

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this and other Sections of Division 22.
- B. References:
 - 1. American National Standards Institute (ANSI):
 - 2. National Standard Plumbing Code (NAPHCC):
 - 3. American Society for Testing and Materials (ASTM):
 - a. ASTM A74, "Specification for Cast Iron Soil Pipe and Fittings".
 - b. ASTM A120, "Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Use".
 - c. ASTM A234, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures".
 - d. ASTM B88, "Specification for Seamless Copper Water Tube".
 - e. ASTM C76, "Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe".
 - f. ASTM C700, "Specification for Extra Strength and Standard Strength Clay Pipe and Perforated Clay Pipe".
 - g. ASTM D3034, "Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings".

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. Following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
 - 1. Submittals.
 - 2. Coordination/Scheduling/Quality Assurance.
 - 3. Record documents.
 - 4. Maintenance manuals.
 - 5. Rough-ins.
 - 6. Mechanical installations.
 - 7. Cutting and patching.
 - 8. Testing/Guarantee
 - 9. Piping materials and installation common to most piping systems.
 - 10. Fittings and Joints.
 - 11. Floor and Trench Drains

12. Back water valves.
13. Cleanouts.
14. Expansion joints for Rain Water Collectors.
15. Valves.
16. Requirements for Equipment Installations.
17. Labeling & Identifying.
18. Touch up painting and finishing.
19. Cutting and patching.

B. Related Sections: Following Sections contain requirements that relate to this Section:

1. The remainder of Division 22, plus general related specifications including:
 - a. Access to mechanical installations.
 - b. Excavation for mechanical installations within the building boundaries, and from building to utilities connections.

C. Definitions:

1. Term "Contractor" used throughout Division 22 shall mean Mechanical Subcontractor.
2. Term "provide" shall mean to furnish all necessary labor, materials, equipment, accessories, transportation, services, installation and adjustment under Contract amount, including Contractor's profit, overhead and payment of all taxes and fees.

1.3 SUBMITTALS

A. General: Follow the procedures specified in Division 01 Section "Submittal Procedures" and as specified in this Section.

B. Shop Drawings and Catalog Sheets. Include:

1. Plumbing line layout.
2. Floor drains.
3. Cleanouts.
4. Expansion joints for plumbing lines.
5. Plumbing fixtures.
6. Back flow preventers.
7. Standpipe fire line layout and components.
8. PIV Valves.
9. Support material and hardware.

C. Substitutions:

1. Products are referenced in Specification and on Drawings to establish standard of quality, style, design, and function of materials, equipment, apparatus, or product.
2. There are often several satisfactory substitutes for standardized utilitarian items which satisfy design objectives.

3. Since it is impractical to name all possible brands that might be furnished, substitutes may be proposed unless specifically stated otherwise.
4. Submit substitutions in accordance with Division 01 and General Conditions of Specification and as follows:
 - a. Submit proposed substitute material or equipment to be considered for approval as equivalent to Engineer/Architect at least 7 days before time set for receiving Bids.
 - b. Contractor assumes all engineering and construction costs necessary for revision in Work due to substitute material or equipment.
- D. See requirements of Division 01 Section, "Submittal Procedures," Part 1 heading, "Submittal Procedures," for limits to resubmittals.
- E. See requirements of Division 01 Section, "Submittal Procedures," Part 2 heading, "Requests for Information," for RFI constraints.

1.4 COORDINATION

1. Visit site before Bidding to note apparent features which may affect Work. No subsequent allowance will be made because of failure to make this examination before Bidding.
2. Verify all dimensions in field before ordering any material or doing any Work.
3. Verify ceiling heights or other architectural and structural details before installing any piping.
4. No extra compensation will be allowed because of differences between actual measurements and dimensions and those indicated on Drawings.
5. Notify Engineer in writing of any difference which may be found before proceeding with Work.

1.5 SEQUENCING AND SCHEDULING

1. Coordinate mechanical equipment installation with other building components.
2. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
3. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
5. Coordinate connection of electrical services.
6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
7. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Panels".

8. Schedule Work so as to coordinate with other Contractors.
9. Before starting Work, prepare and submit to Prime Contractor schedule of operations outlining proposed order of procedure, giving dates of execution and estimated time required for completion of each step.
10. After schedule has been accepted by Prime Contractor and Engineer/Architect, do not deviate from schedule without written consent of Prime Contractor.
11. No subsequent extras will be allowed for materials and labor not included by Bidder for Mechanical Work due to lack of familiarity with Contract Documents as they relate to Work of all other trades required for Project.
12. Before construction starts, cut off and plug any abandoned existing services at property line. Coordinate with local utility company and civil engineer.
13. Coordinate service connection to meter with local water department and civil engineer.

1.6 QUALITY ASSURANCE

- A. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code--Steel".
- B. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
 1. Comply with provisions of ASME B31 Series "Code for Pressure Piping".
 2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.
- C. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- D. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

1.7 CODES AND STANDARDS

1. Comply with:
 - a. American Welding Society (AWS).
 - b. American Society of Mechanical Engineers (ASME).
 - c. American National Standards Institute (ANSI).
 - d. American Society for Testing and Materials (ASTM).
 - e. American Insurance Association (A.I.A.).
 - f. National Fire Protection Association (NFPA).
 - g. Underwriters' Laboratories, Inc. (UL).

- h. Manufacturer's Standardization Society of the Valve & Fittings Industry, Inc. (MSS).
 - i. Factory Mutual Research Corp. (FM).
 - j. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 - k. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- 2. All local, state, and federal rules and regulations.
 - a. International Building Code (IBC):
 - 1) IBC International Building Code.
 - 2) IBC International Mechanical Code.
 - 3) IBC International Plumbing Code.
 - 4) IBC International Fire Prevention Code.
 - b. Building Officials and Code Administrators, International, Inc. (BOCA):
 - 1) The BOCA National Building Code.
 - 2) The BOCA National Mechanical Code.
 - 3) The BOCA National Plumbing Code.
 - 4) The BOCA National Fire Prevention Code.
 - c. Southern Building Code Congress International, Inc. (SBCCI):
 - 1) The SBCCI Standard Building Code.
 - 2) The SBCCI Standard Mechanical Code.
 - 3) The SBCCI Standard Plumbing Code.
 - 4) The SBCCI Standard Fire Prevention Code.
 - d. Uniform Building Code (UBC):
 - 1) The UBC Uniform Building Code.
 - 2) The UBC Uniform Mechanical Code.
 - 3) The UBC Uniform Plumbing Code.
 - 4) The UBC Uniform Fire Code.
- 3. Should any change in Drawings and Specifications be required to comply with local regulations, notify Engineer/Architect at least 7 days before time set for receiving Bids. After entering into contract, Contractor will be held to complete all Work necessary to meet local requirements without extra expense to Owner.
- 4. Maintain a competent superintendent at Project throughout progress of Work and until Work is completed.

1.8 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 01 Section "Closeout Procedures". In addition to the requirements specified in Division 01, indicate the following installed conditions:
 - 1. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
 - 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 3. Approved substitutions, contract modifications, and actual equipment and materials installed.
 - 4. Contract modifications, actual equipment and materials installed.
- B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified in Division 01 Section "Execution Requirements" to record the locations and invert elevations of underground installations.

1.9 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 01 Section "Closeout Procedures" In addition to the requirements specified in Division 01, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions and lubrication charts and schedules.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Deliver materials to Project in good condition. Store materials off ground and protected from elements.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 02 through 33 for rough-in requirements.
- C. Drawings are generally diagrammatic and indicative of Work to be installed.
- D. Do not scale Drawings for rough-in Work.

3.2 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate mechanical systems, equipment, and materials installation with other building components so as not to delay Contractors.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - 7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - 8. Install systems, materials, and equipment to conform with approved submittal data to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer/Architect.
 - 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames" and this section.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Install piping to occupy minimum of space. Install parallel and close to walls, ceiling, columns or other members providing proper space for covering or removal of pipes.
14. Coordinate Work to avoid interferences with other trades.
15. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings or valves which may be required. Investigate structural and finish conditions affecting this Work. Plan accordingly, furnishing such offsets, fittings and valves as may be required.
16. Where possible, locate all plumbing lines in areas which are out of public view.
17. Review plumbing layout with Engineer/Architect before construction.
18. In case of conflict between riser diagram and floor plan, greater quantity or better quality prevails, subject to approval of Engineer/Architect.
19. Coordinate all Work specified in this Division with Work of all other trades required for Project.
20. Check Structural Drawings for location of drains, vents and other Mechanical Work. In case of conflict between Structural Drawings and Mechanical Drawings, Structural Drawings take precedence.
21. Notify Engineer/Architect immediately and confirm in writing of any conflict between Mechanical and Structural Drawings.
22. Finish painting will be done by others.
23. Any galvanized equipment, material, or hardware that is cut, scratched, field threaded or grooved shall be coated with a Zinc Rich Coating (ZRC or approved equivalent).
24. Trench and backfill in accordance with Division 31 Section "Earth Moving."
25. In case interferences between Work develop, Engineer/Architect will decide which Work is to be relocated regardless of which was first installed.
26. Cleanup:
 - a. At completion of Work under this contract, remove from site and dispose of all rubbish and discarded materials and restore disturbed facilities and surfaces.
 - b. Provide entire installation thoroughly free from all oil and grease after successfully completing all tests and before Work is turned over to Owner.

3.3 PIPING SYSTEMS-COMMON REQUIREMENTS

- A. General: Install piping as described below, except where system Sections specify otherwise.
- B. 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.

- C. Install all piping parallel to building walls and column lines at such height for proper drainage and so not to interfere with doorways, stairway or traffic.
- D. Install suspended pipes as close to ceiling as possible and at uniform grade.
- E. Where interferences develop in field, offset or reroute piping as required to clear such interferences. Use proper fittings, no bent pipe is permitted.
- F. Install full-time water lines in areas not subject to freezing within building and below frost line and minimum of 36 in. below grade outside building.
- G. Install water meter and backflow preventor in protected area not subject to freezing.
- H. Use small amount of prepared, pipe thread lubricant on outside threads.
- I. Work pipe into place without springing
- J. Install all piping such that it will drain and vent as shown or required.
- K. Provide uniform grade to all horizontal pipes and provide drains at all low points in water piping system.
- L. Cast-in-Place Insert Installation: Before placement of concrete, furnish, locate and set on forms, cast-in-place inserts which support Mechanical Work.
- M. Furnish hot dipped galvanized steel pipe sleeves extended one inch above finished floor line for all pipe running through floors.
- N. Install piping at indicated slope.
- O. Install components having pressure rating equal to or greater than system operating pressure.
- P. Install piping free of sags and bends and neat in appearance.
- Q. Install couplings according to manufacturer's printed instructions.
- R. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-in. (25mm) annular clear space between pipe and sleeve for installation of mechanical seals.
- S. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 07 Section "Penetration Firestopping".
- T. Verify final equipment locations for roughing in.
- U. Refer to equipment specifications in other Sections for roughing-in requirements.
- V. 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. Soldered Joints: Construct joints according to AWS "Soldering Manual", Chapter 22 "The Soldering of Pipe and Tube".
4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" Chapter.
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

W. All piping routed over finished areas must be insulated.

3.4 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

- A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Engineer/Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location. Provide unions to facilitate equipment replacement.
- E. Install equipment giving right-of-way to piping systems installed at a required slope.
- F. Provide 4 inch high concrete housekeeping pad with rounded edges under all floor mounted equipment where clearance allows.
- G. Fasteners and Anchors: Hot dipped galvanized or stainless steel, type, grade, and class as required. Mounting holes for all fasteners must be drilled. The use of powder, gas, or other types of power propelled fasteners is prohibited.

3.5 HANGER AND SUPPORT INSTALLATION:

- A. Support piping in building on standard clevis type (MSS SP-69, No. 1) hangers, with adjustable rods.
- B. Properly support all piping installed on suitable pipe hangers and supports. Permanent hangers, supports, and anchors shall be fabricated from durable materials, hot dipped galvanized or stainless steel, suitable for service conditions in accordance with details on Drawings.
- C. Base required strength of all supporting equipment on combined weight of piping filled with water, plus any insulating covering.
- D. Install hangers for horizontal piping with following minimum rod sizes:

<u>Nominal Pipe Size</u>	<u>Minimum Rod Size</u>
0.75 in. to 2 in. pipe	0.375 in.
2.5 in. to 3.5 in. pipe	0.5 in.
4 in. to 5 in. pipe	0.625 in.
6 in. pipe	0.75 in.
8 in. to 12 in. pipe	0.875 in.

- A. Provide and install anchors in piping system to fix direction of expansion and contraction. Fabricate and assemble anchors to secure desired points of piping in relatively fixed positions. Hangers shall permit line to take up expansion and contraction freely in opposite directions away from anchored point and shall be so arranged as to be structurally suitable for particular location, line, and loading conditions in question.
- B. Use expansion anchors to anchor pipe hanger and supports where inserts have been improperly located, or where necessary to support piping from existing concrete construction. Provide expansion anchors equal to Ackerman-Johnson, Paine, Phillips, Hilti, ITW Ramset/Red Head, or Rawl. Expansion anchor locations must have approval of Engineer/Architect before installation. Coordinate location with structural.
- C. Support parallel pipe lines at same level on approved trapeze or saddle type hangers.
- D. Use steel rods to attach ring or trapeze hangers to building structure. Space hangers at sufficiently close intervals to support piping and its contents, 12 ft on center maximum for threaded pipes.
- E. Support copper piping with copper clevis hangers, or clevis hanger with copper supporting loop.
- F. Provide sheet metal collar at each pipe hanger for insulated pipe with vapor barrier.
- G. Any support hardware or material that is cut, scratched or treaded shall be coated with a zinc rich coating (ZRC or equivalent) at these locations.

3.6 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 01 Section "Cutting and Patching". In addition to the requirements specified in Division 01, the following requirements apply:
1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
 2. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - a. Uncover Work to provide for installation of improperly scheduled Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in structures.
 - f. Upon written instructions from the Engineer/Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- B. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, and trim, and other mechanical items made obsolete by the new Work.
1. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
 2. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 3. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
 - a. Refer to Division 01 Section "Reference Standards and Definitions" for definition of "experienced Installer".
 4. Respective trades will provide openings in floors, walls, and other members as required for installation of piping and equipment, provided that necessary information regarding such openings is furnished by contractor in timely manner.
 5. If contractor fails to provide information regarding required openings, cutting and repairing of completed Work will be performed by respective trades at expense of contractor.
 6. Seal all such openings in accordance with Division 07 Section "Joint Sealants."
 7. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations only with written approval of Engineer/Architect. Perform cutting by skilled mechanics of the trades involved.
 8. Repair cut surfaces to match adjacent surfaces.

3.7 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: Complying with ASME A13.1.
 - 2. Locate pipe markers wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exposed exterior locations as follows:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
 - c. Near locations where pipes pass through walls, floors, ceilings, or enter inaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at a maximum of 50 ft (15m) intervals along each run. Reduce intervals to 25 ft (7.6 m) in congested areas of piping and equipment.
- B. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.8 PAINTING AND FINISHING

- A. Refer to Division 09 Section "Painting" for field painting requirements.
- B. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.9 CONCRETE BASES

- A. Construct concrete equipment bases of dimensions indicated, but not less than 4 in. (101 mm) larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.70MPa), 28-day compressive strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete".

3.10 TESTING AND GUARANTEE

- A. Testing:
 - 1. Take out all necessary permits, arrange for all required inspections, and pay all fees and expenses associated with performing Mechanical Work.
 - 2. Test all piping systems at full operating pressure under normal conditions of use in accordance with requirements of Water Department, Board of Health, Fire Department, and all other authorities having jurisdiction. As a minimum, the water supply system shall be tested at 125 psi for 4 hrs, the sewer system at 5 psi for 15

minutes, natural gas at 100 psi for 2 hours, and the standpipe system at 225 psi for 2 hrs.

3. Provide all instruments for making tests.
4. Perform tests on following systems:
 - a. Water Supply System.
 - b. Sewer System.
 - c. Natural Gas Supply System.
 - d. Standpipe System.
5. Test all parts of system in presence of Contractor, Engineer/Architect, Owner and Authority having jurisdiction for sufficient period of time to permit complete examination and inspection.
6. Successfully test all concealed piping before its being permanently covered up.
7. Remedy all defects in materials or workmanship which appear during test or retest of system.

B. Guarantee:

1. In addition to any specific guarantee called for by Specifications, furnish to Owner written guarantee against defects in materials, workmanship for all apparatus and materials furnished, and for entire workmanship of installation for period of 1 yr from date of acceptance of Work.
2. During guarantee period and without expense to Owner, repair all defects in workmanship or material provided under this Section.

END OF SECTION 220500

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