architect. The minimum number of dry contacts shall be 5 nos. N/C and 5 nos. N/O.

This Contractor shall liaise with the MVAC scope of work and provide dry contacts for tripping of air-conditioning and mechanical ventilation fans.

## ELECTRICAL WORKS

### Electricity Supply

The electricity supply shall be 3-phase, 4-wire, 380 V and 1-phase, 220 V., 50 Hz. This Contractor shall indicate the rating and location of necessary power supply for approval and coordination.

Power supply to pumps are to be supplied and installed by Electrical Contractor terminated at isolating switches as shown on the drawings. All outgoing switches, busbar chambers, cables, starters, controls, etc. are to be supplied and installed by this Contractor.

### Cables

All cables shall be fire resistance/Low Smoke to meet the requirement of IEC 331 and B.S. 6387 for categories C,W and Z.

Power supply and starter cables within the pump rooms shall be single core Mica/Glass Fire Resistant tape LSOH insulated copper cables in conduits or metal trunking as appropriate. PVC conduits are to be adopted for concealed conduit wirings only.

G.I. conduit system shall be adopted for surface conduit wiring system.

Cables for fire alarm and control shall be single core or multi-core Mica/Glass Fire Resistant tape LOSH insulated copper cables.

Unless otherwise specified, all conduits for fire alarm system shall be concealed in concrete, supplied and installed during concreting by this contractor.

Minimum sizes of single-core Mica/Glass Tape or fire resistant copper cables shall be:

Power cable, 2.5 sq.mm.

Control circuit, 1.5 sq.mm.

G.I. conduits and fittings shall comply with BS. 4568 : Parts 1 & 2 and shall be of Class 4 galvanized type.

## CATALOGUE & SAMPLES

Catalogue of equipment shall be submitted for approval by the Client/ Consultant within 2 weeks on issuance of the Letter of Intent. Samples of selected equipment, where applicable, shall be submitted for inspection and approval by the Client/consultant prior to ordering of equipment.

## STATUTORY AUTHORITIES' TESTS & INSPECTIONS

The Contractor shall arrange and attend the test by the Fire Service Department and all other tests by the Authorities, when notified.

The contractor shall submit all necessary forms and drawings to Fire Services Department for the fire services installation that is installed.

## SPARE & MAINTENANCE TOOLS

All spare parts and tools shall, unless otherwise indicated, be stored in custom built kit and located as appropriate. It shall be kept in a cabinet inside the sprinkler control valve chamber or adjacent to the Fire Control Panel or located at a prominent and easily accessible position, exact location of which shall be as indicated or as approved by the Architect.

## LABELLING

All plant and equipment should be labelled in both English and Chinese.

Labels shall be of white Traffolyte with black engraved lettering not less than 20mm high or as otherwise required and approved by the Architect.

Manufacturers' nameplate, serial, model numbers and date of manufacture should be provided for all plant and equipment.

Label shall be screwed or rivetted to sheet metal. Adhesive fixing is not acceptable.

Plant & equipment shall include but not be limited to:

Pipework & Conduit, etc.

The Contractor is responsible for the primer for all piping & equipment, etc. and finishing coats.

## SHOP DRAWINGS AND AS BUILT DRAWINGS

Shop drawings shall be submitted by the Contractor as required by the Architect for approval of installation details based on actual dimensions of materials/equipment used. These shall be submitted at least 2 weeks before commencement for the installation work and shall include the followings :

Layout of hose reel, sprinkler, etc. including all relevant details.

Surfaced and Concealed conduit routing.

Pipe routing.

The number of copies required are as follows :

1 copy of shop drawing to be submitted for approval.

1 copy of approval shop drawing.

1 copy of As-built drawing, maintenance manual, photocopy of certificate and warranty card

1 electronic copy of computerized as-built drawings prepared by latest version of Auto CAD. Such drawings and electronic copies shall comply with all requirements of presentation format shall be specified by the Employer, if any.

1 set of duly endorsed Test and Commissioning Reports, shall be required.

## FREE SERVICE & MAINTENANCE

The Contractor shall provide service and maintenance to the entire installation without charge to the Employer for a period of not less than 12 months. The service and maintenance work shall include systematic examination, adjustment and lubrication of the equipment, and also the repairing and replacement of the part etc. whenever it is required. Immediate attendance shall be provided on a 24 hours on call basis upon notification of breakdown or hazardous situation or condition with respect to the plant and equipment. The free maintenance period shall commence from the date of practical completion of the Main Contract Works certified by the Architect and shall expire after expiration of Defects Liability Period or issue of the Certificate of Completion of Making Good Defects whichever is the later.

At the end of the above stated period, a further test will be carried out on the equipment by the Architect. Any defects shall be rectified by the Contractor at his own expense.

In addition to the requirements as stated, this Contractor shall include, but not necessarily be limited to, the maintenance works during the Defects Liability/Free Maintenance Period as per the following to satisfy the requirements of this Contract:

Maintain the whole fire services system included in the Contract, including systematic checking, adjustment and inspection / testing of all equipment.

Repair and replace all mal-functioning contactors, fuses, indicating lamps, alarm bells, broken glass, etc.

Maintain valves packings, clean and grease spindles of valves as necessary.

Inspect conditions of equipment operating in site as directed but not less than once per month.

Prepare a log book at a location as directed by the Consultant, for all maintenance, repair, replacement and inspections carried out, including a status report of all equipment.

At the completion of the Defects Liability Period, a functional test shall be carried out to demonstrate that the entire system is in good working conditions. All the rusty pipework, fixing bolts, brackets, etc. shall be touch-up painted as and when necessary. Any defects found during such functional test, proven due to defects in equipment and installation shall be remedied by the Contractor with no additional charge to the Client.

A certificate F.S. 251 is required to issue by this Contractor to the owner and a copy to the FSD for annual inspection. (Including F.S., sprinkler, exit signs and emergency lighting, etc.).

# GENERAL

## The Site

The site composed of renovation works for International Commerce Centre (ICC) 51/F, Unit 5105 and International Gateway Centre (IGC) Tower 1, 21/F, Units 04-06.

Tenderers are strongly advised to visit the site and check conditions and locations of existing services.

On submitting this tender, the tenderer must satisfy himself that he is familiar with the site conditions and he has made due allowance in his sum for every special working condition.

## General Specifications

All the materials, installation and workmanship shall comply with the General Specifications.

## SCOPE OF WORK

The Contractor shall be responsible for the supply of the whole of the materials and labour necessary to form a complete plumbing and drainage installation as described in this Particular Specification and the relevant drawings. This contract shall include not only the major items for equipment shown or specified but also all the incident sundry components necessary for the complete execution of the works and for the operation of the installation, including necessary labour, whether or not these sundry components are mentioned in detail on the drawings and Specification. In case any discrepancy between the drawings and this Particular Specification, this particular Specification shall take precedence.

In general this shall include but not be limited to the following main items:

### Plumbing Installation

The installation shall include but not be limited to the following items :

1. The contractor shall be responsible for dismantle all existing obsolete potable, flushing and cleansing water pipeworks in associate with the scope of work and working area.

2. Supply and install potable water supply system including connections to water sink, wash basin, etc. as shown on the drawings.

3. All installation works shall be carried out in strict accordance with the requirement of Water Authority, this specification and the relevant regulations and standards.

4. The contractor shall be responsible for all the necessary applications to be made to the Water Authority concerning the plumbing installation for this project.

Drainage Installation

The drainage installation for this contract includes the following:

1. The contractor shall be responsible for dismantle all existing obsolete drainage pipeworks in associate with the scope of work and working area.

2. Carry out site survey and CCTV inspection, record and report any discrepancy found between as-built and Tender Drawings / the Buildings Department record plans.

3. Carry out diversion works and modification works of existing drainage works to suit new drainage works installation as shown on drawings and any discrepancy found between as-built and tender drawings / the Buildings Department record plans;.

4. Clearing up all area and cart away all rubbish, etc. to dumping area.

5. Submission of Form WR1a endorsed by Registered Electrical Worker upon work completion.

6. Drawings and forms submission to government departments and utility companies have jurisdiction in associated with the contract work and follow up for obtain early approval. Liaise and attend government departments and Utilities Company during installation and inspection at completion of contract work shall also include by this contractor. Licensed plumber shall be responsible for all sanitary fittings associated with the new plumbing installation whether they are supplied by this contractor or not.

7. Liaison with Management Office for executes work in common area. Sufficient protection and cleaning of work site afterward shall be provided to the satisfaction of Building Management.

8. Sleeved openings/holes, filling/patch up of all gaps.

9. Provide information about locations and sizes of access panels to enable such works done properly and in compliance with requirements of the relevant statutory inspection.

10. Painting labeling.

11. Testing and Commissioning

12. Provision of training to the employer staff on the system operation

13. Provision of sample board, shop drawings, as-fitted drawings and O&M manual.

14. One Year Free Maintenance including existing installation retained.

15. Dismantle and reinstate existing false ceiling and fire rated enclosure for work execution

16. Modification of existing E&M installation to suit the interfacing connection of new and existing installation.

17. Night work for execute the scope of work that will affect the building operation

## ASSOCIATED WORKS FOR PLUMBING AND DRAINAGE INSTALLATION

The following works, associated with the plumbing and drainage service installation shall be provided under the contract:

Work Provided under the Main Contractor

Supply of sanitary fixtures and fittings.

Pump plinth.

Work Provided under Electrical Scope of Work

Supply and installation of electrical power supply terminated with appropriate isolator (380V, 3 phases, 50 Hz or 220V, 1 phase, 50 Hz):

Inside all plant rooms and pump rooms.

To the point adjacent to the starter/control panels for the sump pumps.

Work Provided under HVAC Scope of Work

Supply and installation of mechanical ventilation for plant rooms and pump rooms.

## GENERAL REQUIREMENT

A minimum outlet pressure of water point shall be kept at 1.8 bar taking the draw-off point to be the measuring point at top floors of the building and top floor where gravity feed is applied.

Water Pipe Pressure Test & Drainage Work

All water pipe used under pressure shall be pressure tested before and after concreting. Test reports shall be witnessed and endorsed by Architect/Employer.

Acoustical Treatment and Vibration Isolation

The Contractor shall supply and install all the spring mount vibration isolators, "silent" check valves on pump discharge, water hammer arrestors and flexible connectors as required to eliminate transmission of vibration and noise through piping and structure.

Authority Requirements

The Contractor shall be responsible for submission of relevant standard forms to the Water Authority for application of final connection of Government Mains potable/flushing water supply and water meter installation.

The Contractor shall responsible for submission of relevant Standard Forms to Government Authorities for approval. Such Forms shall be submitted in phase if the construction programme is required and the Contractor shall be responsible the following up with Government Authorities for timely approval of the submission.

The Contractor shall arrange and pay for all the necessary inspections required by the relevant Government Authorities, and shall obtain all the necessary permits/certificates, with copies to the Architect.

Sample/Mock-up Areas

The Contractor shall allow for the installation for mock-up and/or sample area in this contract. The mock-up and show flat installation shall generally be carried out in advance of the normal programme of works. (Exact area shall be confirmed by the Architect at appropriate time).

The Contractor shall ensure that all necessary deliveries are made to allow for completion all element of the contract work to the Sample/Mock-up Area.

Remote Indication Panel for Plumbing System

In addition to the pump control panel provided locally inside each pump room, the contractor shall supply and install a remote indication panel with location as shown on drawings and comprising the followings:

Visual Signal Indicators

Trip signals of each potable and flushing water pumps, sump pumps.

Overflow and low water alarm for each water tank related to this installation including up-feed tanks storage tanks, sump pit, etc.

Audio Signal Indicators

Overflow and low level alarm for item a ii) above.

Buzzer

Alarm reset push button

Lamp test key switch

Power on indication lamp

Dry-contact for BMS signal interfacing

Alarm mute button.

The contractor is responsible to liaise with Architect/Engineer for the exact position of the remote indication panel.

Painting

In addition to a special painting and finishing specified elsewhere, the contractor shall allow for painting after erection of all plant and equipment including motors, pumps, hydro-pneumatic booster plants, pipework, provided and requiring to be painted.

PUMPS

Construction Standards

General :-

Duties of pumps are specified in the Schedule of Equipment, but all duties and power consumption shall be approved before ordering against requirements of the systems as finally installed,

Each pump shall be fitted with an air cock drain plug and calibrated pressure gauges of suitable range on both suction and discharge sides of the pump,

Horizontal pumps shall be mounted on common C.I. bed-plate directly coupled to totally enclosed fan cooled squirrel cage motor,

Vertical pumps, except submersible sump pumps, shall be driven by elevated "in-line" TEFC squirrel cage motor with the motor connected to the pump via integrally casted motor flanges and be complete with high quality coupling. The coupling and shaft shall be completely protected by a stainless steel mesh safety screen,

Pump bases shall be machine finished, accurately aligned and bolted onto heavy concrete plinth with anti-vibration mounting as specified,

All pumps supplied shall be constructed to meet the maximum required working condition, water temperature and test pressure as specified,

Adequate pump guards shall be provided at pump couplings.

All motors coupled to water pumps shall be TEFC type sized at 125% of designed duty of the corresponding pump.

All pumps are to be designed and fully guaranteed to degree of accuracy Class B in accordance with ISO acceptance test code.

Complete with casing vent, drain and gland drain leading to nearest drain channel,

Provide with label showing duty flow, head and close valve head, design efficiency and casing pressure rating.

Selection

All pumps shall be selected for use with speed not exceeding 1,500 rpm, unless otherwise specified. Pumps offered shall be selected for minimum vibrations and noise level during operation. Should these be excessive and not within normally acceptable standards, the Contractor shall be responsible for provision of further acoustical and anti-vibration treatment as necessary. Contractor should pay special attention to such requirement where the pumps are located in or adjacent to acoustically critical areas.
Pumps shall be selected for maximum efficiency and minimum power consumption.
Pumps shall have relatively non-overloading characteristics suitable for combined parallel operation but selected to permit single-pump operation. Characteristic curves for individual and combined operating points at the duties specified shall be submitted for approval. Special attention shall be given to the selection of NPSH to eliminate occurrence of cavitation.
Pump heads specified in the Schedule of Equipment have been calculated on assumed pressure drops for equipment. The Contractor shall compute exact resistance of equipment and system piping, based on data from actual equipment offered and actual pipe routing. The Contractor shall be held responsible for checking the final resistance before ordering of equipment. Any modifications to the equipment (motor, switchgear, impeller size, wiring, etc.) necessary to meet the scheduled duties and space conditions shall be entirely at the Contractor's expense, except where the modification is brought about by written Architect's Instruction.
Pump impellers shall be sized at 80% to 85% of casing diameter so that impeller size may be upgraded where necessary to accommodate any unforeseen or unexpected increase in pump head or flow.
The pumps shall have a relatively steep characteristic, which shall permit the pump to operate under varying head without undue fluctuate to capacity and facilitate pressure control.
Lubricating oil as recommended by the pump manufacturer shall be provided.

Pumps Construction

Upfeed Pumps :-

Upfeed pumps shall be centrifugal multi-stage type selected for silent and balance operation,
Pumps shall have outboard, double ball sealed bearing provided with splash guard,
Pump shaft and coupling shall be extra strong type designed for frequent start/stop operation,
Pumps shall have identical stages arranged in tandem of balance drum design,
Each impeller to be keyed individually onto the common shaft. Seal ring to each stage to be individually adjustable,
Of the following construction :-
For potable water services:-

| | | |
|---|---|---|
| Casing | : | high grade close grained cast iron to B.S.1453 Grade 220 or better. |
| Impeller | : | bronze to B.S.1400:1973 LG2, keyed to shaft. |
| Shaft | : | high tensile steel with inter-changeable 316 S16 stainless steel shaft sleeve. |
| Seal | : | mechanical seal with stainless steel face material. |
| Coupling | : | flexible without intermediate sleeve complete with coupling guard. |
| Wear Ring | : | Bronze, renewable type. |
| Bearing | : | ball thrust type of at least 100,000 hours B10 operating life. |
| Maximum speed | : | 1500 rpm. |

For flushing water services :-

| | | |
|---|---|---|
| Casing | : | zinc free aluminium bronze to B.S.1400:1985 with maximum 0.05% zinc. |
| Impeller | : | zinc free aluminium bronze to B.S.1400:1985 with maximum zinc content not exceeding 0.05%, keyed to shaft. |
| Shaft | : | 316 S16 stainless steel with inter-changeable 316 S16 shaft sleeve. |
| Shaft Seal: | : | metallic gland pack, renewable type with gland drain. |
| Coupling | : | flexible without intermediate sleeve, complete with coupling guard. |
| Wear Rings | : | monel. |
| Bearings | : | ball thrust type of at least 100,000 hours B10 operating life. |
| Maximum Speed | : | 1500 rpm |

The shaft-impeller assembly, when coupled to the motor, shall have its critical speed outside the operating speed range.
Pneumatic pressure boostering units shall consist of centrifugal single stage or multistage pumps coupled with matching pneumatic tank and controller system on a common bed plate, all from the same manufacturer.
All accessories in contact with sea water are to be 316S16 stainless steel. Pressure switches to be UL listed and properly selected for the operating pressure range.

## ELECTRICAL WORKS

### Electricity Supply

The electricity supply shall be 3-phase, 4-wire, 380 V and 1-phase, 220 V., 50 Hz. This Contractor shall indicate the rating and location of necessary power supply for approval and coordination.

Power supply to pumps, water heater, air-sourced heat pump, etc. is to be supplied and installed by Electrical Contractor terminated at isolating switches as shown on the drawings. All outgoing switches, busbar chambers, cables, starters, controls, etc. are to be supplied and installed by this Contractor.

## CATALOGUE & SAMPLES

Catalogue of equipment shall be submitted for approval by the Client/ Consultant within 2 weeks on issuance of the Letter of Intent. Samples of selected equipment, where applicable, shall be submitted for inspection and approval by the Client/consultant prior to ordering of equipment.

## STATUTORY AUTHORITIES' TESTS & INSPECTIONS

The Contractor shall arrange and attend the test by the Water Supplies Department and all other tests by the Authorities, when notified.

The contractor shall submit all necessary forms and drawings to Water Supplies Department for the plumbing installation that is installed.

## HANGER AND SUPPORT

a. All angle iron, hangers, screws, bolt and nut and supporting structure shall be stainless steel and stainless steel bolts and nuts.

## LABELLING

All plant and equipment should be labelled in both English and Chinese.

Labels shall be of white Traffolyte with black engraved lettering not less than 20mm high or as otherwise required and approved by the Architect.

Manufacturers' nameplate, serial, model numbers and date of manufacture should be provided for all plant and equipment.

Label shall be screwed or rivetted to sheet metal. Adhesive fixing is not acceptable.

Plant & equipment shall include but not be limited to:

Pipework & Conduit, etc.

The Contractor is responsible for the primer for all piping & equipment, etc. and finishing coats.

## SHOP DRAWINGS AND AS BUILT DRAWINGS

Shop drawings shall be submitted by the Contractor as required by the Architect for approval of installation details based on actual dimensions of materials/equipment used. These shall be submitted at least 2 weeks before commencement for the installation work and shall include the followings:

Layout of plumbing and drainage installation, etc. including all relevant details.

Surfaced and Concealed conduit routing.

Pipe routing.

The number of copies required are as follows :

1 copy of shop drawing to be submitted for approval.

1 copy of approval shop drawing.

1 copy of As-built drawing and maintenance manual.

1 electronic copy of computerized as-built drawings prepared by latest version of Auto CAD. Such drawings and electronic copies shall comply with all requirements of presentation format shall be specified by the Employer, if any.

1 set of Test and Commissioning Reports, shall be required.

## FREE SERVICE & MAINTENANCE

The Contractor shall provide service and maintenance to the entire installation without charge to the Employer for a period of not less than 12 months. The service and maintenance work shall include systematic examination, adjustment and lubrication of the equipment, and also the repairing and replacement of the part etc. whenever it is required. Immediate attendance shall be provided on a 24 hours on call basis upon notification of breakdown or hazardous situation or condition with respect to the plant and equipment. The free maintenance period shall commence from the date of practical completion of the Main Contract Works certified by the Architect and shall expire after expiration of Defects Liability Period or issue of the Certificate of Completion of Making Good Defects whichever is the later.

At the end of the above stated period, a further test will be carried out on the equipment by the Architect. Any defects shall be rectified by the Contractor at his own expense.