GENERAL SPECIFICATION

FOR

PLUMBING INSTALLATION

IN

GOVERNMENT BUILDINGS

OF

THE HONG KONG SPECIAL ADMINISTRATIVE REGION

2017 EDITION

ARCHITECTURAL SERVICES DEPARTMENT
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

PREFACE

This General Specification aims to lay down the technical requirements of materials and equipment, the standards of workmanship, the requirements on testing and commissioning, and operation and maintenance as well as requirements on document submissions for Plumbing Installation in Government Buildings of the Hong Kong Special Administrative Region (HKSAR).

The 2017 edition of this General Specification was developed from the 2012 edition (incorporating Corrigendum No. GSPD02-2012) of the General Specification for Plumbing and Drainage Installation in Government Buildings by the Plumbing and Drainage Specialist Support Group that was established under the Building Services Branch Technical Information and Research & Development Committee of the Architectural Services Department (ArchSD). It incorporates updated international standards and codes as well as technological developments which find applications in Hong Kong. To be in line with the Department's endeavour to reduce the environmental burden on our neighbours and to help preserving common resources while improving the quality of our service, this General Specification puts emphasis on green features and green practice for construction as well as initiatives for enhancement of client satisfaction on completed projects.

With the benefit of information technology, electronic version of this edition is to be viewed on and free for download from the ArchSD Internet homepage. As part of the Government's efforts to limit paper consumption, hard copies of this General Specification will not be put up for sale.

The draft of the 2017 edition has been circulated to stakeholders within and external to the Government before finalisation. Nevertheless, the ArchSD welcomes comments on its contents at any time since the updating of this General Specification is a continuous process for the inclusion of any developments that can help meeting the needs of our community.

DISCLAIMER

This General Specification is solely compiled for Plumbing Installation carried out for or on behalf of the ArchSD in Government buildings of the HKSAR.

There are no representations, either expressed or implied, as to the suitability of this General Specification for purposes other than that stated above. Users who choose to adopt this General Specification for their works are responsible for making their own assessments and judgment of all information contained here. The ArchSD does not accept any liability and responsibility for any special, indirect or consequential loss or damages whatsoever arising out of or in connection with the use of this General Specification or reliance placed on it.

The materials contained in this document may not be pertinent or fully cover the extent of the installations in non-government buildings and there is no intimated or implied endorsement of the sales, supply and installation of the materials and equipment specified in this General Specification within the territory of the HKSAR.

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PART A – SCOPE AND GENERAL REQUIREMENTS

SECTION A1

SCOPE OF SPECIFICATION

A1.1 INSTALLATIONS TO COMPLY WITH THIS GENERAL SPECIFICATION

The Plumbing Installations shall comply with this General Specification which details the intrinsic properties (including materials and workmanship) of the Installations in so far as it is not overridden by the Conditions, Particular Specification, Drawings and/or written instructions of the Supervising Officer.

A1.2 SCOPE OF THE INSTALLATIONS

This General Specification, Particular Specification, Tender Equipment Schedule and Drawings detail the performance requirements of the Installations. The Installations to be carried out in accordance with this General Specification shall include the installation and supply of all materials necessary to form a complete installation including any necessary tests, adjustments, commissioning and maintenance as prescribed and all other incidental sundry components together with the necessary labour for installing such components, for the proper operation of the Installations.

A1.3 TERMS AND DEFINITIONS

In this General Specification, all words and expressions shall have the meaning as assigned to them under the Conditions unless otherwise provided herein. The following words or expressions shall have the meanings assigned to them except when the context otherwise requires:-

A/C	Air Conditioning
A/C General Specification	General Specification for Air-conditioning, Refrigeration, Ventilation and Central Monitoring & Control System Installation in Government Buildings of the HKSAR issued by ArchSD
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ArchSD	Architectural Services Department, the Government of the Hong Kong Special Administrative Region
ASTM	American Society for Testing and Materials

BD	Buildings Department, the Government of the Hong Kong Special Administrative Region
BS	British Standards, including British Standard Specifications and British Standard Codes of Practice, published by the British Standards Institution
BS EN	European Standard adopted as British Standard
BSB	The Building Services Branch of the Architectural Services Department, the Government of the Hong Kong Special Administrative Region
Building Contractor	The Contractor employed by the Employer for the execution of the Works or the Specialist Contractor separately employed by the Employer to execute the Specialist Works as appropriate.
CCMS	Central Control and Monitoring System
CIBSE	The Chartered Institution of Building Services Engineers
Conditions	The "Conditions of Contract" as defined in the Contract. For Nominated Sub-contract works, the "Main Contract Conditions" and the "Sub-contract Conditions" as defined in the Nominated Sub-contract as appropriate
DI General Specification	The General Specification for Drainage Installation in Government Buildings of the HKSAR issued by ArchSD
DSD	Drainage Services Department, the Government of the Hong Kong Special Administrative Region
EMSD	Electrical and Mechanical Services Department, the Government of the Hong Kong Special Administrative Region
EPD	Environmental Protection Department, the Government of the Hong Kong Special Administrative Region
EPDM	Ethylene propylene diene monomer (M-class)
FRP	Fibreglass reinforced polyester

FRR	Fire resistance rating as defined in the Code of Practice for Fire Safety in Buildings published by Buildings Department, the Government of the HKSAR
FSD	Fire Services Department, the Government of the Hong Kong Special Administrative Region
G.I.	Galvanised Iron
GRP	Glass Reinforced Plastics
HOKLAS	The Hong Kong Laboratory Accreditation Scheme
IEC	International Electrotechnical Commission
Installations	The work or services for the Plumbing Installation forming parts of the Works to be installed, constructed, completed, maintained and/or supplied in accordance with the Contract and includes Temporary Works
IP	Index of Protection
ISO	International Organization for Standardization
LPHW	Low Pressure Hot Water
L.V.	Low Voltage
OD	Outside Diameter
Or equivalent standards	Means internationally recognised standards acceptable to the Supervising Officer having similar requirements and specification as regards to the type of construction, functions, performance, general appearance and standard of quality of manufacture and approved by the Supervising Officer
O&M	Operation and Maintenance
Particular Specification	The specifications drawn up specifically for the Installations of a particular project
Plumbing Contractor	The Nominated Sub-contractor, the Specialist Sub-contractor, or the Sub-contractor employed by the Building Contractor or the Contractor directly employed by the Employer as appropriate for the execution of the Plumbing Installations in accordance with the Contract

PN	Practice Notes for Authorised Persons, Registered Structural Engineers and Registered Geotechnical Engineers issued by Buildings Department
Proprietary brand name products or materials	The phrase "or alternative products or materials having equivalent functions or performance" is deemed to be included wherever products or materials are specified by proprietary brand names in the Contract. Alternative products or materials of different brands or manufacture having equivalent functions or performance maybe submitted for the consideration of the Supervising Officer.
PVC	Polyvinyl Chloride
SCCU	Statutory Compliance Checking Unit established within ArchSD
Supervising Officer	The Supervising Officer or the Maintenance Surveyor defined in the Contract as appropriate
Tender	The Contractor's tender for the Contract or the Nominated Sub-contractor's tender for the Nominated Sub-contract as appropriate
UL	Underwriters Laboratories
UPVC	Unplasticised Polyvinyl Chloride
UV	Ultra-violet
VSD	Variable Speed Drive
WA	Water Authority, the Government of the Hong Kong Special Administrative Region
WRAS	Water Regulations Advisory Scheme of United Kingdom (UK)
WSD	Water Supplies Department, the Government of the Hong Kong Special Administrative Region

A1.4 SINGULAR AND PLURAL

Words importing the singular only also include the plural and vice versa where the context requires.

SECTION A2

STATUTORY OBLIGATIONS AND OTHER REGULATIONS

A2.1 STATUTORY OBLIGATIONS AND OTHER REQUIREMENTS

The Installations shall conform in all respects with the followings:-

A2.1.1 Statutory Obligations

All Enactments and Regulations, in particular, the Plumbing Contractor's attention is drawn to the followings:

(a) Buildings Ordinance (Cap. 123);

(b) Building (Administration) Regulations under Buildings Ordinance (Cap. 123);

(c) Building (Construction) Regulations under Buildings Ordinance (Cap. 123);

(d) Building (Standard of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations under Buildings Ordinance (Cap. 123);

(e) Building (Planning) Regulations under Buildings Ordinance (Cap. 123);

(f) Building (Refuse Storage and Material Recovery Chambers and Refuse Chutes) Regulations under Buildings Ordinance (Cap. 123);

(g) Waterworks Ordinance (Cap. 102), and other subsidiary legislation made under the Ordinance;

(h) Fire Services Ordinance (Cap. 95), and other subsidiary legislation made under the Ordinance;

(i) Electricity Ordinance (Cap. 406), and other subsidiary legislation made under the Ordinance;

(j) Noise Control Ordinance (Cap. 400), and other subsidiary legislation made under the Ordinance;

(k) Water Pollution Control Ordinance (Cap. 358), and other subsidiary legislation made under the Ordinance;

(l) Air Pollution Control Ordinance (Cap. 311), and other subsidiary legislation made under the Ordinance;

(m) Ozone Layer Protection Ordinance (Cap. 403), and other subsidiary legislation made under the Ordinance;

(n) Waste Disposal Ordinance (Cap. 354), and other subsidiary legislation made under the Ordinance;

(o) Environmental Impact Assessment Ordinance (Cap. 499), and other subsidiary legislation made under the Ordinance; and

(p) Land (Miscellaneous Provisions) Ordinance (Cap. 28), and other subsidiary legislation made under the Ordinance.

(q) Buildings Energy Efficiency Ordinance (Cap. 610), and other subsidiary legislation made under the Ordinance.

(r) Energy Efficiency (Labelling of Products) Ordinance (Cap. 598).

A2.1.2 Other Requirements

(a) Practice Notes for Authorised Persons, Registered Structural Engineers and Registered Geotechnical Engineers issued by BD;

(b) Practice Notes of Professional Persons Environmental Consultative Committee issued by EPD;

(c) Hong Kong Waterworks Standard Requirements for Plumbing Installations in Buildings issued by WSD;

(d) Water Supplies Department Circular Letters issued to Licensed Plumbers and Authorised Persons

(e) Handbook on Plumbing Installation for Buildings issued by WSD;

(f) Codes of Practice for Minimum Fire Service Installations and Equipment and Inspection, Testing and Maintenance of Installations and Equipment published by FSD;

(g) Requirements and Circular Letters of FSD;

(h) Code of Practice for Fire Safety in Buildings published by BD;

(i) Code of Practice for the Electricity (Wiring) Regulations published by EMSD;

(j) Code of Practice for Energy Efficiency of Building Services Installation issued by EMSD; hereinafter referred as the “Building Energy Code” or “BEC”;

(k) General Specification for Building issued by ArchSD;

(l) General Specification for Air-conditioning, Refrigeration, Ventilation and Central Monitoring & Control System Installation in Government Buildings of the HKSAR issued by ArchSD;

(m) General Specification for Drainage Installation in Government Buildings of the HKSAR, issued by ArchSD;

(n) General Specification for Electrical Installation in Government Buildings of the HKSAR issued by ArchSD;

(o) General Specification for Fire Service Installation in Government Buildings of the HKSAR issued by ArchSD;

(p) Design Manual: Barrier Free Access 2008 published by BD;

(q) Technical Memorandum to issue Air Pollution Abatement Notice to control Air Pollution from Stationary Processes issued by EPD;

(r) Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites issued by EPD;

(s) Technical Memorandum on Environmental Impact Assessment Process issued by EPD;

(t) Code of Practice for Prevention of Legionnaires' Disease issued by the Prevention of Legionnaires' Disease Committee, the Government of the HKSAR; and

(u) The Supply Rules and other requirements issued by the relevant local electricity suppliers and Water Authority;

A2.1.3 Safety Requirements

(a) Occupational Safety and Health Ordinance (Cap. 509), and other subsidiary legislation made under the Ordinance;

(b) Factories and Industrial Undertakings Ordinance (Cap. 59), and other subsidiary legislation made under the Ordinance;

(c) Public Health and Municipal Services Ordinance (Cap. 132), and other subsidiary legislation made under the Ordinance;

(d) Construction Sites (Safety) Regulations, Factories and Industrial Undertakings Ordinance (Cap. 59);

(e) Construction Site Safety Manual issued by the Development Bureau, the Government of the HKSAR;

(f) Code of Practice on Working near Electricity Supply Lines published by EMSD; and

(g) Code of Practice on Avoiding Danger from Gas Pipes published by EMSD.

A2.1.4 Technical Standards

BS, BS EN, ISO Standards, IEC Standards and Codes of Practice, etc. shall be deemed to include all amendments, revisions and standards superseding the standards listed herein, which are published before the date of first tender invitation for the Contract or the Nominated Sub-contract (as appropriate) unless otherwise specified.

A summary of technical standards quoted in this General Specification to which the Installations shall comply is listed in Annex I.

A2.2 CASE OF CONFLICT

The documents forming the Contract are to be taken as mutually explanatory of one another but in case of ambiguities or discrepancies the same shall be dealt with in accordance with the Conditions.

SECTION A3

EXECUTION OF INSTALLATIONS

A3.1 THE INTERNATIONAL SYSTEM OF UNITS (SI)

The International System of Units of weights and measures shall be used for all materials, equipment and measurements.

A3.2 PROGRAMME OF INSTALLATIONS

The Plumbing Contractor shall submit to the Supervising Officer a detailed programme of the Installations within 4 weeks from the acceptance of his Tender showing the intended method, stages and order of work execution in coordination with the building construction programme, together with the duration he estimated for each and every stage of the Installations. The programme shall include at least the following:-

(a) Dates for the placement of orders for equipment and materials;

(b) Expected completion dates for builder's work requirements, i.e. when work site needs to be ready;

(c) Delivery dates of equipment and materials to the Site;

(d) Dates of commencement and completion of every stage of the Installations in line with the building construction programme, i.e. each floor level and/or zone area;

(e) Dates of documents/drawings submissions to relevant Government departments to obtain the necessary approvals;

(f) Dates of requirement of temporary facilities necessary for testing & commissioning, e.g. electricity supply, water and town gas.

(g) Dates of water supply and drainage/sewage pipe connection;

(h) Dates of completion, testing and commissioning; and

(i) Short term programmes showing the detailed work schedules of coming weeks and months shall also be provided to the Supervising Officer. Programmes shall be regularly updated to reflect the actual progress and to meet the Plumbing Contractors' obligations under the Contract.

In addition, detailed submission schedules for installation drawings, equipment and testing and commissioning shall be submitted to the Supervising Officer for approval. The formats and information to be included in the schedules shall be as directed by the Supervising Officer.

A3.3 BUILDER'S WORK

All builder's work including openings or holes through building structure or partition walls; trenches, ducts and cutting; and all plinths, concrete bases, supports, ducts, etc. required for the Installations will be carried out as part of the building works by the Building Contractor at the expense of the Employer provided that the Plumbing Contractor has submitted full details of such requirements within a reasonable time to the Supervising Officer for approval, so that due consideration may be given before the Building Contractor commences the building works in accordance with the building programme in the areas concerned. After obtaining the said approval of the Supervising Officer, the Plumbing Contractor is required to mark out at the relevant locations of the Site the exact positions and sizes of all such works and to provide detailed information of such works to the Building Contractor to facilitate him to carry out the builder's works as the works proceed.

All "cutting-away" and "making-good" as required to facilitate the Plumbing Contractor's works will be carried out by the Building Contractor, except for minor provisions required for the fixing of screws, raw plugs, redhead bolts, etc. which shall be carried out by the Plumbing Contractor. The Plumbing Contractor shall mark out on Site and/or supply drawings of all "cutting-away" to the Building Contractor within a reasonable time.

All expenses properly incurred and losses suffered by the Employer as a result of the Plumbing Contractor's failure to comply with the above requirements are recoverable by the Employer from the Plumbing Contractor as a debt under the Contract or via the Building Contractor as if it is a debt liable to the Building Contractor under the Sub-contract as appropriate.

The Plumbing Contractor shall ensure that such works are essential for the execution of the Installations. In the event that any of such works is proved to be non-essential, unnecessary and/or abortive, the Plumbing Contractor shall bear the full cost of such works including but not limited to any unnecessary or incorrect cutting-away and making-good and shall reimburse the Employer for all cost incurred in this connection are recoverable by the Employer from the Plumbing Contractor as a debt under the Contract or via the Building Contractor as if it is a debt liable to the Building Contractor under the Sub-contract as appropriate.

Upon completion of the builder's works by the Building Contractor, the Plumbing Contractor shall forthwith check and examine that all builder's works so executed have been completed in accordance with his requirements. If at any time it becomes apparent to the Plumbing Contractor that any builder's works completed by the Building Contractor does not comply with his requirements in any respect whatsoever, the Plumbing Contractor shall forthwith give notice in writing to the Supervising Officer and specify in details the extents and effects of such non-compliance in that notice. The Plumbing Contractor is deemed to have satisfied with the builder's works after a period of 14 days from the date of completion of the builder's works if the above notice is not served to the Supervising Officer within such period. All additional expenditure properly incurred and all loss suffered in this

connection by the Employer in having such works re-executed and rectified shall be recoverable by the Employer from the Plumbing Contractor as a debt under the Contract or via the Building Contractor as if it is a debt liable to the Building Contractor under the Sub-contract as appropriate.

A3.4 COORDINATION OF INSTALLATIONS

The Plumbing Contractor shall coordinate the Installations with those works of the Building Contractor and any other contractors and sub-contractors of the Building Contractor.

The Plumbing Contractor shall note that the Drawings supplied to him only indicate the approximate locations of the Installations. He shall make any modification reasonably required of his programme, work sequence and physical deployment of his work to suit the outcome of work coordination or as necessary and ensure that all cleaning, adjustment, test and control points are readily accessible while keeping the number of loops, cross-overs and the like to a minimum.

The Plumbing Contractor shall pay particular attention to the building works programme and shall plan, coordinate and programme his works to suit and adhere to the building works in accordance with the building programme.

Any significant problems encountered during the coordination work, which are beyond the Plumbing Contractor's control, shall promptly be reported to the Supervising Officer.

A3.5 COOPERATION WITH OTHER CONTRACTORS

The Plumbing Contractor shall cooperate at all times with the Building Contractor and all other contractors and sub-contractors of the Building Contractor in order to achieve efficient workflow on the Site and keep the Site in a clean and tidy condition.

Any significant problems beyond the Plumbing Contractor's control shall promptly be reported to the Supervising Officer.

A3.6 SITE SUPERVISION

The Plumbing Contractor shall keep on the Site a competent and technically qualified site supervisor to control, supervise and manage all his Installations on Site. The site supervisor shall be vested with suitable powers to receive instructions from the Supervising Officer and his Representative.

The site supervisor shall be technically competent and have adequate site experience for the Installations. The qualified and competent site supervisor shall have minimum 5 years on site experience for similar type of installation works. The Plumbing Contractor shall also refer to the Particular Specification for other specific requirements, if any, on site supervision.

Approval by the Supervising Officer shall be obtained prior to the posting of the site supervisor on Site. The Plumbing Contractor shall immediately replace the site supervisor whose experience, skill or competency is, in the opinion of the Supervising Officer, found to be inadequate for the particular work.

All tradesmen must be experienced in the trade and the work carried out shall be consistent with good practice in Hong Kong and to the satisfaction of the Supervising Officer. In this connection, the Plumbing Contractor's attention is drawn to the Special Conditions of Contract under the Contract for the requirements relating to Qualified Tradesmen/Qualified Skilled Workers and Intermediate Tradesmen/Qualified Semi-skilled Workers.

The Plumbing Contractor shall also employ a full time competent foreman on Site for each trade. All trade foremen shall be registered tradesmen/skilled workers of the relevant trade.

A3.7 SAMPLE BOARD

Within 6 weeks of the acceptance of his Tender and prior to the commencement of the Installations, the Plumbing Contractor shall submit to the Supervising Officer for approval a sample board of essential components proposed to be used in the Contract. However, the Plumbing Contractor may request the Supervising Officer in writing for a longer period for submission if 6 weeks are practically insufficient.

The sample board shall comply with the requirements of the Water Authority. Items displayed shall be deemed to be adequate for the Installations unless otherwise clearly indicated. Each sample, with clear numbering and labelling, shall be firmly fixed onto a rigid wooden or metal board. A list shall also be affixed on the sample board to show the item description, make and brand, country of origin and locations of installation (if not generally used). Samples rejected by the Supervising Officer shall be replaced as soon as possible. Upon approval of all items, the Supervising Officer will endorse the list on the sample board and the Plumbing Contractor shall deliver the board to the site office of the Supervising Officer's Representative for reference.

The board shall contain samples of all "compact" sized materials and accessories to be used in the Installations. Written approval of all samples and technical details shall be obtained from the Supervising Officer before commencement of any installation work.

In the context of this General Specification the term "compact" means any item that will fit into a 300 mm cube.

The following items shall be included in the sample board as a minimum:

(a) Pipework, fitting and their support complete with fixing accessories;

(b) Valves; and

(c) Taps, shower mixers and solder materials if used.

Relevant certificates/testing reports/catalogues as appropriate are also required to be provided together with the sample board.

Additional items may be required by the Supervising Officer and/or specified in the Particular Specification.

A3.8 ADVICE OF ORDER PLACED

The Plumbing Contractor shall submit copies of all orders placed for major items of equipment and materials to the Supervising Officer for record.

A3.9 RECORD OF MATERIALS DELIVERY

All materials and equipment delivered to Site shall be accurately listed and recorded in the site record books maintained by the Supervising Officer's Representative on Site.

Such materials and equipment shall not be removed from Site without the prior approval of the Supervising Officer in writing.

Where the Building Contractor is in overall control of the Site, the Building Contractor may also be required to record details of all incoming/outgoing materials and equipment. In this case, the Plumbing Contractor shall comply with the Building Contractor's arrangements.

The Plumbing Contractor shall print the major technical details on equipment/ materials or supporting documents (e.g. delivery note), or else submit a written declaration to confirm compliance of the equipment/materials with the approved technical details so as to facilitate checking of equipment/materials delivered on site.

A3.10 PROTECTION OF MATERIALS AND EQUIPMENT

Unless the responsibility is clearly defined in the Contract that the protection on Site for delivered equipment, materials and installation is solely by other contractors, the Plumbing Contractor shall be responsible for the safe custody of all materials and equipment as stored or installed by him. In addition, the Plumbing Contractor shall protect all work against theft, fire, damage or inclement weather and carefully store all materials and equipment received on Site but not yet installed in a safe and secure place unless otherwise specified.

All cases of theft and fire must immediately be reported to the police, the Building Contractor, the Supervising Officer and his Representative on Site with full details.

Where necessary the Plumbing Contractor shall provide lockable steel container or other equally secure enclosures placed within a securely fenced-in

compound provided by the Building Contractor on Site for the storage of materials and equipment.

The Plumbing Contractor shall co-ordinate and arrange with the Building Contractor who shall provide clean, reasonably finished and lockable secure accommodation for the storage of sensitive and/or expensive items before installation.

If there is no Building Contractor, all the storage facilities and spaces shall be provided by the Plumbing Contractor.

A3.11 SERVICE CONDITION

The following service conditions shall apply to materials and equipment

(a)	Climate	: Hong Kong (tropical);
(b)	Ambient temperature	: Peak –5 ^{o}C to +40 ^{o}C (continuously 4 hours) Average 0 ^{o}C to +35 ^{o}C (over 24 hours);
(c)	Altitude	: up to 2000 m above sea level; and
(d)	Relative humidity	: 99% maximum.

A3.12 VOLTAGE COVERED BY THIS GENERAL SPECIFICATION

Unless otherwise specified, all apparatus, equipment, materials and wiring shall be suitable for use with a 3-phase and neutral, 4-wire, 380/220 V ±6%, 50 Hz ±2%.

A3.13 LABEL

In order to make cross reference to the Operation/Maintenance/Service Manuals and Schematic Drawings, etc., the Plumbing Contractor shall provide labels for marking all valves, pipework, filtration tanks, fuses, terminals, lamps, switches, handles, keys, instruments, gauges, control and other equipment, etc. and elsewhere to facilitate maintenance or as directed by the Supervising Officer with engraved multi-layer laminate or similar material. Wording shall be submitted to the Supervising Officer for approval before manufacture.

All labels shall be of adequate size as to give clearance between lettering and fixings to ensure an aesthetic arrangement on completion. Pipeline labels shall generally be not smaller than 100 mm x 20 mm. Where applicable, labels shall be fixed utilising non-ferrous round head bolts and nuts or woodscrews. Adhesives or self tapping screws are not acceptable.

For pipelines or valves, where applicable, labels shall be fixed by means of a key ring attached to the upper corner of the pipe mounting bracket or the hand wheel of valves. The labels shall be suspended from brass or stainless steel chain loops over the relevant pipe.

The Plumbing Contractor shall submit a schedule for all labels, notices, identifications for the Supervising Officer's approval prior to order and installation. The information of the schedule shall include the description of the items, height and font type of the text, dimensions of the labels and material used.

All English lettering used on labels shall be "Bold" capitals (except otherwise directed) with black letters on white labels for normal purposes. Where special colours or details are required these shall be as specified or directed.

All labels shall be in English complete with translation in Chinese characters. The Chinese translations shall be referred to the "Glossaries of Terms Commonly Used in Government Departments" issued by Civil Service Bureau of the Government of the HKSAR. Sample of label and notice shall be submitted to the Supervising Officer for agreement. In general, height for the English lettering shall be of 8mm with that for Chinese characters to match.

For electrical panels or other items, lettering shall be:-

(a) Black on white for normal purposes;

(b) Red letters on white where connected to essential supply; and

(c) Green letters on white where operated by direct current.

A3.14 WARNING NOTICE

Warning notices shall be provided as required by the Electricity Ordinance (Cap. 406) and the Code of Practice for the Electricity (Wiring) Regulations (Cap. 406E). In addition, the following warning notices in English and Chinese shall be provided at the appropriate positions :-

(a) A label having minimum size of 65 x 50 mm marked with the words 'DANGER - HIGH VOLTAGE' in red lettering not less than 5 mm high to be fixed on every container or enclosure of equipment for operating at voltages exceeding "Low voltage"; and

(b) A label to be fixed in such a position that any person may gain access to any moving parts of an item of equipment or enclosure will notice or be warned of such a danger.

A3.15 GUARD AND RAILING FOR MOVING OR ROTATING PARTS OF EQUIPMENT

All moving or rotating parts of equipment shall be provided with an approved guard and railing complying with the Factories & Industrial Undertakings (Guarding and Operation of Machinery) Regulations, (Cap. 59Q), together with any amendments made thereto.

Guards shall be rigid and of substantial construction and shall consist of heavy galvanised mild steel angle frames, hinged and latched with either heavy galvanised mild steel wire crimped mesh securely fastened to frames or galvanised sheet metal of 1.2 mm minimum thickness. All apertures shall be such that finger access to dangerous part is not possible. All sections shall be bolted or riveted. Railings shall be made of 32 mm dia. galvanised mild steel pipe and railing fittings.

A3.16 EQUIPMENT DEVIATIONS

Subsequent to the acceptance of his Tender, and only in exceptional circumstances where it is demonstrated in writing by the Plumbing Contractor that the original equipment offered cannot be obtained, the Supervising Officer may, subject to the Conditions, consider and approve, in writing, alternative equipment and materials proposed by the Plumbing Contractor provided always that these are fully in compliance with the relevant Specification and Drawings and do not impose any additional contractual or financial liabilities onto the Employer.

A3.17 WATERPROOFING

Where any work requires piercing waterproofing layers or structures, the method of installation must have prior approval, in writing, from the Supervising Officer.

Unless otherwise specified or instructed, the Plumbing Contractor shall provide all necessary sleeves, puddle flanges, caulking and flashing as appropriate to make these penetrations absolutely watertight.

A3.18 SURVEYS AND MEASUREMENTS

The Plumbing Contractor shall relate all horizontal and vertical measurements taken and/or applied, to establish bench marks such as design drawing grid lines, finished floor levels, etc. and shall thus establish satisfactory lines and levels for all work.

All works shall be installed to these established lines and levels and the Plumbing Contractor shall verify all measurements on Site and check the correctness thereof as related to the Installations.

Primary bench base line, datum level, horizontal reference grid, secondary grid and transferred bench mark on each structural level will be provided by the Building Contractor. The Plumbing Contractor shall co-ordinate with the Building Contractor to obtain all necessary datum and reference grids prior to their surveys and measurements.

SECTION A4

DRAWINGS AND MANUALS

A4.1 DRAWINGS IN ELECTRONIC FORMAT

The Plumbing Contractor shall provide drawings in electronic format as required in the following clauses. These drawings shall conform to the latest version of CAD Standard for Works Projects (CSWP) as posted in the website of the Development Bureau and in accordance with the latest version of CAD Manual for ArchSD Projects. Should any technical conflict between the CSWP and the CAD Manual arise, the CSWP shall take precedence.

A4.2 INSTALLATION DRAWINGS

A4.2.1 Drawing Submission Schedule

The Plumbing Contractor shall submit a detailed installation drawing submission schedule and programme to the Supervising Officer. The Plumbing Contractor shall allow reasonable time in the programme for vetting of the installation drawings by the Supervising Officer and for drawing resubmissions as necessary.

The Plumbing Contractor shall submit to the Supervising Officer a comprehensive "Submission Schedule" of installation drawings and builder's work drawings within 2 weeks after the acceptance of Tender, taking into account of the overall programme of the Installations including any Specialist Works and works by the utility undertakings. No equipment shall be delivered to the Site and no work shall be executed until the installation drawings have been approved by the Supervising Officer. The Plumbing Contractor shall ensure that the installation drawings and builder's work drawings are progressively submitted in accordance with the approved "Submission Schedule".

The Plumbing Contractor shall provide at least 6 hard copies and one electronic copy, unless otherwise specified in the Contract or the Sub-contract as appropriate, of the approved installation drawings to the Supervising Officer for distribution.

A4.2.2 Size of Installation Drawings

Drawings submitted by the Plumbing Contractor shall only be of standard sizes from A0 to A4 or B1 size as stipulated in ISO 5457:1999 +A1:2010.

Plumbing Contractor's installation drawings and/or shop drawings shall be prepared to such scales that will clearly show all necessary details.

A4.2.3 Contents of Installation Drawings

In accordance with the provisions of this General Specification and as stated elsewhere in the Contract, the installation drawings must incorporate details of the actual plant and equipment items as approved by the Supervising Officer.

The Plumbing Contractor shall ensure all installation drawings are accurate representation of the Installations, before submitting them to the Supervising Officer. All installation drawings shall be fully dimensioned and suitably scaled showing construction, sizes, weights, arrangements, operating clearances and performance characteristics.

(a) "Installation drawings" shall generally include, but not limited to, the following:-

- Symbols and notations same as and compatible with the Employer's own Contract Drawings' standard;

- Complete layout/assemblies including all necessary minor items and accessories;

- Positions of all fixings, hangers and supports;

- Maintenance spaces for all withdrawable items, such as gratings, cleaning eyes, access points, manholes, etc.;

- Lifting points and safe working weights of each item. Note: These may be shown on separate drawings, if necessary, to avoid confusion.

(b) Pipework Installation Drawings

Prior to the commencement of any manufacture, fabrication, or installation, the Plumbing Contractor shall submit to the Supervising Officer for technical appraisal installation drawings for the pipework installation. Generally, the drawings shall be drawn to a scale of not less than 1:50. Subject to the Supervising Officer's approval a scale of 1:100 may be adopted where the installation is a simple one.

The drawings shall indicate the location, with dimensions given, of all pipework in relation to the building structure and other pipework and equipment. The position of all valves, strainers, check valves, etc. shall be shown together with clearances necessary for removal of strainer baskets, internal parts of all valves, motors for motorized valves, solenoids, etc.

Positions and details of all hangers and supports shall be shown and the positions dimensioned.

(c) Special Plant Rooms Co-ordination Work

Unless otherwise stated in the Contract, in the case of a plant room where the Plumbing Contractor's equipment constitutes the major item involved (i.e. as in the case of pump room), the Plumbing Contractor shall allow in the Tender for taking effective responsibility for the coordination of other services/building details within these specific areas. Furthermore the Plumbing Contractor shall carry out this responsibility in co-operation with whoever has the responsibility for the overall project construction stage coordination.

Where necessary, the foregoing plant room co-ordination requirement shall include the preparation of plant room coordination drawings which other Contractors involved in the plant room are to comply with. The Plumbing Contractor shall, also be responsible for the cross checking of other contractors' plant room installation drawings before work thereon proceeds.

A4.2.4 Builder's Work Drawings

Unless otherwise approved by the Supervising Officer, the Plumbing Contractor shall submit to the Supervising Officer in accordance with the approved "Submission Schedule", 6 copies of drawings showing details of all builder's work required e.g. the weight and the load on each support of equipment. Such drawings shall clearly indicate the details and positions of all openings, trenches, ducts, drain and cutting required and construction details for plinths and equipment bases.

A4.2.5 Manufacturer's Shop Drawings

The manufacturer's shop drawings are drawings for equipment or plant to be manufactured by a specialist manufacturing supplier in their own workshops and places away from the Site.

The drawings shall show detailed construction, principal dimensions, weights and clearances for maintenance, etc. Immediately after placing of any order or at any event within 4 weeks unless otherwise approved in writing by the Supervising Officer, the Plumbing Contractor shall forward to the Supervising Officer for comment, 4 copies of manufacturer's shop drawings indicating detailed construction, principal dimensions and weights, clearances for withdrawals and/or cleaning, etc. No work shall proceed on or off Site unless drawings requiring approval are so approved in writing by the Supervising Officer.

A4.2.6 Drawings for Submission to other Authorities

The Plumbing Contractor shall submit plumbing proposals prior to the installation work, with all necessary drawings and information approved by the Supervising Officer, to the SCCU established under ArchSD, Building Authority, WSD or DSD where appropriate for approval/inspection.

No plumbing work shall be commenced before the plumbing proposal has been approved by the WA.

A4.2.7 Checking Drawings of Other Trades

The Plumbing Contractor shall follow the design intent of the Contract Drawings in planning and carrying out the work and shall cross check with other trades in order to verify the line, level, space and sequence in which the Installations are to be installed.

If directed by the Supervising Officer, the Plumbing Contractor shall, without extra charge, make reasonable adjustments to the proposed installation drawing layouts as are necessary to prevent conflicts with the work of other trades or for the proper sequence of and execution of Installations. Where such modifications are of a nature and of such unforeseen complexity that they involve unreasonably extra work not covered by the Contract, they may be covered by variation order to be issued by the Supervising Officer wherever such a requirement is justified.

A4.3 AS-BUILT DRAWINGS

A4.3.1 Submission of As–built Drawings

The Plumbing Contractor shall submit to the Supervising Officer as-built drawings, including the draft prints and revised draft prints for checking and the final approved drawings for record in accordance with the requirements set out in the contract documents.

A4.3.2 Size of As-built Drawings

As-built drawings shall only be of standard sizes of A0, A1 or B1 size as stipulated in ISO 5457:1999 +A1:2010. Smaller size (A2 to A4) is accepted for installation drawings.

A4.3.3 Content of As-built Drawings

The Plumbing Contractor shall ensure all as-built drawings are accurate representation of the Installations, before submitting them to the Supervising Officer.

"As-built" drawings shall complete with all details such as design water flow rates to be used for commissioning purposes. Any amendments noted on these drawings during the commissioning and test stage shall subsequently be transferred to the original "As-built" drawings once the amendments have been accepted by the Supervising Officer.

A4.3.4 Framed Drawings

The Plumbing Contractor shall provide and install in the relevant major plant room glass-framed, non-fading prints of the following:-

(a) Valve chart consisting of schematic diagrams showing the layouts and positions and identification of all valves with record of final settings/adjustment for regulating devices;

(b) Plant room record drawings showing all plant items, pipework and equipment, etc. including all electrical and control schematics and diagrams; and

(c) Vertical plumbing line diagrams and water pipe alignment plans.

Glazing shall be polished plate of not less than 6 mm thickness mounted in natural finish, extruded and anodised aluminium frames with the prints mounted on acid free mounting board and the whole backed with marine grade plywood not less than 8 mm thick.

A4.4 OPERATION AND MAINTENANCE (O&M) MANUAL AND USER MANUAL

A4.4.1 General

The Plumbing Contractor shall provide two types of manuals to the Supervising Officer with all changes made to the installation during the course of the Contract suitably incorporated.

The O&M Manual is for use by the maintenance agent of the completed Installations. It shall contain detailed technical information covering both operation and maintenance aspects of the Installations.

The User Manual seeks to give users of the completed Installations an overview of the essential information of the Installations. The contents of the manual should be concise and succinct for ease of comprehension by people with a non-technical background.

A4.4.2 Presentation

All manuals shall be written in English, unless otherwise specified. The text of descriptive parts shall be kept concise while at the same time ensure completeness. Diagrammatic materials shall also be supported by comprehensive descriptions.

The manuals shall comprise A4 size loose-leaf, where necessary, A3 size folded loose-leaves. The loose-leaf shall be of good quality paper that is sufficiently opaque to avoid "show-through". Unless otherwise specified in the Contract, the manuals shall be bound in durable loose-leaf 4 ring binders with hard covers. The manuals shall have labels or lettering on the front cover and spine. The Supervising Officer's approval shall be obtained on this at the draft manual stage. The electronic copy of manuals including the technical literatures shall be in PDF format readable by Acrobat Reader Freeware.

A4.4.3 Checking and Approval

The Plumbing Contractor shall submit to the Supervising Officer the draft of O&M Manuals and User Manual for checking and approval and the approved O&M Manual and User Manual for record according to the requirements as specified in the contract documents.

A4.4.4 Structure and Contents of O&M Manual

The detailed requirements, structure and contents of the O&M Manual shall be as specified in elsewhere in the Contract.

A.4.4.5 Structure and Contents of User Manual

The detailed requirements, structure and contents of the User Manual shall include, where applicable, the following information:-

(a) Project Information

This shall include:-

Project title, site address, contract no., contract title, contract commencement date, substantial completion date and expiry date of Maintenance Period.

(b) System Description

- Type(s) of system(s) and equipment installed, and their purposes;

- Locations of the major plant rooms and riser ducts; and

- Brief description of the operation and functions of the systems and equipment.

(c) Schedule of Major Plant Rooms and Installed Equipment

- Schedule of major plant rooms and riser ducts including their locations; and

- Schedule of major equipment and plants including their locations and serving areas.

(d) Safety Precautions for Operation

Any safety precautions and warnings signals that the users shall be aware of in the daily operation of the various systems and equipment in the Installations including:-

- Mandatory requirements relating to safety;

- Features or operational characteristics of the installed systems or equipment which may cause hazard and the related safety precautions.

- Protective measures and safety precautions for operation; and

- List of warning signals and the related meanings that the user shall be aware of and the actions to be taken.

(e) Operation Instructions

Instructions for the safe and efficient operation, under both normal and emergency conditions, of the installed system which shall comprise:-

- An outline of the operating mode;

- Step by step operation instructions for systems and equipment that are to be operated by the user, including at least procedures for start-up and shut-down;

- Means by which any potentially hazardous equipment can be made safe;

- Cleaning and basic maintenance procedures.

(f) List of Statutory Periodic Inspections and Tests

A schedule of periodic inspections and tests that owner and/or user of the Installations have to arrange to achieve compliance with the requirements stipulated in the relevant

Laws of Hong Kong. The frequency of such inspections and tests shall be expressed in specific time intervals.

(g) Drawings

A set of selected as-built drawings which shall be able to illustrate to the user the general layout of the completed Installations.

(h) Photographs

A set of photographs with suitable captions to illustrate to the user the appearance and locations of devices which require their setting and operation.

A4.4.6 Intellectual Property Rights

The Government shall become the absolute and exclusive owner of the Operation and Maintenance Manuals and the User Manual and all intellectual property rights subsisting therein free from all encumbrances.

In the event that the beneficial ownership of any intellectual property rights subsisting in the above Manuals are vested in anyone other than the Plumbing Contractor, the Plumbing Contractor shall procure that the beneficial owner shall grant to the Employer a transferable, non-exclusive, royalty-free and irrevocable licence (carrying the right to grant sub-licences) to utilise the intellectual property rights in the manuals for the purposes contemplated in the Contract. For the avoidance of doubt such purposes shall, but not limited to, include providing free copying of the materials in the manuals by any subsequent owner or user of the Installations, and/or any party responsible for the operation and maintenance of the Installations in connection with any subsequent alteration, extension, operation and maintenance of the Installations.

PART B – INSTALLATION METHODOLOGY

SECTION B1

PLUMBING SYSTEMS

B1.1 GENERAL

The Scope of Installations under this section shall include the complete plumbing installation for fresh, flush, fire service pipework systems as shown on the Drawings and as specified, including but not limited to:

(a) Fresh and flushing water supply systems, pumps and pipework installations commencing from the government mains at the entry of site boundary to individual sanitary fixtures, gas water heaters and taps (including connection to sanitary fixtures and associated taps and water heaters installed by others) where shown on the Drawings or as specified;

(b) Water supply for fire service installation commencing from the government mains at the entry of the site boundary including the up-feed pipework and connection to the fire service roof/transfer tanks where shown on the Drawings or as specified;

(c) Hot water pipework installations (including connection to sanitary fixtures and associated taps and water heaters/boilers/calorifiers installed by others) where shown on the Drawings or as specified;

(d) Rainwater recycling system including associated pumps and pipework installations and water treatment equipment, where shown on the Drawings or as specified;;

(e) Water supply for feeding/make-up to air-conditioning installation, fountain installation, swimming pool installation and irrigation system; and

(f) Extend and connect the fresh, flush and fire service water pipes to the government mains outside the site boundary, if applicable. Where shown in the Drawings or as specified, connection shall be made to existing in-service supply mains of adjacent building blocks instead of government mains.

The complete plumbing installation shall mean, not only the major items of equipment and apparatus conveyed in the Specification and Drawings, but all the incidental sundry components necessary for the complete execution of the works and for the proper operation of the installation with their labour charges, whether or not these components are mentioned in detail in the Contract.

The Plumbing Contractor shall make all necessary applications to WSD and attend upon their representative for the purpose of tests and inspections for the

plumbing installation.

B1.2 HANDLING AND STORAGE

B1.2.1 Materials shall be stored properly in accordance with the manufacturer's instructions to afford maximum protection against weather, corrosion, mechanical damage and other causes prior to installation.

B1.2.2 Pipes shall be stored with closed ends. The exposed end of pipework shall be covered throughout the erection.

B1.2.3 Pipes and fittings shall be stored under cover and clear of a leveled, well-drained and maintained hard-standing ground. Do not rest pipes on their sockets.

B1.2.4 Rubber jointing rings shall be stored in protective bags. Plastic pipes and fittings under storage shall not be exposed to sunlight to avoid any deformation.

B1.2.5 Pipes and fittings shall be cleaned before erection to remove all scale, burrs, furs, sand, slag etc. Damaged pipes or fittings shall be removed from the Site immediately.

B1.3 FIXING PIPES AND FITTINGS

B1.3.1 General Details

Pipes and fittings shall be inspected before fixing.

Avoid crimping and restricting the diameter of tubes when forming bends in pipes.

Provide air vents of automatic type at high points as shown on the Drawings.

B1.3.2 Protection to Movement and Expansion

Make adequate provision to control and/or allow for thermal movement in the length of pipes and gutters.

Provide expansion joints in plastic pipes by means of loops or other methods in accordance with the manufacturer's recommendation.

Provide solar protection or insulation for pipes running at roof top by shelter or by painting them white.

B1.3.3 Pipework Arrangement

Water pipes shall not run over electrical switchgear; inside transformer room, switch room, generator room, meter room,

telephone equipment room, PABX room, server room, riser duct for electrical services, or any other rooms containing electrical hazard or susceptible to water damage hazard.

Dead legs and stagnant corners in the pipework shall be avoided. The number and length of spurs shall be minimised.

Unless otherwise approved, do not embed pipes in concrete or grout in or install in such a way as to make alterations difficult at a later date.

Pipes requiring protection against corrosion shall be fixed with 40 mm (minimum) clearance between the pipe, structure or adjacent surfaces.

Pipework shall not be casting in or build into chases in walls and floor unless otherwise approved by the Supervising Officer. Where this is unavoidable and approved, pipes shall be wrapped in an approved protective tape.

Pipework installation shall avoid contact between certain dissimilar metals in particular avoid the direct contact of copper with galvanised iron or steel pipes. If unavoidable use gunmetal joints between dissimilar metals.

B1.3.4 Bends and Offsets of Copper Pipework

Offsets shall be achieved using 45° in preference to 90° bends.

Bends and offsets of up to 90° shall only be formed for pipe sizes from 15 mm to 35 mm provided they:

(a) Have a minimum centre line radius of more than or equal to 3.5 times the pipe diameter;

(b) Are only formed using tools specifically designed for that purpose, i.e. spring benders and formers;

(c) Are free of deformation that may restrict water flow.

Bends and offsets of up to 30° and have a minimum centre line radius of more than or equal to 3.5 times the pipe diameter shall only be formed in pipe sizes less than or equal to 54 mm by heat bending/ annealing techniques without the need for bending tools.

Do not remove or damage the polyethylene sheath where bends are formed in copper pipes with factory applied polyethylene sheath.

Terminate factory applied polyethylene sheath at a consistent/uniform distance not more than 20 mm from the connecting compression type fitting body.

B1.3.5 Pipe Sleeves

Where pipes pass through walls, beams and floor/ceiling slabs, pipe sleeve shall be provided and fixed with uniform annular clearance to allow for expansion and movement of pipe.

For pipes passing through walls and beams, pipe sleeves shall be fixed that flush with the finished surfaces.

For pipe passing through floor slabs, pipe sleeves shall be fixed in position with 100 mm projection above finished floor level and flush with the underside of the floor.

For metal sleeves used in walls and slabs between fire compartments, the sleeves shall be filled for its full length of annular space between the sleeve and the pipe with non-flammable mineral wool or approved equivalent materials. Caulk both ends with fire-rated mastic sealant which is durable and effective in sound insulation to maintain the required FRR of the walls/floor slabs.

Puddle flange cast in basement shall be used for pipes passing through external basement walls where there is ground water pressure.

B1.4 JOINTING PIPES AND FITTINGS

B1.4.1 General

All pipe joints shall be carried out in accordance with the manufacturer's instructions. Pipe joint shall not be made in the thickness of any wall, floor and ceiling unless otherwise approved by the Supervising Officer.

Particular care shall be taken to ensure that joints are not built in and if bends are necessary they shall be made bends and not jointed bends.

Expansion joint shall be provided for all pipework passing through any building expansion joint and where necessary to absorb the effect of expansion on pipes.

Jointing rings, couplings and adaptors shall be of types recommended by the manufacturer of the pipes being jointed.

Cut ends of pipes and gutters clean and square, and chamfer internally or externally if required using equipment appropriate to the material.

Jointing material shall not project into the bore of pipes or fittings.

B1.4.2 Jointing of Galvanised Steel Pipes

Galvanised steel pipes of sizes up to and including 100 mm shall be jointed with screwed fittings. Screwed flanges shall be employed only for connection to flanged valves or equipment.

Galvanised steel pipes of sizes of 150 mm and above shall be jointed with screwed flanges.

Do not joint steel pipes by welding unless approved.

Screwed fittings shall have pipe threads complying with BS 21: 1985 or BS EN 10226-1: 2004. Screwed joints shall have tapered threads and shall be made with approved jointing material.

B1.4.3 Jointing of Copper Pipes

Unless otherwise specified in Particular Specification or Drawings, compression type fittings, solder (end feed or integral) capillary fittings or brazed capillary fittings shall be used for copper pipe sizes less than or equal to 54 mm diameter. For pipe size larger than 54 mm diameter, solder (end feed or integral) capillary fittings or brazed capillary fittings shall be used for jointing. For pipe size larger than 108 mm, brazed capillary fittings shall be used for jointing.

For copper pipe joint by compression type fittings, written confirmation from the manufacturer on suitability of the compression type fittings for use with hot water piping system in 80°C under the required working and maximum pressure shall be submitted to the Supervising Officer for examination and approval for use.

Soldering alloys for copper and copper alloy capillary fittings shall comply with Table 6 Section II and III of BS EN 1254-1: 1998. Chemical compositions of soldering alloy shall comply with Table 3 of BS EN ISO 9453:2014 and shall be of lead-free. Non-corrosive type of flux recommended by the solder alloy manufacturer shall be used.

Lead-free soldering alloys and cadmium-free brazing alloy shall be used in installations for water for human consumption and shall fully comply with the requirements of WSD and this section. Supporting document of lead-free grade and /or cadmium-free grade soldering materials and filler metal used in soldering/brazing shall be provided.

All plumbing works using soldering for connecting copper pipes shall have the permission of the Water Authority.

Brazing alloys for copper and copper alloy capillary fittings shall

comply with Table 6 in Section VI of BS EN 1254-1: 1998. Chemical compositions of brazing alloy shall comply with Table 7 of BS EN ISO 17672:2010 with 2% nominal silver content and shall be of cadmium-free. These brazing alloys should never be used on copper alloys containing nickel. Flux shall not be used for brazing copper-to-copper joints. For joints other than copper-to-copper, type of flux recommended by the brazing alloy manufacturer shall be used.

Use dielectric fittings or epoxy coated flange with gasket for connecting copper pipe to galvanised steel or ductile iron pipe or cast iron valve.

Fit "clip-on" type preformed polyethylene sheaths to cover the capillary type joints and fittings after jointing of the pipework.

The following procedures shall be followed for jointing copper pipes with soldering: -

(a) Remove copper oxide and dirt from pipe spigot and fitting socket prior to the application of soldering flux.

(b) Apply flux sparsely, insert the pipe end into fitting cup and remove excess flux prior to heating.

(c) Apply heat to the body of the fitting and pipe.

(d) Apply a small amount of lead-free solder wire to the pipe where it enters the fitting. The solder will be drawn inside the joint by capillary action.

(e) Clean pipe joints with a damp cloth on completion to remove flux residues and excess solder.

The following procedures shall be followed for jointing copper pipes with copper alloy capillary fittings by brazing: -

(a) Apply flux to the tube spigot and fitting socket and assemble the joint.

(b) Apply heat to the body of the fitting and pipe.

(c) Apply the brazing filler metal to the pipe where it enters the fitting. The filler metal will be drawn inside the joint by capillary action.

(d) Remove residual flux after brazing.

B1.4.4 Jointing of Stainless Steel Pipes

Jointing of stainless steel pipe shall be by mechanical joint or other jointing approved by the Supervising Officer.

B1.4.5 Jointing of Ductile Iron Pipes

All ductile iron pipes shall be jointed with screwed flanges or flanged fittings. Flanges shall comply with BS EN 1092-2: 1997 PN16 as minimum.

B1.4.6 Jointing of UPVC Pipes

UPVC pipe shall be solvent joint using spigot and socket end and fittings. Solvent shall be recommended by the manufacturer.

Unless otherwise approved by the Supervising Officer, interchangeability shall not be allowed between different plastic pipe manufacturer's products.

B1.5 PIPEWORK SUPPORT

B1.5.1 General

Pipework shall be supported in such a manner as to allow adequate movement for expansion and contraction.

Pipes on flat roofs shall be supported at least 150 mm above roof finish on concrete blocks and pipe brackets or PVC sleeves.

Pipe brackets shall be of stainless steel to BS EN 10088-3: 2014 number 1.4301 or SAE Grade 304 or other approved material. The pattern shall suit the type of pipe and the surface to which they are to be fixed, including where appropriate:

(a) Flanged ends for building in;

(b) Plain round ends for fixing in drilled holes with an approved adhesive;

(c) Approved expanding bolts or stud anchors for fixing to concrete, brickwork etc.;

(d) Threaded ends for fixing to steelwork, or wood, as required;

(e) Holed face plates for screwing to wood or plugs.

Bolts, nuts and washers for pipe brackets shall be of stainless steel to BS EN 10088-3: 2014 number 1.4301 or SAE Grade 304 or other approved materials.

Pipe bracket inside pump room shall not be anchored on wall or ceiling as far as practicable. If unavoidable, neoprene or rubber vibration isolation pad of 8 mm thick between the pipe and bracket for those pipe brackets mounted on wall, and vibration isolator for those pipe bracket mounted to ceiling or steel support frames, shall be added.

Do not connect pipe brackets to copper pipes by means of brazing or soldering.

Pipe bracket shall be lined with plastic which fitted between the pipe and the bracket for UPVC pipes and copper pipes.

B1.5.2 Pipe Bracket Intervals

Pipe bracket shall be installed at intervals not exceeding those shown in Table B1.5.2 for straight runs, and with not less than one bracket per length of pipe. Short length of pipe can be without pipe bracket if approved by the Supervising Officer. All brackets shall be equally spaced.

Table B1.5.2 - Spacing of Pipe Fixing

Pipes	Nominal Size (mm)	Maximum Spacing (mm)	
		Vertical pipes	Horizontal pipes
Cast iron and ductile iron	All	3000	1750
Steel	Up to 15	2400	1800
	20 and 25	3000	2400
	32	3000	2700
	40 and 50	3600	3000
	65 to 80	4500	3600
	100 to 125	4500	4000
	150	5400	4500
Copper	15	1800	1200
	22 and 28	2400	1800
	35 and 42	3000	2400
	54	3000	2700
	76 and 108	3600	3000
UPVC	Up to 25	1500	750
	32	1800	900
	40 and 50	2000	1000
	65 to 150	2500	1200

Additional pipe brackets shall be provided next to cast iron valve installed in UPVC pipe. Also, additional pipe brackets shall be provided at turning point of UPVC flush water pipe riser and down pipe.

B1.6 PIPEWORK PENETRATING BUILDING STRUCTURE

B1.6.1 Pipes Through Walls and Floors

Where pipes pass through walls or floors:

(a) Cast or build in UPVC sleeves to BS 3505: 1986 or BS EN ISO 1452-1: 2009 with 2 to 12 mm clearance to allow for expansion and movement of pipe.

(b) Finish sleeves flush with finished face of walls and ceilings and projecting 100 mm above finished floor level.

(c) Provide loose plastic or chromium plated cover plates, when specified, to ends of sleeves visible in completed work. Plates shall be 50 mm larger than the external diameter of pipe and either clipped to the pipe or screwed or plugged and screwed to the adjacent surfaces.

(d) If required to be water tight, point with approved mastic sealant.

(e) No split PVC sleeves shall be permitted.

B1.6.2 Pipes Through Fire Barriers

(a) For metal pipes pass through fire barriers:

(i) The installation shall be as Clause B1.6.1 but

- Cast or built in fire rated pipe sleeve with 2 to 25mm clearance.

- Firmly fix sealing system around the pipes to properly seal up the gaps between the pipes and the fire barriers to maintain the required FRR of the fire barriers and in compliance with the Code of Practice for Fire Safety in Buildings. The sealing system shall be tested to BS EN 1366-3: 2009 or BS 476-20: 1987 and the installation of which shall be in accordance with the manufacturer's recommendations.

(b) For non-metal or plastic pipes pass through fire barriers, suitable fire collars shall be used. The fire collars shall be tested to BS EN 1366-3: 2009 or BS 476-20: 1987 with integrity not less than of the fire barriers as prescribed under the relevant Building Regulation and the Code of Practice for Fire Safety in Buildings. The fire collars shall be fixed at underneath of fire barriers or other locations around the pipes in accordance with the manufacturer's recommendations.

B1.6.3 Pipes Through Basement Wall

Where pipes pass through external basement walls:

(a) Cast or build in cast iron or 2.5 mm galvanised mild steel sleeve to BS EN 10255: 2004 after fabrication with 2 to 12 mm clearance.

(b) Caulk space and point both ends with approved mastic sealant.

B1.6.4 Pipes Through Basement Wall with Ground Water Pressure

Where pipes pass through external basement walls where ground water pressure is significant:

(a) Cast or build in short length of cast iron pipe as sleeve with split bolt on puddle flange and with socket on outside.

(b) Well caulk socket around pipe with yarn and lead including a cast iron plug drilled to take long screw and backnuts if necessary.

(c) Point inside with an approved mastic sealant.

B1.6.5 Pipes Through Flat Roofs

Where pipes pass through flat roofs incorporating either asphalt or proprietary roofing waterproofing material:

(a) Cast or build in fire rated pipe sleeves with 2 to 12 mm clearance projecting 150 mm above roof finish.

(b) Fill the annular space between pipe and sleeve and caulk all spaces and voids at both ends for the full length with approved fire rated materials and sealant, e.g. mastic sealant, add waterproof protection and sealant where necessary;

(c) Cover tops of sleeves with stainless steel collars or cover as per roofing specification or as specified by pipe manufacturer.

B1.7 THERMAL INSULATION

B1.7.1 Thermal insulation to the requirements as specified in this Specification or other parts of the Contract shall be applied to hot water supply pipework and fittings.

B1.7.2 Pipework insulation shall include all pipework, valves, flanges, fittings, pumps and other plant items whether specifically mentioned or not.

B1.8 VALVES

B1.8.1 Unless otherwise specified, install the valve in accordance with manufacturer's recommendations.

B1.8.2 Non-return valve shall be installed horizontally or in such a manner that the water flow direction is in an upward direction for vertical installation.

B1.8.3 Non-return valve shall be installed at relevant upstream tee-off branches to non-drinking water points to avoid cross contamination between drinking and non-drinking water points.

B1.8.4 Non-return valve shall be installed immediately before water filters to avoid contamination of upstream pipework.

B1.8.5 The portion of pipework connecting to flushing valve shall be flushed to clear debris before the installation of flushing valve. .

B1.8.6 No pipe sealant or plumbing grease shall be allowed on any flushing valve components or couplings unless otherwise specified in the manufacturer’s literature.

B1.8.7 Valves and taps installed in public areas, not intended for public use, shall be housed in vandal resistant and corrosion resistant enclosures provided by the Building Contractor.

B1.9 CISTERNS AND TANKS

B1.9.1 Connection of Pipes

Generally, when connecting pipes to cisterns and tanks, ensure that cisterns and tanks are properly supported to avoid undue stress on the pipe connections. Correctly position holes for the connection of pipes to cisterns and tanks. Remove all debris and fillings. Holes in cisterns and tanks shall not be formed by flame cutters.

Connect steel pipes to steel or glass fibre reinforced plastics cisterns and tanks by either:

(a) backnuts and washers both inside and outside;

(b) by using bolted or welded flanged connections; or

(c) as recommended by the manufacturer.

Connect plastic pipes to steel or glass fibre reinforced plastics cisterns by a backnut to the inside. Use corrosion resistant support washers on both the inside and outside of the cistern or tank.

Connect copper pipes to GRP cisterns or tanks in a similar manner.

Do not connect copper pipes to steel cisterns or tanks.

Connect pipes to concrete tanks with short thread flanged connections having a puddle flange either cast or welded on. Ensure that the connections are properly aligned both in the horizontal and vertical planes when being cast into the concrete. Compact around the puddle flange to ensure a water tight joint.

B1.9.2 Connection of Overflow Pipes

Overflow pipes shall be at least one commercial size larger than the inlet pipe and shall be in no case less than 25 mm diameter. It shall be extended to terminate in conspicuous positions which are not susceptible to water damage.

The top of the overflow pipe shall be not less than 25 mm below the invert of the inlet pipe or the face of the outlet nose of the ball float valve.

B1.9.3 Tank Covers

Fit FRP or stainless steel access covers and frames to water tanks.

Fit double sealed access covers to potable water tanks.

Bed and haunch access cover frames in cement mortar.

B1.10 WORKS OUTSIDE SITE BOUNDARY

The Plumbing Contractor shall make all necessary provisions for the connection of water supply mains from town mains to the Installations.

WSD shall be notified accordingly to inspect completed pipework and valve pit prior to back filling.

B1.11 PROTECTION OF WORKS

B1.11.1 Sealing the System

Ends of pipes and openings shall be sealed off to prevent entry of foreign matter into the system during construction. Access covers and cleaning eyes shall be fitted when the works proceed.

B1.11.2 Valves and Taps

House valves and taps installed in public areas or those not intended for public use in vandal-resistant and corrosion-resistant enclosures.

B1.11.3 Underground Pipework

Underground pipework shall be protected against corrosion and mechanical damage.

Anti-corrosion petrolatum tape shall be applied for steel pipe without external protective coating, flange joint, slip-on coupling and flange adaptor. Bituminous tape shall be applied in buried or non-exposed condition for welded joints of steel pipe. The pipework shall be cleaned before applying the anticorrosion tape.

Underground pipework shall be pressure tested before the application of anti-corrosion tape.

B1.11.4 Pipework Passing under Road

Pipes crossing under roads shall be passed through in ducts of similar construction to cable ducts as Clause 24.31 of General Specification for Building.

Where top of the underground pipework is less than 900 mm from finish level of roads for vehicles, the pipework shall be surrounded by concrete.

B1.12 CLEANING AND DISINFECTION OF INSTALLATIONS

B1.12.1 General

The plumbing installation pipework and water storage tanks shall be thoroughly flushed clean to remove rust, sludge and sediment upon commissioning. Fresh water distribution pipework and associated water storage tanks shall be further disinfected and flushed thoroughly with potable water upon completion of cleaning and before water supply is resumed. The Plumbing Contractor shall arrange with the Water Authority to collect water samples for testing.

Disinfection of plumbing installation for potable use shall be carried out not more than 7 days before hand over the installation to users for operation. Where the plumbing installation for potable use is not brought into use immediately after commissioning, it shall be disinfected before use unless it has been flushed weekly to maintain a flow of water.

B1.12.2 Methodology of Cleaning and Disinfection

The Plumbing Contractor shall carry out the cleaning and disinfection in accordance with the requirements as required by WSD and as stipulated in the Testing and Commissioning Procedure for Plumbing Installation in Government Buildings Hong Kong issued by the Building Services Branch, Architectural Services

Department, and to the satisfaction of the Water Authority.

For pipework downstream of the water tank or downstream of the water meter for the case of direct feed system, the disinfection process shall be in accordance with the requirements of WSD.

The Plumbing Contractor shall submit a cleaning and disinfection plan indicating the scope of work, detail of the compartmentation if any, work schedule, method statement, procedures and equipment for checking and testing, location of sampling, method statement for the de-chlorination, etc. for the Supervising Officer's approval prior to carrying out the work.

Any discharge of disinfectant solution or used water for disinfection shall comply with the Water Pollution Control Ordinance (Cap. 358). The Plumbing Contractor shall submit a method statement for the de-contamination of used water to the Supervising Officer for approval.

B1.12.3 Water Quality Test

The Plumbing Contractor shall arrange water sampling tests upon completion of the cleansing and disinfection of the plumbing installations. The water sampling tests shall comply with the requirements of WSD and to the satisfaction of the Water Authority.

Sampling and analysis of the water samples shall be carried out by the Water Authority or by accredited laboratories under the HOKLAS. For water samples to be tested by accredited laboratories, the water samples shall be taken on site by the accredited laboratories in accordance with the sampling procedures developed with reference to BS EN ISO 5667-5: 2006.

If any of the water samples fails to comply with WSD's requirement, the Plumbing Contractor shall investigate the cause, take necessary rectification action and re-arrange water quality testing for the concerned part of installations.

B1.13 QUALITY CONTROL OF SOLDERING/BRAZING JOINTS FOR COPPER PIPES

B1.13.1 General

All soft solder materials, soldering flux and filler metal used in soldering, brazing and/or welding for jointing copper pipes for the fresh water supply system shall be of lead-free and cadmium-free grade. The Plumbing Contractor shall take all precautions to ensure good quality control during installation.

B1.13.2 Site Record

The Plumbing Contractor shall keep record of soldering/brazing joints done by each individual plumber/worker during installation and shall submit to the Supervising Officer for checking.

B1.13.3 Sampling and Testing of Soldering/Brazing Joints

To ensure the soldering/brazing joints of copper pipes are in compliance with the lead-free grade to Table 3 of BS EN ISO 9453:2014 and cadmium-free grade to Table 7 of BS EN ISO 17672:2010, the Plumbing Contractor shall arrange sampling and testing of soldering/brazing joints and submit the sampling and analysis methodology, including but not limited to the proposed independent accredited laboratory and the procedures for collection and analysis of test samples and submission of test results, for the Supervising Officer's approval.

The Supervising Officer shall at random select a number of completed soldering/brazing joints for carry out testing of the lead and cadmium content of the jointing materials. Quick lead test on the surface of the soldering joints may be used to aid the random selection.

The Plumbing Contractor shall be responsible for cutting out and repair of all such joints for inspection.

The testing of the lead and cadmium content of the soldering/brazing joints shall be carried out by accredited laboratory. The Plumbing Contractor shall declare in writing that the accredited laboratory appointed has no affiliation as a legal entity to the contractor and its sub-contractors.

The Supervising Officer shall agree with the Plumbing Contractor either to appoint representative(s) from the accredited laboratory to collect test samples on site or to arrange contractor's representative(s) to collect test samples on site. The Plumbing Contractor has to ensure that all the procedures stated in the approved methodology are strictly followed. Test samples collected shall be kept in sealed container inaccessible to unauthorised persons at all times.

If any of the soldering/brazing joint is found with lead or cadmium content that exceeds the required limit, Supervising Officer shall order same number of the soldering/brazing joints at random selection for further testing. If any of the samples from further testing is found with lead or cadmium content, it is sufficient to conclude that the soldering/brazing materials are not lead-free or cadmium-free and the Plumbing Contractor shall submit remedial plan to rectify the defects for approved by the Supervising Officer. Further contractual and legal actions against the Plumbing Contractor shall be taken as appropriate.

SECTION B2

WATER HANDLING EQUIPMENT

B2.1 GENERAL

The installation details should be in accordance with the instruction prepared by the manufacturer.

Pumps shall be "Type-tested" in accordance with the requirement of BS EN ISO 9906: 2012. Test certificates with performance curves shall be submitted to the Supervising Officer.

Pumps and their drives shall be segregated such that failure of pump seals shall not result in damage to the drive motors.

B2.2 STORAGE

The equipment should be stored in a dry space when they are delivered to Site. Special rust preventive measures to protect the internal parts of pumps shall be applied if the equipment must be stored for an extended period of time. Such provisions shall be removed completely before final installation and the bearings should then be re-lubricated.

B2.3 PUMPS

B2.3.1 Centrifugal Water Pumps

Common Installations for Fresh Water Pumps and Flushing Water Pumps

(i) Driving Arrangements

The pump and motor shall be direct coupled and mounted on a substantial machined bedplate; accurately aligned, and fitted with guards. The whole assembly including the bedplate shall be designed and supplied by the pump manufacturer. Coupling with spacer shall be used for end suction pumps so that the impeller may be dismantled from the motor side for servicing without neither disrupting the pipework nor dismounting the motor.

The pump and motor for vertical multi-stage pump for potable application shall be of close-coupled type.

(ii) Stand-By Pumps Arrangement

Where stand-by pumps are specified with automatic changeover provision, the changeover shall be initiated by

means of flow sensing devices of an approved pattern. The necessary non-return valves shall be incorporated in the pipework to interconnect such pumps.

B2.3.2 Sump Pumps

The sump pumps shall be of vertical centrifugal design suitable for dry sump or wet sump installation. Each pump shall be constructed with double mechanical shaft seal and close-coupled to a submersible electric motor.

The sump pumps should operate automatically under level control with an alarm to alert the operator when high water level is being exceeded.

Each pump shall be equipped with factory built-in suspension device and a factory mounted discharge elbow should be provided for wet sump installation, and cast iron or steel base for dry sump installation to provide correct pump alignment for wet sump pump installation, the disconnection shall simply consist of easy removal of each pumping unit for inspection, repairs and services. The pumps when lowered into the pits shall automatically be connected to the discharge piping. There shall be no need for the maintenance or operation personnel to enter the wet well to carry out the work. Each pump shall be complete with guide bars, cable supports and lifting chains.

The pump discharge shall be fitted with a resilient seal that provides a positive hydraulic seal for maximum pump efficiency. Each impeller shall be trimmed to meet the specified flow requirements.

For installation in flammable zones, each sliding guide bracket shall have non-sparking material to prevent ignition of explosive wet well gases.

B2.4 PLANT ROOM LOCATION

The Plumbing Contractor shall check and assure that adequate working space must be provided to access for maintenance and sufficient headroom to lift the parts for repairing is provided. For large pumps, a hoist with travelling crane or other facility shall be provided over the pump location.

For an open loop system, the location of pump should be sited so that it will use the shortest and most direct suction and smallest vertical lift. Where possible, the pump centre line should be placed below the level of the liquid in the suction tank.

The Plumbing Contractor shall take all precautions against flooding when pumps are located in pits or other places liable to flooding. The pumps shall be of the vertical spindle type with the motor mounted above the potential flooding level. Motor and pump shall form one unit being joined by a

common stool. Where shaft extension is required, the pump shall be driven through a flexible shaft that consists of a universal joint at each of the drive and driven end and the slip joined at centre of travel.

B2.5 PUMP FOUNDATION

The foundation for a pump should be of sufficient size and rigidity to properly support the full area of the base-plate, to absorb any normal strains and to maintain correct alignment. The minimum mass of inertia block of concrete shall be not less than 2.5 times the mass of the pump assembly with at least 100 mm thick and 150 mm wider than the pump base-plate.

The space between the pump unit and the foundation bolts should be allowed in accordance with the manufacturer's recommendation. Each foundation bolt should be installed in a pipe sleeve type holder and should be cast before the concrete foundation is being poured.

Unless otherwise specified, pump base shall be mounted on the raised housekeeping plinth using appropriate anti-vibration spring mountings. Each spring shall be individually selected according to load distribution and shall have an additional free travel equal to one half of the rated deflection. Spring mounts shall have a leveling bolt and shall be mounted to the concrete inertia block via height saving brackets that allows a base clearance of 50 mm.

A curb ring or soleplate should be used as a bearing surface for mounting of a vertical wet-pit pump. The mounting face of the curb ring or soleplate should be machined for pump alignment. Tie rods should be installed to secure the pump that is designed to discharge below ground.

B2.6 PUMP ALIGNMENT

The pump unit should be accurately aligned in accordance with the manufacturer's instructions prior to operation. The unit should be supported over the foundation by strips of steel plate close to the foundation bolts, allowing a space of 20 to 50 mm between the bottom of the base-plate and the top of the foundation for grouting. The alignment shall be rechecked after the suction and discharge piping have been bolted to the pump to test the effect of piping strains.

The pump and driver alignment should be rechecked and adjusted correct at the expiry of the Maintenance Period.

B2.7 GROUTING OF PUMP BASE

The base-plate shall be grouted before piping connections are made and pump alignment is finally rechecked. Grouting by Building Contractor should be properly done with concrete that shall compose of one part of pure cement and two parts building sands or be a proprietary non-shrink grout to the acceptance of the Supervising Officer to prevent lateral shifting of the base-plate. Grout holes shall be allowed in the base-plate to serve as vents for air escape. The

expose surface of the grout shall be covered with wet burlap to prevent cracking from drying too rapidly. The pump alignment should be rechecked thoroughly after the grouting has hardened for a period that should not be less than 72 hours.

B2.8 SUPPORT FOR PIPING

Suction and delivery pipes shall be supported independently of the pump. The connecting pipes to a pump should not strain the pump. Pipes installation should match up to the respective flanges without being strained into position. The faces of the coupling should be checked with a straight edge to make sure that they are parallel and concentric.

B2.9 CONNECTION PIPING TO PUMP

B2.9.1 Suction Piping

The suction piping shall be properly installed for a satisfactory pump operation. This shall be achieved by keeping as direct and as short as practicably possible with a minimum number of bends. The installations should be laid out such that a continuous fall can be maintained from the pump to water source to prevent air pockets forming. Concentric reducers should not be used on suction branch.

The size of the suction pipe shall be larger than the pump inlet and eccentric reducers shall be used. If the source of supply is located below the pump centreline, the reducer shall be installed straight side up. If the source of supply is above the pump, the straight side of the reducer shall be at the bottom.

A straight section piping at least 4 to 6 diameters long at the pump inlet and long radius bend shall be used for suction pipeline installations to create less friction and provide more uniform flow distribution.

B2.9.2 Delivery Piping

Unless otherwise specified, the size of the delivery pipe shall be at least one size larger than the pump delivery and the velocity shall be kept around 2 metre per second for pumping water over long distance. The check valve shall be installed between the pump and the gate valve. The gate valve should be installed close to the pump discharge for pump priming and repairing. Provision such as a sprocket rim wheel and chain shall be provided for manually operated valves that are difficult to access.

Air release valves shall be installed at the highest points on each rise to allow accumulated air or vapour or other gases to escape from the pipe.

A 'Y' type branch connection shall be used for distribution of more than one-discharge points.

A taper piece with the included angle between 10-13 degrees shall be used for reduction of pipe diameter.

Adequate support and anchorage shall be provided if the pipes are laid above or below ground. For this purpose, it is acceptable to have thrust blocks in either corner type or puddle flange type that are designed to absorb reactions or turning forces to ensure no mechanical and hydraulic forces imposed on the pump.

B2.9.3 Pipe Flanges

Pipe flanges should match with the sizes of pump flanges with full-face gaskets.

B2.9.4 Expansion Joints

Expansion joints/flexible connectors shall be installed in suction and delivery pipelines to take up vibration but shall not be used to take care of the misalignment during installation. A suitable pipe anchor shall be installed between the expansion joint and the pump.

If expansion joints are not specified, expansion loops that are formed by looping the pipe shall be provided to prevent the transmission of strains to the pump.

B2.9.5 Intake

The installation work should be carried out properly to prevent air being entrained as bubble within the water. The intake pipe shall run well below the sump tank level to prevent from forming air gulps.

High level entry into the sump should be avoided as air may be entrained by the falling jet.

Vortex inhibitor shall be installed to prevent air being drawn from bottom of vortex into the intake.

B2.10 SUCTION STRAINERS

The suction strainer shall be installed as close as practicably possible to the pump. This suction pipe strainer should not be used for flushing the pipe. A temporary strainer fitted with a finer mesh than the permanent strainer should be used for flushing all piping and cleaning thoroughly all possible mill scale and other foreign matter. The temporary strainer shall be removed afterwards.

B2.11 VENTING VALVES FOR PUMP-SET

Venting valves shall be installed at one or more points of the pump-casing waterway to provide a means to escape for air or vapor trapped in the casing. These valves shall be connected so as not to endanger the operation staff in handling toxic, inflammable or corrosive liquid.

B2.12 DRAIN FOR PUMP-SET

All drain and drip connections shall be piped to a point where the leakage can be disposed of or collected for reuse if specified.

B2.13 INSTRUMENTATION

Each pump installation shall include pressure gauges and a gas cock to measure the system pressures and pressure drop.

All measuring and isolation instruments, such as the pressure gauges, check valves, globe valves, gate valves and strainers, etc., or as specified in the Particular Specification shall be installed properly to maintain a close check on control on the performance and condition of the pumps.

Instruments shall be mounted in a suitable location so that they can be easily observed.

SECTION B3

PAINTINGS, FINISHING AND IDENTIFICATION

B3.1 GENERAL

All surfaces except otherwise specified, other than those indicated to be left self finished such as stainless steel, anodised aluminium, or otherwise approved by the Supervising Officer, shall be finished in first class paint work as appropriate. All metallic surfaces shall be wire-brushed and cleaned to make it free from rust, scale, dirt and grease prior to painting. Primer shall be applied to metal surface on the same day as they have been cleaned. All works shall be carried out by qualified tradesmen/ qualified skilled workers.

Pipework concealed in false ceiling or pipe ducts not normally accessible need not be painted, unless otherwise specified but appropriate colour code identifications shall be applied.

All paint shall comply with the requirement in General Specification for Building and shall be submitted for the approval of the Supervising Officer.

The volatile organic compound (VOC) content, in grams per litre, of all paint and primer shall not exceed the prescribed limit under the Air Pollution Control (Volatile Organic Compounds) Regulation or the limit set by EPD, whichever is more stringent.

VOC content of paint shall be determined by methods stipulated in Air Pollution Control (Volatile Organic Compounds) Regulation or other methods acceptable to EPD.

All painting works shall be completed and left in ventilated environment for at least one week, or the curing period recommended by the paint manufacturer whichever is longer, before occupation or handover of the renovated area.

All surfaces shall be painted and finished as specified to meet and match the aesthetic architectural design as required.

B3.2 NUMBER OF PAINT COATS REQUIRED

All painted surfaces are to receive at least one primer coat and two coats of the finishing colour. For external installation/ equipment installation, polyurethane paint shall be used for finishing colour to provide better UV resistance unless otherwise specified. Ferrous surfaces shall receive one coat of rust inhibiting primer, one under-coat and two finishing coats.

Where painting is carried out in occupied areas with central air-conditioning or areas without good natural ventilation, pre-painting preparation and primer coat shall be carried out off-site and only the finishing coats shall be painted on-site.

B3.3 IDENTIFICATION OF PIPELINES

All pipework in the pump rooms shall be finished generally in accordance with BS ISO 3864-1: 2011. All pipework, where exposed on surfaces outside the pump room, shall be painted either as in the pump room or to match the surrounding surface with distinguishing colour code bands plus flow arrows in the specified colour scheme as directed by the Supervising Officer.

Pipes and pipelines shall be painted in colours either in accordance with BS ISO 3864-1: 2011 or as directed by the Supervising Officer completed with the identification colour code indicators. The basic identification colour or the decoration colour shall be applied over the whole length of the pipe with colour code indicators placed at all junctions, at both sides of valves, wall penetrations and at any other places where identification is necessary as directed by the Supervising Officer.

Valves may be painted in the same colour as the associated pipework. However, if the pipeline is part of the fire service installation and has been coded only with the safety colour, the valves involved shall be fully painted "safety-red".

The direction of flow of fluid shall be indicated by an arrow over the basic identification colour and painted white or black in order to contrast clearly with the basic identification colour.

Schedule of paint colours shall be to BS 4800: 2011.

PART C – MATERIAL AND EQUIPMENT SPECIFICATION

SECTION C1

PLUMBING SYSTEMS

C1.1 GENERAL

C1.1.1 All materials and equipment shall be constructed of materials suitable for the required working and test pressures and temperatures of the fluid carried. They shall be capable of withstanding concerned working pressure and maximum static pressure that may arise upon failure of the associated pressure reducing devices.

C1.1.2 All materials and equipment shall be of standard products. On-site fabricated products shall not be used unless otherwise approved by the Supervising Officer.

C1.1.3 All materials and equipment shall be approved by the Water Authority for the intended application. Type test reports and certificates to the required standards issued by recognised accredited laboratories shall be submitted to prove compliance with this General Specification.

C1.1.4 The internal lining of pipes, pipe fittings, joints and gaskets for portable water applications shall be certified safe for potable water use. Test reports or certificates demonstrate compliance to BS 6920-1: 2014 for non-metallic components shall be provided.

C1.1.5 Pipes and fittings shall have marking in accordance with manufacturing standard and the make.

C1.2 PIPES, JOINTS AND FITTINGS

C1.2.1 General

The application of pipework types to the various plumbing systems shall be as stated in Table C1.2.1 if not specified in the Contract. All pipes and fittings shall comply with the relevant standards and shall have suitable markings to indicate the standards.

Table C1.2.1 - Application of Pipework Types

Application	Type
Cold water potable and non-potable water supply systems	For mains supply and up feed riser: Ductile iron to BS EN 545: 2010, Class 100 with minimum thickness in full compliance with the following Table C1.2.4 with internal cement lining For down feed pipes: Copper to BS EN 1057: 2006 +A1: 2010 or Stainless Steel to BS EN 10312: 2002 +A1: 2005 (<50 mm dia.) and BS EN 10217-7: 2014 (>50 mm dia.)
Fire service mains supply	To the requirements of General Specification for Fire Service Installation in Government Buildings of the HKSAR
Hot water potable and non-potable water supply systems	Copper pipe to BS EN 1057: 2006 +A1: 2010 or Stainless Steel pipe to BS EN 10312: 2002 +A1: 2005 (<50 mm dia.) and BS EN 10217-7: 2014 (>50 mm dia.)
Flushing water supply system	For mains supply and up feed riser: Ductile iron to BS EN 545: 2010, Class 100 with minimum thickness in full compliance with the following Table C1.2.4 with internal cement lining For down feed pipes: Ductile iron to BS EN 545: 2010, Class 100 with minimum thickness in full compliance with the following Table C1.2.4 with internal cement lining or UPVC to BS EN ISO 1452-2: 2009 series S8 or above, or UPVC to BS 3505: 1986 Class E.

C1.2.2 Copper Pipes, Joints and Fittings

Copper pipe shall be of hard drawn temper copper tubes to BS EN 1057: 2006 +A1: 2010. For pipe sizes with nominal diameter equal to or below 28 mm, half hard temper copper tubes to BS EN 1057: 2006 +A1: 2010 is acceptable.

Copper and copper alloy fittings such as end feed capillary, integral solder capillary and compression type bushes, reducers, bends and

tees shall comply with BS EN 1254-1: 1998, BS EN 1254-2: 1998, BS EN 1254-4: 1998 and BS EN 1254-5: 1998.

Copper pipes for cold water application shall be encapsulated with factory applied moisture resistant polyethylene sheath.
Joints and fittings, such as end feed capillary, integral solder capillary and compression type bushes, reducers, bends and tees for cold water application shall be encapsulated with moisture resistant polyethylene sheath or other approved type sheath for protection.

Copper pipes for hot water application above 30°C but below 80°C shall be pre-insulated with factory applied thermal insulation polyethylene sheath with internal profile to entrap air and provide thermal barrier. Thermal insulation for pipework install inside plant room and pipe duct shall refer to other section of this Specification.

Lead-free soldering alloys and cadmium-free brazing alloy shall be used in installations for water for human consumption and shall fully comply with the requirements of WSD and Section B1.4.3.

C1.2.3 Stainless Steel Pipes, Joints and Fittings

Stainless steel pipe shall be to BS EN 10312: 2002+A1: 2005 light gauge stainless steel tubes for pipe size up to 50 mm diameter.

Stainless steel pipe shall be to BS EN 10217-7: 2014 for pipe size greater than 50 mm diameter.

C1.2.4 Ductile Iron Pipes, Joints and Fittings

Ductile iron pipe shall be to BS EN 545: 2010, Class 100 with minimum thickness in full compliance with the following Table C1.2.4 with internal cement lining and external bitumen coating.

Table C1.2.4 – Minimum Thickness of Ductile Iron Pipe & Fitting

Nominal Size DN (mm)	Class	Minimum Pipe & Fitting Thickness (mm)
80	100	5.62
100	100	5.8
150	100	6.35
200	64	6.9
250	64	7.45
300	64	8
350	64	8.55
400	50	9.1
450	50	9.65
500	50	10.2
600	50	11.3

C1.2.5 UPVC Pipes, Joints and Fittings

UPVC pipe shall be to BS 3505: 1986 Class E or to BS EN ISO 1452-2: 2009 series S8 (SDR 17) PN12.5 or higher to suit system pressure.

UPVC pipe fittings shall comply with BS EN ISO 1452-3: 2010 or BS 4346-1: 1969.

Jointing compound shall be of type recommended by the manufacturer.

All UPVC pipes must be properly supported and shielded from direct sunrays and must be painted with white acrylic paint when exposed.

C1.3 EXPANSION JOINTS AND FLEXIBLE CONNECTORS

C1.3.1 Stainless Steel Type Expansion Joint

Stainless steel type expansion joint shall be used for potable water application. It shall be of axial pattern bellow type and able to withstand horizontal and vertical movement.

The expansion joint shall be screwed or flanged ends as appropriate to suit application.

The expansion joint shall be manufactured from stainless steel to relevant parts of BS EN 10088:2014 number 1.4301 or SAE Grade 304. It shall be manufactured to withstand the test pressure of the system and maximum static pressure that may arise upon failure of the associated pressure reducing devices. In any case, the working pressure shall not be less than 16 bar with a minimum test pressure of 150% of the working pressure and a minimum burst pressure of 40 bar.

The expansion joint shall be equipped with guide rod assembly which consists of guide rod plates, guide rods, resilient neoprene sleeves, resilient neoprene washers and steel washers.

Test report and certificate shall be provided to prove suitability for potable application if install for potable water supply system.

C1.3.2 Rubber Type Expansion /Flexible Joint

Rubber type expansion /flexible joint shall be used for flush water application. It shall be of double or multiple arch/sphere type, non-toxic, corrosion and abrasion resistant and of sufficient length for effective isolation of vibration.

The expansion /flexible joint shall be fitted with galvanised steel or ductile iron floating flanges to BS EN 1092-1: 2007 +A1:2013 or BS EN 1092-2: 1997 wherever applicable. It shall include a flexible tube made of multiple layers of high tensile fabric reinforcement with EPDM, neoprene or synthetic rubber cover and liner. Tube end shall be of locked bead construction with steel wire bead ring and raised face.

The expansion /flexible joint shall be equipped with control rod/cable assembly to prevent damage from excessive movement. The assembly shall consist of control rod/cable plates, control rods/cables, resilient neoprene sleeves, resilient neoprene washers and steel washers to prevent metal to metal contact between the rod/cable and the connector flange.

C1.4 PIPE SLEEVES

C1.4.1 Diameter of pipe sleeves shall be as shown on Drawings, otherwise at least one size larger than the pipe that passes through.

C1.4.2 For pipes passing through walls, slabs etc. which separate different fire compartments, use sleeves of galvanised steel to BS EN 10255: 2004 medium grade and carbon steel to BS EN 10217-1: 2002 for pipe diameter up to and above 150 mm respectively.

C1.4.3 For pipes passing through walls, slabs etc. within the same fire compartment, use sleeves of UPVC pipe to BS 3505: 1986 or BS EN ISO 1452-2: 2009.

C1.4.4 Where UPVC pipe passes through fire barriers such as fire rated walls and floor slabs, provide an approved type fire collar to BS EN 1366-3: 2009 or BS 476-20: 1987 with equal or higher fire resistant rating than that of the walls and slabs.

C1.4.5 Puddle sleeves shall be used for pipe passing through external basement walls where there is ground water pressure.

C1.4.6 Puddle flanges for fresh water systems shall be of stainless steel to BS EN 10088-1: 2014 Grade 1.4301 with flange end connection to BS EN 1092-1 or gunmetal to BS EN 1982: 2008. Puddle flanges for salt water systems shall be of cast iron to BS EN 1561: 2011.

C1.5 STRAINERS

C1.5.1 Strainer shall be of Y-type with minimum free flow area ratio of 2 and the maximum aperture size to be of diameter 1.5 mm for strainers or nominal size 100 mm or below and of diameter 3 mm for strainers of nominal size 150 mm or above.

C1.5.2 Strainer shall have the same nominal sizes as the pipes in which they are connected and shall be suitable for both working and test pressures of the piping system in which they are installed.

C1.5.3 The construction of fresh water application strainer with nominal sizes up to and including 50 mm shall be as following: -

(a) Body & cover: copper alloy to BS EN 1982: 2008 CuSn5Zn5Pb5; and

(b) Screen: austenitic chromium nickel stainless steel or austenitic chromium nickel molybdenum stainless steel to BS EN 10088-1: 2014 number 1.4301 or 1.4401.

C1.5.4 The construction of flush water application strainer with nominal sizes up to and including 50 mm shall be of UPVC or gunmetal type.

C1.5.5 The construction of fresh water and flush water application strainer with nominal sizes above 50 mm shall be as following: -

(a) Body & cover: grey cast iron to BS EN 1561: 2011 EN-GJL-250, or spheroidal graphite cast iron to BS EN 1563: 2011 EN-GJS-400-15;

(b) Screen: austenitic chromium nickel stainless steel or austenitic chromium nickel molybdenum stainless steel to BS EN 10088-1: 2014 number 1.4301 or 1.4401;

(c) Drain plug: malleable iron or copper alloy; and

(d) Cast iron components shall be coated with an epoxy based material.

C1.5.6 All bronze type strainers shall be of screwed female end connection to BS 21: 1985 in conjunction with BS EN 10226-1: 2004 and all cast iron type strainers shall be of flanged end connection to BS EN 1092-2: 1997 PN16.

C1.6 VALVES

C1.6.1 General

Valves shall be designed and constructed of materials suitable for both the working and test pressure of the piping system in which they are installed and the temperature of the fluid carried. Unless otherwise specified, all valves shall have a working pressure of not less than 16 bar.

Valves shall be pressure tested in accordance with the relevant standards by the valve manufacturer before leaving the factory.

Unless otherwise approved by the Supervising Officer, valves of the same type and same size shall be from the same manufacturer.

Valves shall be of the same nominal size as the pipe in which they are installed except those for flow or pressure control such as modulating float valves or pressure reducing valves as shown on the Drawings.

Manually operated valves shall be closed by turning the handwheel in a clockwise direction when facing the handwheel.

Isolation valves shall be of the full-way solid or split-wedge disc-type and handwheel operated.

All valves shall be provided with or fitted with an indicator to show the open and shut position.

Valves shall generally comply with the following standards: -

(a) Cast iron globe valve shall be to BS EN 13789: 2010.

(b) Copper alloy gate, globe and non-return valve shall be to BS 5154: 1991 or BS EN 12288: 2010 as appropriate.

(c) Cast iron non-return valve shall be to BS EN 12334: 2001.

(d) Cast iron gate valve for fresh potable water application, street fire hydrant system and underground pipework system for fresh/flush water application shall be to BS 5163-1: 2004 and BS 5163-2: 2004 in conjunction with BS EN 1074-1: 2000 and BS EN 1074-2: 2000.

Valves shall be of the type approved by the WSD. The Plumbing Contractor shall submit type test certificates/reports issued by accredited laboratories confirming that the valves have been tested in conformity with this Specification. Wherever appropriate, the following type test certificates/reports shall be provided upon the request by the Supervising Officer: -

(a) Test certificates for valves in compliance with the standards quoted in this Specification.

(b) Test certificates on composition analysis, chemical, physical and mechanical properties of the metallic materials for valves.

(c) Test certificates for resilient seating material and epoxy coating showing compliance with the physical property and thickness requirements of this Specification.

(d) In case of valves in potable water application, test certificates issued by WRAS or an equivalent organisation for non-metallic materials including resilient seating material and epoxy coating, showing compliance with the full tests of effect on water

quality to BS 6920-1: 2014 and suitable for potable water usage.

All bronze valves shall be of the screwed female-end connections and all cast iron valves to be of the flanged-end connections.

Threads in screwed-end connections shall comply with BS 21: 1985 and flanges of flanged-end connections to comply with BS EN 1092-2: 1997 PN 16.

Cast iron parts of all valves shall be coated with an epoxy based material both on internal and external surfaces. The minimum thickness of epoxy coating shall comply with Table C1.6.1. The coating for use in fresh potable water shall comply with the requirement laid down in BS 6920-1: 2014 and shall be approved by WSD.

Table C1.6.1 - Minimum Thickness of Epoxy Coating for Cast Iron Parts of Valve

	Electrostatically Fusion Powder Coated (μm)	Airless Sprayed Application (μm)
Flat and pressurised parts	250	400
Convex outer edges	150	300

C1.6.2 Valves for Fresh Water and Fire Service Application

For nominal sizes up to and including 50 mm: -

(a) Body, bonnet and disc: copper alloy to BS EN 1982: 2008 CuSn5Zn5Pb5;

(b) Stem: brass to high tensile brass to BS EN 12163: 2016.

For nominal sizes above 50 mm:

(a) Body and bonnet: grey cast iron to BS EN 1561: 2011 EN-GJL-250, or spheroidal graphite cast iron to BS EN 1563: 2011 EN-GJS-400-15;

(b) Disc and seat:

- Solid or trimmed with bronze to BS EN 1982: 2008 CuSn5Zn5Pb5 or trimmed with austenitic chromium nickel stainless steel to BS EN 10088-3: 2014 number 1.4301 or 1.4401;

- Resilient material to BS EN 681-1: 1996, Type WA, Hardness Category "70" with nominal thickness of minimum 1.5 mm on the non-seating areas and 4.0 mm on the seating areas, and in case for potable water application, showing compliance with full tests of effect on water quality to BS 6920-1: 2014.

(c) Stem

- For underground application as well as cast iron gate valve installed in fresh potable water or street fire hydrant system, stainless steel to BS EN 10088-3: 2014 number 1.4057.

- For applications other than that mentioned in above clause, brass to high tensile brass to BS EN 12163: 2016 or stainless steel to BS EN 10088-3: 2014 number 1.4301, 1.4401, 1.4006, 1.4005, 1.4021 or 1.4057.

C1.6.3 Valves for Flush Water Application

For nominal sizes up to and including 50 mm:

(a) Plastic Type Valve

- Body, bonnet and disc: PVC or UPVC;

- Stem: one-piece with O-ring for positive sealing of the body;

- Valve shall be operated by wrench turned in a clockwise direction to close when facing the wrench;

- Suitable stops for both fully open and fully closed positions of valve shall be provided;

- Socket or union shall be suitable for direct connecting to pipe to which it is installed;

- It shall be suitable for both the working pressure and test pressure of the piping system in which it is installed with working pressure of at least 10 bar at 35°C unless otherwise specified.

(b) Metallic Type Valve

- Body, bonnet and disc: copper alloy to BS EN 1982: 2008 CuSn5Zn5Pb5;

- Stem: brass to high tensile brass to BS EN 12163: 2016.

For nominal sizes 65 mm and above:

(a) Body and bonnet: grey cast iron to or BS EN 1561: 2011 EN-GJL-250, or spheroidal graphite cast iron to BS EN 1563: 2011 EN-GJS-400-15;

(b) Disc and seat:

- Solid or trimmed with zinc free bronze to BS EN 1982: 2008 CuSn10 or trimmed with austenitic chromium nickel stainless steel or austenitic chromium nickel molybdenum stainless steel to BS EN 10283: 2010.

- Resilient material to BS EN 681-1: 1996, Type WA, Hardness Category "70" with nominal thickness of minimum 1.5 mm on the non-seating areas and 4.0 mm on the seating areas.

(c) Stem: stainless steel to BS EN 10088-3: 2014 number 1.4401 or 1.4057.

C1.6.4 Non-return Valves

Non-return valves shall be of hinged swing type or wafer spring type suitable for vertical or horizontal installations unless otherwise specified.

Non-return valves shall be designed to close before reversal of flow starts.

Spring type non-return valves shall have a flow area not less than the cross-sectional area of the connected pipework and shall be non-slam in operation. The valves shall be designed to close before reversal of flow starts. Hinge pins and springs shall be of stainless steel.

Cast iron swing non-return valves shall have the cap and body bolted together to ensure a strong, tight closure.

Bronze swing non-return valves shall have screwed type cap.

Flange end connections shall be to BS EN 1092-1: 2007 +A1:2013, BS EN 1092-2: 1997 and BS EN 1092-3: 2003 whenever applicable.

C1.6.5 Gate and Globe Valves

Gate valve shall be full way solid or split wedge disc type with rising or non-rising stem.

Globe valve shall be of straight globe type with rising stem.

The valves shall be provided with an indicator to show the open and

shut position at critical locations for cast iron valves as shown on Drawings.

For bronze type valves, the bonnet shall be of the screwed type with ample threads to ensure positive sealing to the body.

All bronze valves shall be of the screwed female end connection to BS 21: 1985 and all cast iron valves shall be of the flanged end connections to BS EN 1092-2: 1997 PN16.

For cast iron type valve, the body and bonnet shall be bolted together and the disc shall be guided. The gland shall be fitted with non-asbestos packing and shall be bolted for cast iron valves.

C1.6.6 Control Valves of Flushing Cisterns

Plastic type ball valve shall be used. It shall be ball centre-pivoted, smooth and spherical with a circular orifice, and seated on resilient seating suitable for tight shut off.

At fully open position of valve, wrench shall be mounted parallel to the flow of passage through the valve. The valve shall be fully closed with the wrench operates at a quarter turn.

The valve shall be suitable for both the working and test pressure of the piping system in which it is installed with working pressure of at least 10 bar at 35°C unless otherwise specified.

C1.6.7 Ball Float Valves for Water Tanks

Ball float valves shall be of the slow closing type unless otherwise specified. The valve body shall be robust and shaped to give a good flow pattern.

The valve piston shall close in the direction of flow such that the pressure in the water supply mains shall tend to keep the valve closed and that the piston seal is afforded protection from the flow by the piston.

All internal parts shall be easily removable for maintenance with the face and piston seals easily replaceable.

Ball floats shall be of tinned copper to BS 1968: 1953 and BS 2456: 1990 or of stainless steel to relevant parts of BS EN 10088: 2014 for fresh water application and of neoprene coated copper for flush water application. All ball floats shall be spherical.

Lever arms shall be of stainless steel for flush water application.

Ball float valves of sizes 50 mm and under shall be copper alloy to BS 1212-1: 1990 suitable for high pressure application.

Ball float valves for tanks for sizes over 50 mm shall be cast iron body with gunmetal piston, seat and guide, suitable for high pressure. For salt water systems ball valves shall be of cast iron body with zinc free bronze piston, seat and guide.

Ball float valves shall be of zinc-free bronze or stainless steel type for salt water application.

C1.6.8 Ball Float Valve for Flushing Cisterns

Ball float valve for flushing cisterns shall be of diaphragm type float operated valve to BS 1212-3: 1990 with rubber or plastic diaphragm, unless otherwise approved by the Supervising Officer and be suitable for high, medium or low pressure as required. It shall be suitably coated to prevent corrosion on metal parts. Valve sample shall be submitted for approval prior to installation.

C1.6.9 Flushing Valves

Flushing valve shall be corrosion resistant, made of brass, stainless steel or high grade thermoplastics and activated by simply pressing on a push-button or lever.

The flow rate of the flush water shall be adjustable. The flushing valve shall maintain a minimum of 1.5 litres/second flow rate.

The valve shall have such feature to allow it to go through the complete flush cycle and then shut off automatically, regardless of whether the handle is held down or released. Such automatic closure to take place slowly and progressively without hammering effect.

The volume of water per flushing cycle shall match with the sanitary fitments.

C1.7 PRESSURE REDUCING VALVES

C1.7.1 Fixed Ratio Type Pressure Reducing Valves

Fixed ratio type pressure reducing valve shall be able to maintain the outlet pressure as a fixed ratio of the inlet pressure, independent of the magnitude of the inlet pressure and the water flow across the valve.

It shall be of a size and pressure ratio as specified on the Drawings.

The operating pressure range of the valve shall be suitable for the particular application and it shall have a rated working pressure of not less than 16 bar.

Each valve shall be hydraulic tested at 1.5 times the nominal pressure of the valve for a period of not less than 1 minute at the factory.

Details of the pressure reduction against flow rate and inlet pressure performance curve and test certificates /reports issued by accredited laboratories confirming that the valve has been tested in accordance with the requirements of this Specification shall be submitted to the Supervising Officer for examination and approval of use.

The valve body shall be of gunmetal to BS EN 1982: 2008 CuSn5Zn5Pb5 or stainless steel to BS EN 10088-1: 2014 number 1.4401.

The valve shall have a piston of straight through design, constructed of stainless steel at least to BS EN 10088-3: 2014 number 1.4301 for fresh water and BS EN 10088-3: 2014 number 1.4401 for flush water application unless otherwise approved by the Supervising Officer.

The valve shall with seats and O-ring seals of high grade synthetic rubber.

The valve shall be provided with an arrow on the exterior to indicate the direction of flow.

The valve shall with end connections of thread-in screw type to BS 21: 1985 or flanged type to BS EN 1092-1: 2007 +A1:2013 and BS EN 1092-3: 2003 whenever applicable.

C1.7.2 Pilot Type Pressure Reducing Valves

Pilot type pressure reducing valve shall be hydraulically operated, pilot-controlled and of diaphragm or piston-actuated type. The whole valve shall be assembled and tested by the manufacturer.

The valve shall be provided with a strainer in the pilot control system. It shall be of flanged-end connection with flange to BS EN 1092-2: 1997 PN16. The main valve and its pilot control system shall contain no packing glands or stuffing boxes.

The valve shall be capable to reduce a higher inlet pressure to a steady downstream pressure regardless of fluctuations in flow rate and/or varying inlet pressure. The downstream pressure shall be adjustable and could be reduced down to a pressure suitable for the application. The valve shall be selected by the Plumbing Contractor in such way that no cavitation shall occur within the anticipated flow and pressure ranges.

Means shall be provided for adjusting the response of the valve to changes in inlet pressure without the use of special tools.

The valve, when in operation, shall not cause any noise nuisance. Otherwise, a suitable acoustic enclosure to cover the valve shall be provided.

The operating pressure range of the valve shall be suitable for the particular application. Unless otherwise specified, the minimum rated working pressure of the valve shall not less than 16 bar.

Each valve shall be hydraulic tested at 1.5 times the nominal pressure of the valve for a period of not less than 1 minute at the factory.

The valve shall be of the type approved by the Water Authority as in accordance with its application. Details of the pressure reduction against flow rate and inlet pressure performance curve within the specified pressure range and test certificates /reports issued by accredited laboratories confirming that the valve has been tested in accordance with the requirements of this Specification shall be submitted to the Supervising Officer for examination and approval of use.

The valve shall have the minimum standard as specified below for its intended purposes: -

(a) Body and bonnet: cast iron to BS EN 1561: 2011 EN-GJL-250 or ductile iron to BS EN 1563: 2011. The body shall be epoxy or polyester coated both inside and outside.

(b) Disc:

- Solid or trimmed with bronze to BS EN 1982: 2008 CuSn5Zn5Pb5, or with stainless steel to BS EN 10088-2: 2014 number 1.4301, or with ductile iron to BS EN 1563: 2011; or trimmed with rubber compound for use in fresh water.

- Solid or trimmed with zinc free bronze to BS EN 1982: 2008 CuSn10 or stainless steel to BS EN 10088-2: 2014 number 1.4301 or ductile iron to BS EN 1563: 2011 with epoxy /polyester coated; or trimmed with rubber compound for use in flush water.

(c) Seat:

- Bronze trimmed as disc for use in fresh water.

- Zinc free bronze or stainless steel trimmed as disc for use in flush water.

(d) Stem:

- High tensile brass to BS EN 12163: 2016 or stainless steel to BS EN 10088-3: 2014 number 1.4006, 1.4005 or 1.4021 for use in fresh water.

- Stainless steel to BS EN 10088-3: 2014 number 1.4301 or 1.4401 for use in flush water.

C1.8 CISTERNS AND TANKS

C1.8.1 Cisterns and tanks for intended applications shall comply with the requirements by the Water Authority.

C1.8.2 Galvanised low carbon steel cisterns and lids, tanks and cylinders shall be manufactured to comply with BS 417-2: 1987 of Grade A thickness. Joints between sections of cistern lids to have weatherproof standing welt type laps.

C1.8.3 Glass fibre reinforced plastic cistern shall be to BS EN 13280: 2001.

SECTION C2

WATER HANDLING EQUIPMENT

C2.1 FRESH WATER PUMPS FOR POTABLE APPLICATION

C2.1.1 Pumps for potable application unless otherwise specified, shall be of one of the following types:-

(a) Vertical multi-stage centrifugal type, the pump set shall be packaged type with close-coupled pump motor integrated as a single unit. The pump unit shall be a proprietary product. The pump motor shall be able to dismantle from the pump unit without disruption of the pipework nor dismounting the pump unit from the plinth; or

(b) End suction centrifugal type, the pump set shall be installed with spacer type coupling so that the pump impeller can be dismantled from the motor side for servicing without disruption of the pipework nor dismounting the motor. Where large static heads have to be pumped against, multi-stage configurations shall be used.

C2.1.2 Materials of Construction

Unless otherwise specified, the materials of construction of the pumps shall be as follows whenever applicable:-

(a)	Casing	:	Stainless steel
(b)	Impeller	:	Stainless steel
(c)	Shaft	:	Stainless steel
(d)	Sleeves	:	Stainless steel
(e)	Casing rings	:	Stainless steel
(f)	Shaft nuts	:	Stainless steel
(g)	Stuffing box housing	:	Gunmetal
(h)	Glands	:	Bronze
(i)	Lantern ring	:	Bronze

Alternative materials subject to the approval of the Supervising Officer.

C2.1.3 Standards

(a) Casing Material

Unless otherwise specified for the above types of pumps, casing shall be of stainless steel to AISI 316.

(b) Impellers & Guide Rings

The impeller shall be of the enclosed type and be of stainless steel to AISI 316. Renewable guide rings shall be bronze and shall be provided in the casing, keyed to prevent rotation.

(c) Shaft, Sleeves and Glands

Stainless steel shall be to BS EN 10095:1999, BS EN 10084:2008 and BS EN 10087:1999, ground and polished. The sleeves shall be keyed to prevent rotation and secured against axial movement.

(d) Stuffing Boxes and Drain Piping

Gunmetal stuffing boxes housing shall comply with BS EN 1982:2008 or ISO 197-4:1983 and shall be of ample length with bronze lined gland and neck bush, fitted with approved packing and lantern ring water seal. Drain piping to the nearest builder's drain to remove gland leakage shall be provided. Alternatively, a mechanical seal may be offered. Mechanical seals shall be of leak free operation. The mechanical seal shall be the product of specialist proprietor and the materials used shall be suitable for the pumped liquid.

C2.2 FRESH WATER PUMPS FOR NON-POTABLE APPLICATION

C2.2.1 Pumps for non-potable application unless otherwise specified, shall be of one of the following types:-

(a) Centrifugal type with volute casing split on the centreline of the shaft with suction and delivery connections flanged and fitted to the non-removable half of the casing;

(b) End suction type, the pump set shall be installed with spacer type coupling so that the pump impeller can be dismantled from the motor side for servicing without disruption of the pipework nor dismounting the motor; or

(c) Vertical spindle type centrifugal pump installed on pump plinth or supported by pipework.

Where large static heads have to be pumped against, type C2.2.1(b) or C2.2.1(c) shall be used in multi-stage configurations. Generally the type of pump required will be specified in the Particular Specification and/or in the Tender Drawings. However, if this is not so, the type as detailed in C2.2.1(b) above shall be installed if suitable.

C2.2.2 Materials of Construction

Unless otherwise specified, the materials of construction of the pumps shall be as follows:-

(a)	Casing	:	Cast iron
(b)	Impeller	:	Zinc free bronze (*cast iron or stainless steel)
(c)	Shaft	:	Carbon steel (*stainless steel)
(d)	Sleeves	:	Bronze (*stainless steel)
(e)	Casing rings	:	Bronze (*stainless or cast iron)
(f)	Shaft nuts	:	Bronze
(g)	Stuffing box housing	:	Cast iron
(h)	Glands	:	Carbon steel
(u)	Lantern rings	:	Bronze

* Alternative materials subject to the approval of the Supervising Officer

Note 1: Stainless steel shall be used for water with temperature $>28^{o}C$.

C2.2.3 Standards

(a) Casing Material

Unless otherwise specified for the above types of pumps, cast iron shall comply with BS EN 1561:2011 or ISO 185:2005.

(b) Impellers & Guide Rings

The impeller shall be of the enclosed type and be of gunmetal to BS EN 1982:2008 or ISO 197-4:1983, keyed to the shaft. Renewable guide rings shall be bronze and shall be provided in the casing, keyed to prevent rotation.

(c) Shaft, Sleeves and Glands

Stainless steel shall be to BS EN 10095:1999, BS EN 10084:2008 and BS EN 10087:1999, ground and polished.

Bronze sleeves shall comply with BS EN 1982:2008 or ISO 197-4:1983 and shall be provided through the sealing glands to protect the shaft from wear. The sleeves shall be keyed to prevent rotation and secured against axial movement.

(d) Stuffing Boxes and Drain Piping

Cast iron stuffing boxes housing shall comply with BS EN

1561:2011 or ISO 185:2005 and shall be of ample length with bronze lined gland and neck bush, fitted with approved packing and lantern ring water seal. Drain piping to the nearest builder's drain to remove gland leakage shall be provided. Alternatively, a mechanical seal may be offered. Mechanical seals shall be of leak free operation. The mechanical seal shall be the product of specialist proprietor and the materials used shall be suitable for the pumped liquid.

C2.3 FLUSHING WATER PUMPS

C2.3.1 (a) These pumps shall be utilised for pumping seawater, harvested rainwater wherever these applications apply.

(b) Unless otherwise specified, the configuration of flushing water pumps inside a building plant rooms shall be of the split casing type as specified in Clause C2.2.1 (a).

C2.3.2 Materials of Construction

Unless otherwise specified, the materials of construction for saline water pump shall be as follows:-

(a)	Casing	:	Cast iron
(b)	Impeller	:	Zinc free bronze
			(*Stainless Steel)
(c)	Shaft	:	Stainless steel
(d)	Sleeves	:	Bronze
			(*stainless steel)
(e)	Casing rings	:	Stainless steel
(f)	Shaft nuts	:	Bronze
(g)	Stuffing box housing	:	Cast iron
(h)	Glands	:	Carbon steel
(i)	Lantern rings	:	Bronze

* Alternative materials subject to the approval of the Supervising Officer

Note 1: Stainless steel shall be used for water with temperature >28^{o}C.

C2.3.3 Standards

(a) Casing

Unless otherwise indicated, the casing shall be of cast iron to BS EN 1561:2011 or ISO 185:2005 or better and approved.

(b) Impeller and Shaft Sleeve

Impeller and shaft sleeve of saline water pumps shall be of one of the materials as below:-

(i) Zinc-free bronze to BS EN 1982:2008 CuSn11 or CuSn10; or ISO 197-4:1983;

(ii) Austenitic cast iron to BS EN 13835:2012 Number 5.1500; or ISO 2892: 2007 Ed2 (R10); or

(iii) Stainless steel to BS EN 10095:1999, AISI 316.

(c) For pumping seawater in harbour area, items (b) (i) & (ii) above shall not be used.

(d) The shaft shall be of stainless steel to BS EN 10095:1999, BS EN 10084:2008 and BS EN 10087:1999, AISI 316, ground and polished.

(e) Stuffing Boxes and Drain Piping

Stuffing boxes shall be of cast iron housing and ample length completed with bronze lined gland and necks bushes, fitted with approved packing and bronze lantern ring water seal. Drain piping to the nearest builder's drain for gland leakage shall be provided. Alternatively, a mechanical seal may be offered. Mechanical seals shall be of leak free operation. The mechanical seal shall be the product of specialist proprietor and the materials used shall be suitable for the pumped liquid.

C2.4 SUMP PUMPS

C2.4.1 Materials of Construction of Dry Pit Pumps

Unless otherwise specified, the materials for dry pit non-clog pumps areas shall be as follows:-

(a)	Pump casing	:	Cast iron
(b)	Impeller	:	Cast iron (*stainless steel)
(c)	Shaft	:	Stainless steel
(d)	Shaft sleeve	:	Stainless steel (*bronze)
(e)	Packing gland	:	Ductile iron (*bronze)
(f)	Casing bolts	:	Steel
(g)	Cap screw and washer, impeller	:	Stainless Steel
(h)	Key, impeller	:	Steel

* Alternative materials subject to the approval of the Supervising Officer

C2.4.2 Materials of Construction of Submersible Pumps

Unless otherwise specified, the materials for submersible non-clog pumps shall be as follows:-

(a)	Pump casing	:	Cast iron
(b)	Impeller	:	Cast iron (*stainless steel)
(c)	Motor casing	:	Cast iron
(d)	Shaft	:	Stainless steel
(e)	Impeller screw	:	Stainless steel
(f)	Mechanical seals	:	Carbon (*ceramic faces)
(g)	Base plate	:	Steel
(h)	Discharge elbow	:	Cast iron
(i)	O-ring seal	:	Neoprene

* Alternative materials subject to the approval of the Supervising Officer

C2.4.3 General Requirements

All bolts, nuts and fasteners shall be of stainless steel and electric cable entry shall be of watertight construction.

Sump pumps for rainwater application shall generally be of materials complying with the standards as specified in Clause C2.2.3. Sump pumps for pumping other fluids shall be of materials compatible with the fluid that are being handled. If sea water is pumped, the pump materials shall comply with Standards as specified in Clause C2.3.3. The sump pumps shall operate automatically by float level control.

The guide bars and brackets for wet sump installation shall be of stainless steel to AISI 316.

Cable supports shall be of stainless steel. A safety provision shall be incorporated for automatic electrical disconnection of the supply in case of cable entry seal failure.

Pumps for flammable zones shall be equipped with flameproof submersible motor in compliance with BS EN 60079-0:2012 and BS EN 60079-1:2007.

C2.5 PUMP BASE PLATE

The based plate shall be made of cast iron or fabricated mild steel. Couplings shall be flexible of the steel pin and synthetic rubber bushing type, and fitted with steel guards.

C2.6 VIBRATION ISOLATORS

The bases shall be mounted on the raised housekeeping plinth using appropriate anti-vibration spring mountings that shall be individually selected according to load distribution and shall have an additional free travel equal to one half of the rated deflection as specified in Clause C8.4 of A/C General Specification.

C2.7 GAUGES

Pressure gauges shall comply with BS EN 837-1:1998 calibrated in kPa from zero to not less than 1.3 times and not more than twice the operating pressure of the respective equipment/system and shall be accurate to 1.5% of full scale reading, unless otherwise specified.

The dials of gauges shall not be less than 100 mm diameter and the cases shall be of polished brass or chromium-plated or anti-corrosive painted mild steel with optical sight glass.

Pressure gauges used solely to indicate the head and pressure of water shall be provided with an adjustable red pointer set to indicate the normal working pressure or head of the system.

C2.8 DRAIN AND VENT

The drain vent shall be built-in completed with a drain plug except where the pump is inherently self-venting, the drain and drip connection valves and air cock shall comply with Section C9 of A/C General Specification.

C2.9 FLANGED CONNECTIONS

Pumps shall have flanged connections conforming to the Table of BS EN 1515-1:2000, BS EN 1092-1:2007 +A1:2013, BS EN 1092-2:1997, BS ISO 7005-1:2011 or ISO 7005-2:1988 as appropriate to the maximum working pressure. Taper pieces shall be provided where necessary for connection to pipework.

PART D – INSPECTION, TESTING & COMMISSIONING DURING CONSTRUCTION PERIOD

SECTION D1

GENERAL REQUIREMENTS

D1.1 GENERAL

The inspection, testing and commissioning shall be carried out in accordance with the requirements specified in this Part and Testing and Commissioning Procedure for Plumbing Installation in Government Buildings which shall be referred to and adopted where appropriate.

Throughout the execution of the installation, the Plumbing Contractor shall be responsible for ensuring compliance with the statutory and related requirements included in Section A2 and Section B1 and shall notify the Supervising Officer of any infringement which directly or indirectly detracts from the safe and satisfactory operation of the Installations whether or not such infringement relates to the works covered in the Installations or to those associated with others. All substandard works or defects found during inspection, testing and commissioning shall be rectified or replaced to the satisfaction of the Supervising Officer.

D1.2 METHODS AND PROCEDURES

The Plumbing Contractor is required to submit detailed inspection, testing and commissioning methods and procedures together with report formats for reporting the inspection, testing and commissioning results for the Supervising Officer's approval at least four months before commencement of testing and commissioning works, or four months after the acceptance of his Tender, whichever is earlier.

D1.3 NOTICES OF INSPECTION, TESTING AND COMMISSIONING WORKS

For items to be witnessed by the Supervising Officer or his Representative, the Plumbing Contractor is required to provide advanced notice for inspection, testing and commissioning works, together with details of date, time and list of items to be inspected or tested, unless otherwise specified in the Conditions:-

(a) Off-site Inspection and Test

An advanced notice of at least one week before commencement of the inspection or test shall be provided.

(b) On-site Inspection, Testing and Commissioning

An advanced notice of at least 3 days before commencement of inspection, testing or commissioning of any part or parts of the Installations shall be provided.

D1.4 LABOUR AND MATERIALS

The Plumbing Contractor is responsible for provision of all labour and both consumable and non-consumable materials for carrying out the inspection, testing and commissioning works at their expenses. Unless otherwise indicated in the Conditions, all electricity supply, water supply, smoke generator, chemicals, and other fuels, such as diesel, LP gas and town gas, during preliminary runs and for full adjustments and inspection and commissioning tests shall also be arranged and provided by the Plumbing Contractor. The Plumbing Contractor shall also properly drain the water and exhaust the gas during and after the inspection, testing and commissioning works as required. The Plumbing Contractor shall provide and adopt measures to avoid damage to the building, Installations, decorations and fixtures during the inspection, testing and commissioning works for any of the Installations.

The Plumbing Contractor shall also provide all necessary equipment, apparatus and tools for carrying out the inspection, testing and commissioning works.

The Plumbing Contractor shall despatch competent and experienced commissioning personnel to carry out the inspection, testing and commissioning works.

D1.5 INSPECTION, MEASURING AND TESTING EQUIPMENT

The Plumbing Contractor is required to supply the calibrated equipment and instrument for the inspection, testing and commissioning works in accordance with the requirements as specified in the Particular Specification for supply of inspection, measuring and testing equipment. Certified true copy of calibration certificates shall be submitted. The period between calibration and testing shall not exceed the calibration period as recommended by the equipment/instrument manufacturer or 12 months whichever is shorter.

D1.6 READINESS FOR INSPECTION, TESTING AND COMMISSIONING

The Plumbing Contractor is required to check the completion of the works to be inspected, tested or commissioned, the associated builder’s works, the associated building services installations and all other prerequisites to ensure that inspection, testing and commissioning can be proceeded in a safe and satisfactory manner without obstruction.

D1.7 "TYPE-TEST" CERTIFICATE

"Type-test" for materials and equipment, where specified, shall be carried out

at the manufacturer's works, recognised institutions or accredited laboratories, or elsewhere as approved in order to demonstrate their compliance with the specified requirements. "Type-test" certificates together with the corresponding drawings, sketches, reports and any other necessary documents shall be submitted to the Supervising Officer for approval before delivery of the materials and equipment.

D1.8 OFF-SITE TESTS / FACTORY TESTS

Factory tests and off-site tests as required shall be carried out at the manufacturer's works, laboratories by independent regulatory/testing bodies, independent accredited laboratories or elsewhere as approved. This shall include quality control tests and general inspection tests in factory recommended by the manufacturer or for compliance with relevant standards.

Where collection of test samples on the Site is required for the off-site tests, the Plumbing Contractor shall submit the sampling and analysis methodology, including but not limited to the proposed independent accredited laboratory and the procedures for collection and analysis of test samples and submission of test results, for the Supervising Officer's approval. The Plumbing Contractor shall notify in advance the date for collection of test samples to the Supervising Officer's Representative, who shall supervise the sampling, transport and delivery of the test samples. Collection of test samples shall be conducted by the independent accredited laboratory unless otherwise agreed by the Supervising Officer. The collected test samples shall be kept in sealed and locked containers inaccessible to unauthorised persons at all times. The test results in sealed envelope shall be submitted by the independent accredited laboratory to the Supervising Officer directly.

Where specified, performance tests shall be carried out in factory for each or some of the offered equipment before delivery. After the performance tests, factory test report/certificate certified by a qualified factory engineer shall be submitted in duplicate to the Supervising Officer for approval immediately after the tests and before the equipment is dispatched from the manufacturer's works.

Factory tests shall be witnessed by an independent approved agency where specified. The Plumbing Contractor shall note that the Supervising Officer may require witnessing the test and inspection of locally and/or overseas manufactured equipment during construction at the manufacturer's works.

D1.9 SITE TESTS

The Plumbing Contractor shall carry out site tests for all static systems during construction period for individual components and/or part of the installed works to ensure safe and proper operation of the complete installation according to the specified requirements. Such tests shall include integrity test of welds and pressure test on the hydraulic systems where applicable. Any component or equipment set to operate at or below the test pressure shall be isolated or removed prior to applying the pressure test. Site tests for electrical works in the Installations shall comply with the COP for the Electricity (Wiring) Regulations unless otherwise specified. Registered or suitably

qualified workers shall be deployed to conduct site tests, where applicable, for the Installations.

Works to be permanently covered up shall be subject to inspection and testing before covering up. If the Supervising Officer or his Representative discovers any work that has been covered up before inspection and testing, this work shall be uncovered for inspection and testing to the satisfaction of the Supervising Officer or his Representative.

For water quality test and sampling/testing of soldering/brazing joints, the Plumbing Contractor shall also comply with the requirements as stipulated in Clause B1.12 and B1.13 respectively.

SECTION D2

INSPECTION

D2.1 INSPECTION OF MATERIALS AND EQUIPMENT DELIVERED TO SITE

The Plumbing Contractor shall provide details of materials and equipment delivered to the Site including, but not limited to, brand name, model number, country of origin (if specified), their tested standards and record of Supervising Officer's approval, purchase order, delivery order, record of delivery, payment vouchers, ex-factory certificate and shipping voucher, and all other relevant documents as applicable to the Supervising Officer for identification and verification of the materials and equipment delivered to the Site are in compliance with the approved submissions.

D2.2 VISUAL INSPECTION AND CHECKING

The Plumbing Contractor shall be responsible for arranging adequate provisions to facilitate visual inspections and checking of the work in progress to be carried out by the Supervising Officer or his Representative from time to time during the construction period. The Plumbing Contractor shall keep such inspection record for checking from time to time. Any defective works or sub-standard works found during visual inspection and checking shall be rectified or replaced before proceeding with further tests.

Visual inspection and checking shall include but not limited to the inspection and verification of the installed equipment being the approved brands and models and checking of any visible damages (such as scratches or dents, or painting problems) found on the equipment surface.

D2.3 HANDOVER INSPECTION

The Plumbing Contractor shall carry out detailed inspections for all components and equipment installed by him and make all necessary checking including operational settings for all equipment and systems in accordance with the instructions and recommendations from the manufacturer and to the satisfaction of the Supervising Officer before the handover of the Installations.

If it is considered difficult or impossible to gain access to a part or parts of the complete installation for dismantling or maintenance purposes, the Plumbing Contractor shall be required to carry out demonstrations on dismantling and assembling those parts of the installation to confirm the provisions are adequate. The Plumbing Contractor shall be responsible for carrying out all necessary modification work at no additional cost to the Employer to alleviate the difficulties associated with dismantling or maintenance access.

The Plumbing Contractor shall note that the Installations cannot be handed over until all the foregoing requirements where applicable have been carried

out to the satisfaction of the Supervising Officer.

The Plumbing Contractor shall provide the following documents and data before the handover inspection:-

(i) Test Certificates

Test records/certificates where applicable shall be provided:-

(a) Copies of manufacturer's works tests records/ certificates on plant items comprising tanks, vessels, motors, pumps, etc.;

(b) Copies of hydraulic and pressure test records/ certificates for works carried out on Site;

(c) Copies of works completion certificates for electrical works.

(ii) "As-built" Drawings

"As-built" drawings as detailed in the contract documents shall be provided.

(iii) Operation and Maintenance Manuals and User Manual

O&M Manuals and User Manual as detailed in the contract documents shall be provided.

(iv) Manufacturer's Name Plate

Every item of plant/equipment/apparatus supplied by a manufacturer, is any, shall be fitted with a clearly engraved, stamped or cast manufacturer's name plate properly secured to the plant/equipment/apparatus and showing:-

- Manufacturer's Name;
- Serial and/or Model No.;
- Date of Supply;
- Rating/Capacity; and
- Test and Working Pressure (where applicable).

(v) Labels and Related Instructions

Labels and the related instructions shall be provided according to relevant clause(s) of the General Specification.

D2.4 INSPECTIONS REQUIRED BY AUTHORITY / MANDATORY INSPECTIONS

The Plumbing Contractor shall carry out all mandatory inspections,

examination and testing, to meet the statutory requirements and to the satisfaction of the relevant Authorities, including Water Authority, Building Authority, DSD, EPD, FSD and WSD, etc. The Plumbing Contractor shall make all necessary applications to the Authorities well in advance and attend inspections conducted by their representatives for the purpose of these inspections, examination and testing.

SECTION D3

TESTING AND COMMISSIONING

D3.1 GENERAL

Where testing and commissioning works for the Installations are required to be witnessed by the Supervising Officer or his Representative, the Plumbing Contractor shall carry out the proper testing and commissioning works to his satisfaction before inviting them to witness the works. The Plumbing Contractor shall arrange to enable the Supervising Officer or his Representative to witness the complete testing and commissioning. Unless otherwise approved by the Supervising Officer, testing and commissioning works carried out by the Plumbing Contractor in the absence of the Supervising Officer or his Representative shall not be accepted as the approved test record.

Any defects of alignment, adjustment, workmanship, materials and performance or other irregularities which become apparent during commissioning or testing shall be rectified by the Plumbing Contractor and the relevant part of the commissioning or testing procedure shall be repeated at the Plumbing Contractor's own expense.

D3.2 PROCEDURES, STANDARDS AND REQUIREMENTS

The Plumbing Contractor shall follow relevant approved standards, procedures, guidelines in the testing and commissioning works, which shall include but not limited to:-

(a) Statutory obligations and requirements, specifications and standards specified in Part A;

(b) Testing and Commissioning Procedure for Plumbing Installation in Government Buildings of the HKSAR issued by BSB, ArchSD;

(c) Detailed inspection, testing and commissioning methods and procedures approved by the Supervising Officer; and

(d) Equipment manufacturers' recommendations and specifications, if any.

D3.3 MASTER PROGRAMME FOR TESTING AND COMMISSIONING WORKS

The Plumbing Contractor is required to submit a programme for testing and commissioning works within the first three months after acceptance of his Tender. The programme shall indicate the tentative dates of all tests and commissioning works that will be carried out throughout the Conditions and all necessary submissions and approval relating to testing and commissioning. The Plumbing Contractor shall ensure that the testing and commissioning programme matches the master programme for construction and that all testing and commissioning works are complete before the prescribed or

extended date for completion of the Works. The programme shall also be updated as the Installations progress towards completion.

The programme shall detail the types of testing and commissioning works required, the breakdown of the programme into floor-by-floor and/or area-by-area basis, the tests that are required during construction and before completion of the Installations, the period of each test with float time allowed, the milestone dates for the key activities of works etc. Critical path programme shall be submitted. The Plumbing Contractor shall plan the programme so as to minimise the overlapping of different tests arranged simultaneously in different locations of the Site.

A detailed checklist of all the Installations to be commissioned and tested shall be submitted at the same time. The checklist will be used for progress monitoring and shall be updated from time to time as the Installations progress towards completion.

D3.4 DOCUMENTATION AND DELIVERABLES

The Plumbing Contractor shall submit full commissioning and testing report to the Supervising Officer within 14 days after completion of the commissioning and testing of the Installations. The report shall be in accordance with the requirements approved by the Supervising Officer.

PART E – TRAINING, INSPECTION, ATTENDANCE, OPERATION AND MAINTENANCE DURING MAINTENANCE PERIOD

SECTION E1

GENERAL REQUIREMENTS

E1.1 GENERAL

Unless otherwise specified in the Particular Specification, the Plumbing Contractor shall provide training, inspection, attendance and operation and maintenance services for the Installations during maintenance period as specified in this General Specification.

The Plumbing Contractor shall supply and install, without additional cost to the Employer, replacements for any equipment or parts thereof, which may, in the opinion of the Supervising Officer, become unserviceable, especially where the causes are attributable to faulty materials, workmanship, or inadequate performance.

In the execution of servicing and maintenance, repair and operation work on Site, apart from transportation, necessary labour, tools, equipment and testing instruments, the Plumbing Contractor shall also be responsible for keeping adequate stocks of spare parts/equipment and other items necessary to maintain all emergency repair in an efficient, satisfactory and safe operation condition at all time.

The interruption of electricity supply and functioning of the Installations during execution of works shall be kept to the minimum. Such interruption shall only be allowed with the prior approval of the Supervising Officer or his Representative.

E1.2 COMPLETION OF OUTSTANDING AND DEFECTIVE WORKS

After receiving the list of defects and outstanding works issued with the Certificate of Completion, the Plumbing Contractor shall complete the outstanding works and rectify the defects concerned to the satisfaction of the Supervising Officer within the agreed time frame during the Maintenance Period. The Plumbing Contractor shall also rectify as soon as practicable any defects identified within the Maintenance Period.

The Plumbing Contractor shall submit periodic report on the progress of outstanding and defective works to the Supervising Officer and attend inspection with the Supervising Officer's Representative to verify satisfactory completion of the outstanding and defective works.

E1.3 REPAIR AND MAINTENANCE RECORDS

The Plumbing Contractor shall be responsible for maintaining a log book in each of the specific locations (e.g. switch room, plant room, etc.) agreed with

the Supervising Officer or his Representative. Every attendance and details of work done for the Installations including but not limited to repair, servicing and maintenance shall be entered into the log book by the Plumbing Contractor so as to form a comprehensive record of attendance and works done. In addition, the Plumbing Contractor shall also keep repair and maintenance records for the Installations in his own office and shall be required to forward such records for checking if so requested by the Supervising Officer.

SECTION E2

TRAINING TO USERS AND OPERATION AND MAINTENANCE AGENTS

E2.1 General

Training for the operation and maintenance of system and equipment shall be provided and arranged by the Plumbing Contractor. The training shall include all training facilities, material and handouts etc. The Plumbing Contractor shall submit a "Training Schedule" at least 3 months prior to the prescribed or extended date for the completion of Works for the Supervising Officer's approval. The schedule shall include but not limited to the following requirements:

(a) Facilities and training programmes to ensure that the users and operation and maintenance agents acquire full knowledge and appreciation of all aspects of the design, day-to-day operation, breakdown and routine maintenance, diagnosis and hence capable to effectively and efficiently operate and maintain the system/equipment;

(b) All aspects of operation and maintenance of the plant including the use of special tools, and equipment portfolio for major systems covering quantity of equipment, equipment cost, recommended serviceable life by the manufacturer and cycle of major overhaul;

(c) Details and duration of the training course(s), qualifications of the instructor and the qualification requirements for the trainee(s);

(d) Full details of the training syllabus, including principles, theory and practical "hands-on" demonstration to reach the required depth of appreciation;

SECTION E3

INSPECTION, ATTENDANCE, OPERATION AND MAINTENANCE REQUIREMENTS

E3.1 RESPONSE AND ATTENDANCE TO EMERGENCY AND FAULT CALLS

The Plumbing Contractor shall attend to emergency, fault and complaint calls arising from defective work materials and/or system operation at any time or as specified in accordance with the following categories during the Maintenance Period and rectify all defects leading to fault or breakdown of the equipment and/or system as required. The costs for the attendance, labour, materials and spare parts for repair, submission of fault/breakdown reports, etc. are deemed to have been allowed for in the Tender.

(a) VERY URGENT for pipe burst and water leakage, the Plumbing Contractor shall respond and attend to the Very Urgent calls immediately within 30 minutes;

(b) NON URGENT for minor pipe cracking, malfunction of valve and strainer clog, the Plumbing Contractor shall respond and attend the fault within 4 hours.

Investigation report and proposal for repair/improvement/ modification shall be submitted.

The Plumbing Contractor shall promptly complete any repair necessary for resuming the breakdown installation. In case immediate permanent repair is not possible due to safety related reason, the following "time for repair" targets counted from the receipt of breakdown or fault call shall be complied with:-

(a) Complete temporary repair for resumption of the suspended or breakdown services to a safe operating condition within 24 hours; and

(b) Complete permanent rectification works within 3 working days unless long component and parts delivery time is required.

E3.2 MAINTENANCE SCHEDULE

The Plumbing Contractor shall prepare and submit the maintenance programme before the commencement of the Maintenance Period for the approval of the Supervising Officer.

Upon the approval of the above maintenance programme and before the commencement of the Maintenance Period, the Plumbing Contractor shall prepare a comprehensive maintenance schedule for all installations and indicate dates for routine and periodic inspection, servicing and maintenance of the installations.

The schedule shall include but not limited to the following:

(a) Monthly Routine Maintenance Services

- Check the general condition of the whole installation to ensure the system are satisfactorily performed as required by the Contract;
- Clean internally all water tanks according to A Guide to Cleansing of Fresh Water Storage Tanks issued by WSD;
- To check any water leakage from the pipework and to repair if required;
- To examine the condition of joints, stop valves, covers and seals for leaks, repair as required; and

(b) Quarterly Maintenance Services

- Clean all strainers;
- Same as (a) above.

(c) Half-yearly Maintenance Services

- To inspect the condition of pipe fittings, supports etc. for sign of corrosion. Remove the rust and repaint with primer and finish coating as necessary;
- Same as (a) and (b) above.

(d) Annual Maintenance Services

- Same as(a), (b) and (c) above.

(e) Others

- Carry out all necessary site works and provide necessary documents to facilitate users for applying the Quality Water Supply Scheme for Buildings – Fresh Water (Plus) and Quality Water Supply Scheme for Buildings – Flushing Water of WSD.

E3.3 INSPECTION DURING MAINTENANCE PERIOD

The Plumbing Contractor shall, in addition to the routine maintenance, make further inspections for the Installations to check and, if necessary, re-adjust the equipment/systems to meet the actual operation conditions and to test the installations to meet statutory requirements including the submission of test reports and certificates.

E3.4 JOINT INSPECTION AT THE END OF MAINTENANCE PERIOD

The Plumbing Contractor shall attend inspections to the Installations at the expiry of the Maintenance Period in order to facilitate the acceptance and handing over of the Installations to the Employer's operation and maintenance agents. The Plumbing Contractor shall conduct site checking and make necessary adjustments to the equipment/systems one month before expiry of the Maintenance Period to ensure that the Installations are in good working order, safe and satisfactory operation condition for handover.

ANNEX I

LIST OF TECHNICAL STANDARDS AND QUALITY STANDARDS QUOTED IN THIS GENERAL SPECIFICATION

The following is a list of technical standards and quality standards quoted in this General Specification. The technical standards and quality standards indicate the basic requirements. The Plumbing Contractor may offer products, materials and equipment complying with alternative internationally recognised equivalent standards acceptable to the Supervising Officer and demonstrated to be equivalent in terms of construction, functions, performance, general appearance and standard of quality to the relevant standards or other standards specified in this General Specification to the Supervising Officer for approval.

Standard	Description
BS 21: 1985 (Partially replaced by BS EN 10226-1: 2004)	Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)
BS 417-2: 1987	Specification for galvanized low carbon steel cisterns, cistern lids, tanks and cylinders. Metric units
BS 476-20: 1987	Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)
BS 1212-1: 1990	Float operated valves. Specification for piston type float operated valves (copper alloy body) (excluding floats)
BS 1212-3: 1990	Float operated valves. Specification for diaphragm type float operated valves (plastics bodied) for cold water services only (excluding floats)
BS 1968: 1953	Specification for floats for ball valves (copper)
BS 2456: 1990	Specification for floats (plastics) for float operated valves for cold water services
BS 3505: 1986	Specification for unplasticized polyvinyl chloride (PVC-U) pressure pipes for cold potable water
BS 4346-1: 1969 (Replaced by BS EN 1452-1 to 5:1999 but remains current)	Joints and fittings for use with unplasticized PVC pressure pipes. Injection moulded unplasticized PVC fittings for solvent welding for use with pressure pipes, including potable water supply

BS 4346-2: 1970 (Replaced by BS EN 1452-1 to 5: 1999 but remains current)	Joints and fittings for use with unplasticized PVC pressure pipes. Mechanical joints and fittings, principally of unplasticized PVC
BS 4800: 2011	Schedule of paint colours for building purposes
BS 5154: 1991 (Specification for gate valves replaced by BS EN 12288: 2010)	Specification for copper alloy globe, globe stop and check, check and gate valves
BS 5163-1: 2004	Valves for waterworks purposes. Predominantly key-operated cast iron gate valves. Code of practice
BS 5163-2: 2004	Valves for waterworks purposes. Stem caps for use on isolating valves and associated water control apparatus. Specification
BS 6920-1: 2014	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water - Specification
BS EN 545: 2010	Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods
BS EN 681-1: 1996	Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Vulcanized rubber
BS EN 837-1:1998	Pressure gauges. Bourdon tube pressure gauges. Dimensions, metrology, requirements and testing
BS EN 1057: 2006 + A1: 2010	Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications
BS EN 1074-1: 2000	Valves for water supply. Fitness for purpose requirements and appropriate verification tests. General requirements
BS EN 1074-2: 2000	Valves for water supply. Fitness for purpose requirements and appropriate verification tests. Isolating valves
BS EN 1092-1: 2007 +A1: 2013	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges
BS EN 1092-2: 1997	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Cast iron flanges
BS EN 1092-3: 2003	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Copper alloy flanges

BS EN 1254-1: 1998	Copper and copper alloys. Plumbing fittings. Fittings with ends for capillary soldering or capillary brazing to copper tubes
BS EN 1254-2: 1998	Copper and copper alloys. Plumbing fittings. Fittings with compression ends for use with copper tubes
BS EN 1254-4: 1998	Copper and copper alloys. Plumbing fittings. Fittings combining other end connections with capillary or compression ends
BS EN 1254-5: 1998	Copper and copper alloys. Plumbing fittings. Fittings with short ends for capillary brazing to copper tubes
BS EN 1366-3: 2009	Fire resistance tests for service installations. Penetration seals
BS EN 1515-1:2000	Flanges and their joints. Bolting. Selection of bolting
BS EN 1561: 2011	Founding. Grey cast irons
BS EN 1563: 2011	Founding. Spheroidal graphite cast iron
BS EN 1982: 2008	Copper and copper alloys. Ingots and castings
BS EN 10084: 2008	Case hardening steels. Technical delivery conditions
BS EN 10087: 1999	Free cutting steels. Technical delivery conditions for semi-finished products, hot rolled bars and rods
BS EN 10088-1: 2014	Stainless steels. List of stainless steels
BS EN 10088-2: 2014	Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes
BS EN 10088-3: 2014	Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes
BS EN 10095: 1999	Heat resisting steels and nickel alloys
BS EN 10217-1: 2002	Welded steel tubes for pressure purposes. Technical delivery conditions. Non-alloy steel tubes with specified room temperature properties
BS EN 10217-7: 2014	Welded steel tubes for pressure purposes. Technical delivery conditions. Stainless steel tubes
BS EN 10226-1: 2004	Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Dimensions, tolerances and designation

BS EN 10255: 2004	Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions
BS EN 10283:2010	Corrosion resistant steel castings
BS EN 10312: 2002 +A1: 2005	Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption. Technical delivery conditions
BS EN 12163: 2016	Copper and copper alloys. Rod for general purposes
BS EN 12288: 2010	Industrial valves. Copper alloy gate valves
BS EN 12334: 2001	Industrial valves. Cast iron check valves
BS EN 13280: 2001	Specification for glass fibre reinforced cisterns of one-piece and sectional construction, for the storage, above ground, of cold water
BS EN 13789: 2010	Industrial valves. Cast iron globe valves
BS EN 13835:2012	Founding. Austenitic cast irons
BS EN 60079-0:2012 + A11:2013	Explosive atmospheres. Equipment. General requirements
BS EN 60079-1:2014	Explosive atmospheres. Equipment protection by flameproof enclosures “d”
BS EN ISO 1452-1: 2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). General
BS EN ISO 1452-2: 2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Pipes
BS EN ISO 1452-3: 2010	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Fittings
BS EN ISO 1452-4: 2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Valves
BS EN ISO 1452-5: 2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Fitness for purpose of the system

BS EN ISO 5667-5: 2006	Water quality. Sampling. Guidance on sampling of drinking water from treatment works and piped distribution systems
BS EN ISO 9453: 2014	Soft solder alloys. Chemical compositions and forms
BS EN ISO 9906: 2012	Rotodynamic pumps. Hydraulic performance acceptance tests. Grades 1, 2 and 3
BS EN ISO 17672: 2010	Brazing. Filler metals
BS ISO 3864-1: 2011	Graphical symbols. Safety colours and safety signs. Design principles for safety signs and safety markings
ISO 185:2005 Ed2 (R10)	Grey cast iron. Classification
ISO 197-4: 1983	Copper and copper alloys. Terms and definitions. Castings
ISO 2892: 2007 Ed2(R10)	Austenitic cast irons. Classification
ISO 5457:1999 +A1:2010	Technical product documentation -- Sizes and layout of drawing sheets
ISO 7005-1: 2011	Pipe flanges. Steel flanges for industrial and general service piping systems
ISO 7005-2:1988	Metallic flanges. Cast iron flanges
ISO 9001: 2008/ Corr1: 2009	Quality management systems. Requirements