

PROPOSED RENOVATION OF PGH NURSES' HOME

PGH Complex, Taft Avenue, Ermita, Brgy. 670, Manila City

PLUMBING AND DRAINAGE SPECIFICATIONS

SIGNED AND SEALED BY:


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Master Plumber

PRC	: 8996	ISSUED ON	: 01-06-2021
PTR	: AC-1604744	ISSUED AT	: ANGELES CITY

PLUMBING AND DRAINAGE ENGINEERING SERVICES

1 PART 1 - PREAMBLES

1.1 INTRODUCTION

Specification

- 1.1.1 Supply, install, set to work, test and commission the complete plumbing and drainage services installation as described in this specification and as shown on the tender drawings.

- 1.1.2 Read the specification in conjunction with the Preliminaries of the Main Contract.
Standards and Codes of Practice

- 1.1.3 References to British Standards, Philippine Codes of Practice and Regulations and the like do not give the year of issue or amendment. The published versions which will apply will be those current ten days before the date set for return of tenders.

Engineer

- 1.1.4 References to the Engineer shall mean the person nominated in the contract as Contract Administrator or his authorized representative.

Approvals

- 1.1.5 References to "approval of the Engineer" or similar terms shall mean the written acceptance in principle of the Engineer.

Tender Drawings

- 1.1.6 The specification lists all tender drawings hereby referred to as "working drawings" for the plumbing and drainage services.

- 1.1.7 If required inspect the Architect's and Structural Engineer's drawings at their respective offices.

Preferred Standard Equipment

- 1.1.8 The specification and working drawings contain references to products and equipment, and all such references quote by name, type, figure number or by detailed specification, particular products of specified manufacturers. The working drawings have been prepared using the dimensions and salient features of such preferred standard equipment.

- 1.1.8 Base the tender on the equipment specified.

- 1.1.9 If the Contractor desires to submit alternative equipment for the approval of the Engineer, do so after the Contract is let only one (1) alternative equipment will be evaluated. Provide calculations to demonstrate the sizing and selection of all plumbing and drainage services plant and equipment.

1.2 INFORMATION TO BE PROVIDED

General

- 1.2.1 Provide installation, builder's work information and drawings and other information as detailed in the specification.

- 1.2.2 Thoroughly check all Suppliers and Specialists drawings etc to ensure that the various works, installations and services do not conflict with each other or with other Sub-Contractors drawings or with the building structure, fabric or finishes, either during construction or in the finished building.

- 1.2.3 Submit drawings in sufficient time to comply with the contract programme. Allow not less than two working weeks for the Engineer's comments. Make due allowance for re-submission of drawings, if

necessary, in accordance with the Engineers comments.

- 1.2.4 The Engineer's comments on installation, shop or manufacturing drawings submitted by the Contractor shall not in any way relieve the Contractor of his responsibility in respect to the accuracy of all such drawings nor from his responsibility for providing equipment suitable in dimension, construction and finish for the location in which it is to be installed, provided that any discrepancies, errors or omissions are not due to inaccurate information or particulars furnished in writing to the Contractor by the Engineer. The Engineer will draw attention to any divergence from the specified requirements or errors which occur to him but his comment shall not imply approval in terms of dimensional accuracy or completeness of detail.

Equipment Manufacturer's and Shop Drawings

- 1.2.5 Obtain manufacturers shop drawings etc for all items of plant, equipment, control panels etc for the purpose of explaining how components of the design are to be assembled, fabricated, connected and installed.

Builders Work Information

- 1.2.6 Prepare drawings and schedules to show the architectural and structural requirements for all builder's works and allow their integration into the project. Include on these drawings and schedules requirements for foundations, bases and supporting structures for plant and equipment.

Installation/Shop Drawings

- 1.2.7 Prepare drawings, based on the working drawings and/or co-ordination drawings showing proposals for the execution of the works. Prepare the drawings in such detail as to enable the works to be installed. Agree the precise location of the pipes and equipment openings with the Engineer.

- 1.2.8 The contractor shall be responsible for producing the following installations/shop drawings:

- complete individual services drawings (ISD's).
- complete combined services drawings (CSD's)
- complete structural, electrical, mechanical drawings (SEM's)

These shall be based on the design working drawings. The contractor shall be responsible for ensuring his plumbing and drainage services are fully coordinated with other services such as, mechanical, electrical, lift and fire protection services.

The contractor shall be responsible for ensuring all structural openings, etc. are reflected on his SEM drawings. All installation/shop drawings shall be submitted with enough time to ensure no clashes between services occur or incorrect structural openings take place.

The contractor shall rectify any clashes or non-coordinated electrical, P&D, FP services at his own cost.

- 1.2.9 Ascertain on site that the installation will not foul other permanent services or equipment. Notify the Engineer if it is necessary to make changes to take account of site conditions.

Working Drawings

- 1.2.10 Keep on site a complete set of prints of installation/shop drawings. Mark all variations, deviations and amendments on these drawings as the installation work proceeds. Use these 'marked-up' drawings as the basis for the record drawings referred to later.
- 1.2.11 Keep working drawings on site and available at all times for inspection by the Engineer.

1.3 STATUTORY & GENERAL OBLIGATIONS

Statutory Obligations

- 1.3.1 In respect of the installation, materials, components, equipment and workmanship comply with statutory and other obligations, regulations of any Local Authority, Public Services or Statutory Undertaking relating to the execution of the works. In particular comply with the requirements of:-
- (a) The Philippine Society of Mechanical Engineers (PSME).
 - (b) Revised National Plumbing Code of the Philippines (NAMPAP).
 - (c) Philippine National Building Codes.
 - (d) Uniform Plumbing Code.
 - (e) The Health and Safety at Work, etc Act.
 - (f) The Rules and Regulation of Local Authority.
 - (g) The Building Regulations.
 - (h) Construction (Design & Management) regulations (CDM)
 - (i) British Standard Institution (BSI)
 - (j) All other relevant British Standard Specifications and Philippine Code of Practice, whether mentioned in this Specification, or not.

1.4 WORK AT COMPLETION

Notices, Charts and Labels

- 1.4.1 Provide all necessary statutory and warning notices.
- 1.4.2 Submit sample copies of all notices, charts and the wording for all labels to the Engineer for approval before ordering them.
- 1.4.3 Identification tapes for pipelines to be provided at 3 meter intervals, changes of direction, both sides of each isolation/regulation device and each side of wall and floor penetrations. Tapes to include service description and direction of flow and to comply fully with BS 1710.

Inspection and Testing of the Works

The Contractor shall hire an independent specialist Testing, Balancing and Commissioning Contractor.

Attendance

- 1.4.4 Provide attendance during the testing and commissioning of all plumbing and drainage plant, equipment and apparatus connected under this contract.

Inspection and Testing of Installations

- 1.4.5 On completion of the works carry out tests on all pipeline systems in accordance with the requirements of the documents listed in the Statutory and General Obligations clause of this specification.
- 1.4.7 Tabulate the results of all tests in an approved format. Note and record on the tabulated forms the date such tests were carried out. Hand these forms to the Engineer on completion of the works.
- 1.4.8 For specialist installations, complete the test certificates as prescribed in the relevant Statutory and General Obligations clause of this specification and hand to the Engineer on completion of the works.
- 1.4.9 Provide all necessary instruments and tools for the tests. Supply the Engineer with copies of recent test certificates confirming the accuracy of all test instruments.
- 1.4.10 On completion of the works, forward to the Engineer duplicate copies of all test certificates and the completion certificates and inspection certificate as prescribed in the Statutory and General Obligations clause of this specification.

Instruction

- 1.4.11 Following satisfactory testing of the works and prior to the completion of the works explain and demonstrate to the Employer's representative(s) the purpose, function and operation of all the works covered in this Specification including all items and procedures listed in the operating and maintenance manual. Include in this undertaking instruction from manufacturers' service engineers. Allow a minimum of 3 working days for this exercise which is to be carried out during normal working hours.

Operating and Maintenance Instructions

- 1.4.12 No later than two weeks prior to the commencement of commissioning provide two draft copies of the manual for comment.
- 1.4.13 Ensure each manual contains the following information:-
- (a) An index.
 - (b) A full technical description of each system written to ensure that the Employer's staff fully understand the scope and facilities provided.
 - (c) A description of the mode of operation of each system.
 - (d) A list of record drawings with a brief description of each.
 - (e) A legend for all colour coded services
 - (f) Schedules, system by system, of plant and equipment stating their locations, duties and performance figures.
 - (g) The manufacturers name, address and telephone number for each item of plant and equipment together with catalogue list numbers.
 - (h) Manufacturers technical literature for all items of plant and equipment.
 - (i) A copy of all test certificates.
 - (j) A copy of all manufacturers guarantees and warranties.
 - (k) Recommendations as to the preventative maintenance frequency and procedures to be carried out to ensure efficient operation.
 - (l) A list of normal consumables.
 - (m) A list of recommended spares.
 - (n) A copy of each record drawing.
 - (o) A list of emergency telephone numbers.
- 1.4.14 Edit manufacturers standard operating and maintenance instructions to ensure only that information relevant and pertaining to the works is used.

Hand Over Procedure

- 1.4.15 On completion of testing the Engineer will make a preliminary hand over inspection and list all outstanding works and defects. Rectify these defects and subsequently offer the works for final hand-over. The Engineer will only recommend handover following receipt of the record drawings, operating and maintenance instructions, manual, written confirmation of the completion of outstanding works and satisfactory instruction of the Client's representative.

Defects Liability Period

- 1.4.15 The defects liability period shall be 12 months following handover, during the defects period attend to further/additional items that need attention
- 1.4.16 Approximately three weeks before the end of the defects period the Engineer will produce a final defects lists. Ensure that any items noted thereon are rectified prior to the end of the defects period. Write to the Engineer confirming such defects have been rectified and the work is complete.

Maintenance Contract

- 1.4.24 The Contractor is to include in his tender a separate price for maintaining (not operating) the plumbing and drainage services for the duration of the defects liability period. Allow for twelve service visits and the cost of all consumables for carrying out the procedures listed in the operating and maintenance manual. This may be accepted or deleted by the Employer.

Warranty

- 1.4.25 The warranty of all equipment shall be a minimum of 12 months from the building practical completion date.

PUBLICATION COMPLIANCE

Where materials are specified to conform to industry and technical society publications or organizations such as Philippine National Standards (PNS) Japanese Industrial Standard (JIS), International Electro-technical Commission (IEC), British Standards (BS), American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will not be acceptable evidence of compliance. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority" having jurisdiction," or words of similar meaning, to mean the Engineer. In lieu of the label or listing, submit a certificate from an approved independent testing organization, adequately equipped and competent to perform such services, stating that the item has been tested in accordance with the specified organization's publication.

1.5 DELIVERY AND STORAGE

Handle and store, and protect materials in accordance with the manufacturer's recommendation. Replace damaged or defective items with new items.

1.6 CATALOGUED / PRODUCTS / SERVICE AVAILABILITY

Materials shall be current products by manufacturers regularly engaged in the production of such products. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of materials under similar circumstances and of similar size. The 2-year period shall be satisfactory completed by a product for sale on the commercial market through advertisements, manufacturer's catalogs or brochures.

END OF SECTION

2 PART 2 – SCOPE OF WORKS

2.1 GENERAL

- 2.1.1 This part of the specification describes the scope of the plumbing and drainage services installation and should be read in conjunction with the remainder of this specification and the Drawings. Together they cover the manufacture, supply, delivery to site, off-loading and positioning, co-ordination, erection, testing and setting to work the Plumbing and Drainage Services Installation.

2.2 THE BUILDING

- 2.2.1 The scheme is for the development of the **Proposed Renovation of PGH Nurses' Home.**

2.3 SCOPE OF WORK

- 2.3.1 The work to be done under this division of the specifications consist of the supply and delivery of all necessary materials and equipment such as pipes etc., accessories, fabrication, installation complete in all details of plumbing and drainage services pipe penetrations and opening, pipe sleeves at the subject project premises and all work and materials incidental to the proper completion of the installations, except those portions of the work which are expressly stated to be done by others. All work shall be in accordance with the governing codes and regulations and with specifications. The requirements in regard to materials and workmanship specify the required standards for the furnishing of the labour, materials and workmanship specify the required standards for the installation/operation of the work specified herein and indicated on the drawings. The information as given on the specification and drawings is to outline the design intent and performance of the works to be required but are not intended to include all detailed design and construction

It is the sole responsibility of the contractor to offer complete, satisfactory workmanship and all other as may be required to meet every aspect whether or not specified in the specification, the requirement of local authorities and of all performance to be acceptable for handing over to the owner.

- 2.3.2 The contractor, before submitting his proposal, shall examine all tender documents, specifications and drawings relating to his work and verify all governing conditions at site and shall become fully informed as to the extent and character of the work required.

No consideration will be granted for any alleged misunderstanding of the equipment/materials to be furnished or work to be done, it being understood that the submission of a proposal is an agreement to all items and conditions referred to herein or indicated on the accompanying drawings and actual site conditions. If specified materials are not locally available, contractor must immediately place an order as soon as project is awarded. Any exceptions, omission or substitutions shall be presented in writing with the contractor's bid.

- 2.3.3 The contractor, before commencing work, shall examine all adjoining areas on which this work is in any way dependent for perfect workmanship according to the intent of this specification and shall report to the Owner's representative any condition which will prevent this contractor from performing first class work. No waiver of responsibility for defective work will be considered unless notice has been filed at the time this contractor submits his proposals.

- 2.3.4 It is the intention of these specifications and drawings to call for furnish work tested and ready for operation. Whenever the word "provide" is used, it shall mean "furnish and install, complete, test and commission and ready to use". Any work or details whether or not shown or specified, but which are necessary for the proper installation and operation, shall be included in the work, the same as if herein specified.

2.4 WORK INCLUDED

Under this division of the specifications, the contractor shall provide all materials and perform all the work necessary for the complete execution of the plumbing and drainage works as shown on the plumbing tender drawings as herein specified except as otherwise excluded and without excluding the generality of the foregoing, shall include but not be limited to the following principal items of work:

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1. Water supply and distribution system for the building and ground including supply and installation of pumps, overhead tank, piping and water meters and its accessories.
 2. Storm drainage system for the building and ground including roof drains, basement and podium parking/area drains.
 3. All building sanitary drains, waste and venting systems as shown in drawings.
 4. Installation of all plumbing fixtures, puttings, trims and accessories.
 5. Supply and installation of sump pumps and accessories.
 6. Connections to existing water, sewer and drainage mains of the building water distribution, sewer and drainage collection systems.
 7. Testing for leakage of water distribution, drains, wastes and venting systems plus pressure testing and disinfection of the water distribution system.
 8. Test run of water pumping system, sump pumps and other equipments.
 9. Electrical power and control/wiring system including motor starters, BMS interfacing devices, interlock and all necessary protection devices from the equipment to disconnect switch. (Coordinate work activity with electrical contractor).
 10. Testing, balancing and commissioning of all equipment. The Contractor shall hire independent Testing and Balancing Contractor.
 11. Furnishing and installation of all required consumable materials and materials to be installed.
 12. Approved hacking on non-structural walls, roof, floors and partitions to provide openings for pipes. These works shall be properly coordinated and agreed with the architect and structural engineer.
 13. If anything has been omitted in any items of work or materials usually furnished which are necessary for the completion of the plumbing work as outlined herein before, then such items must be and are hereby included in this division of the work.
 14. The contractor shall prepare all plans, applications, permits, etc. and shall complete all tests, forms, etc. required by all rules, regulations, etc. of the government having jurisdiction.
 15. Provide anchor bolts, sleeves, templates and other materials incidental to equipment installation on concrete base pad. The contractor shall provide steel shims and non-shrink grouting as necessary to ensure accurate levelling of base plates. Clean and wet concrete base and/or pad surfaces to assure bond.
 16. The contractor shall supply and install irrigation pipes, fittings, valves, controls as indicated in the tender drawing.
 17. The contractor shall supply and install swimming pool/kid pool pipeworks, pumps, tanks, filters, dosing unit and other accessories.

2.5 SHOP DRAWINGS, SAMPLES AND OTHER SUBMITTALS

- 2.5.1 The Contractor shall submit to the Engineer, for approval, detailed shop drawings of all equipment and all material required to complete the project, and no material or equipment may be delivered to the jobsite or installed until the Contractor has in his position the approved shop drawings for the particular material or equipment. The shop drawings shall be complete as described herein.
- 2.5.2 Prior to the delivery of any material to jobsite, shall be submitted sufficiently in advance of requirements to allow ample time for checking. Submit for approval detailed, dimensioned, operating clearances, performance characteristics and capacity. Each item of equipment proposed shall be all a standard

catalog product of an established manufacturer and of equal quality, finish and durability to that specified.

- 2.5.3 Samples, drawings, specifications and catalog submitted for approval, shall be properly labelled indicating specific service for which material or equipment is to be edited, section and article number of specifications governing, Contractor's name and name of job. The Contractor shall bind properly the material's catalog submittal for Engineer's review.
- 2.5.4 Catalogs, pamphlets, or other documents submitted to described items in which approval is being requested, shall be specific and identification in catalog, pamphlet, etc. of item submitted shall be clearly made in ink. Data of general nature will not be accepted. Approval rendered on shop drawings shall not be considered as a guarantee of measurements of building conditions. Where drawings approved, said approval does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.
- 2.5.5 All shop drawings, etc. shall be submitted sufficiently in advance of field requirements to allow ample time for checking. Failure of the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of contract time and no claim for extension by reason of such default will be allowed.
- 2.5.6 Contractor shall prepare and submit to Engineer for approval the following:
- 2.5.6.1 Basic Materials
- a. Samples: Contractor shall submit sample for each of the following materials.
1. Pipework system, and all other necessary consumable materials needed for complete and operable system.
 2. Pipework system, valves, fitting and all other necessary consumable materials needed for complete and operable system.

2.6 WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner to the satisfaction of the Architect and the Engineer, who will jointly interpret the meaning of the Drawings and Specifications and shall have power to reject any work and materials which, in their judgment, is not in full accordance therewith.

The Contractor shall assume unit responsibility and shall provide the service of a highly qualified Engineer to supervise the complete installation of equipment and systems and who shall be available for conducting the final acceptance tests.

2.7 WARRANTY

The contractor shall provide manufacturer's written warranties covering defects in material and workmanship of products and equipment utilized for the project.

Warranties shall be for a period of one (1) year from the date of the building practical completion certificate.

END OF SECTION

PART 3 - BASIC MECHANICAL MATERIALS AND METHODS

3.1 GENERAL

3.1.1 Summary

3.1.1.1 This part includes the following basic materials and methods to complement other parts of the Specification.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete equipment base construction requirements.
3. Labeling and identifying mechanical systems and equipment
4. Non-shrink grout for equipment installations.
5. Field-fabricated metal wood equipment supports.
6. Installation requirements common to equipment specification Sections.
7. Cutting and patching.
8. Touchup painting and finishing.

3.1.2 Definitions

3.1.2.1 Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

3.1.2.2 Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

3.1.2.3 Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

3.1.2.4 Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

3.1.2.5 Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

3.1.2.6 Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

3.1.3 Submittals

3.1.3.1 Submit product data and samples for following piping specialties:

- All Piping

3.1.3.2 Prepare coordination drawings according to a 1:50 scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:
 - a. Planned piping layout, including valve and specialty locations and valve stem movement.
 - b. Equipment service connections and support details.
 - c. Exterior wall and foundation penetrations.
 - d. Fire-rated wall and floor penetrations.
 - e. Sizes and location of required concrete pads and bases.
2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

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4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

3.2 PRODUCTS

3.2.1 Pipe and Pipe Fittings

- 3.2.1.1 Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.

- 3.2.1.2 Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

3.2.2 Joining Materials

- 3.2.2.1 Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 3 mm maximum thickness, except where thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
2. ASME B16.20 for grooved, ring-joint, steel flanges.
3. AWWA C110, rubber, flat face, 1/8 inch (3 mm) thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

- 3.2.3.1 Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.

1. Inside Diameter: Closely fit around pipe.
2. Outside Diameter: Completely cover opening.
3. Cast Brass: One-piece, with set-screw.
 - a. Finish: Rough brass.
 - b. Finish: Polished chrome plate.
4. Cast Brass: Split casting, with concealed hinge and set-screw.
 - a. Finish: Rough brass.
 - b. Finish: Polished chrome plate.
5. Stamped Steel: One-piece, with set-screw and chrome-plated finish.
6. Stamped Steel: One-piece, with spring clips and chrome-plated finish.
7. Cast-iron Floor Plate: One-piece casting.

- 3.2.3.2 Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.

3.2.5 Grout

- 3.2.5.1 Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, non-corrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.50 MPa), 28-day compressive strength.
3. Packaging: Premixed and factory-packaged.

3.3 EXECUTION

3.3.1 Piping Systems – Common Requirements

- 3.3.1.1 General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specify piping installation requirements unique to the piping system.
- 3.3.1.2 General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- 3.3.1.3 Install piping at indicated slope.
- 3.3.1.4 Install components having pressure rating equal to or greater than system operating pressure.
- 3.3.1.5 Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- 3.3.1.6 Install piping free of sags and bends.
- 3.3.1.7 Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- 3.3.1.8 Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- 3.3.1.9 Install piping to allow application of insulation plus 1-inch (25 mm) clearance around insulation.
- 3.3.1.10 Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- 3.3.1.11 Install fittings for changes in direction and branch connections.
- 3.3.1.12 Install couplings according to manufacturer's printed instructions.
- 3.3.1.13 Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
1. Chrome-Plated Piping: Cast-brass, one-piece, with set-screw, and polished chrome-plated finish. Use split-casting escutcheons, where required, for existing piping.
 2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with set-screw.
 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
 4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips, and chrome-plated finish.
 5. Piping in Utility Areas: Cast-brass or stamped-steel, with set-screw or spring clips.
- 3.3.1.14 Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following standards:
 - a. Comply with ASTM F 402 for safe handling of solvent-cement and primers.
 - b. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM D 2846 and ASTM F 493.
 - c. Poly(Vinyl Chloride) (PVC) Pressure Application: ASTM D 2672.
 - d. Poly(Vinyl Chloride) (PVC) Non-Pressure Application: ASTM D 2855.
 4. Plastic Pipe and Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment according to manufacturer's printed instructions.

- a. Plain-End Pipe and Fittings: Butt joining.
- b. Plain-End Pipe and Socket-Type Fittings: Socket joining.

3.3.1.24 Piping Connections: Except as otherwise indicated, make piping connections as specified below.

1. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50 mm) or smaller threaded pipe connection.
2. Install grooved flanged couplings in piping 2-1/2 inches (65 mm) and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Dry Piping Systems (Compressed Air): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.3.7 Grouting

- 3.3.7.1 Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- 3.3.7.2 Clean surfaces that will come into contact with grout.
- 3.3.7.3 Provide forms for placement of grout, as required.
- 3.3.7.4 Avoid air entrapment when placing grout.
- 3.3.7.5 Place grout to completely fill equipment bases.
- 3.3.7.6 Place grout on concrete bases to provide a smooth bearing surface for equipment.
- 3.3.7.7 Place grout around anchors.
- 3.3.7.8 Cure placed grout according to manufacturer's printed instructions.

3.4 PIPE FIXINGS

- 3.4.1 Generally, hangers and supports shall be steel of adequate dimensions and designed to allow for expansion and contraction. All hangers and supports shall be primed and finished coated with black bituminous paint.
- 3.4.2 All pipeworks connected to Sanitary and Plumbing Fixtures shall be isolated from the building structure by using flexible pipe hangers, anchors and pipe guides as specified. No direct connection between the building structure and any part of the pipework shall be allowed.
- 3.4.3 Generally, all horizontal steel pipes shall be supported on cradles or by clevis type hangers or clamp type hangers with steel rod hangers and support spacing in accordance with the table below :-

Nominal Pipe Dia. (mm)	Max. Span (metres)	Min. Rod Dia. (mm)
Up to and including 50	2.0	M10
63 to 89	3.0	M13
100 to 150	4.0	M20
200 to 300	3.0	M20
350 to 400	3.0	M22
450 to 600	2.0	M22

- 3.4.4 Pipe hangers shall be placed not more than 600mm from each change of direction where possible.
- 3.4.5 Vertical runs of pipe shall be supported by anchors.
- 3.4.6 Samples of pipe hangers, supports and anchors shall be submitted to the Architect or Engineer for review.

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- 3.4.7 Fixing of the plumbing and drainage pipes at the main pipe risers shall be isolated from the structure by the use of special hangers as detailed hereunder unless otherwise stated in the Schedule and/or in the Specification Drawings:-

a. Main Plumbing and Drainage Pipe Risers

These shall be supported by anchors as specified elsewhere.

END OF SECTION