

OFPC Standard Specification

SECTION 22 13 16

PLUMBING PIPING

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The issuance and revision history of this Section is tabulated below. Please destroy any previous copy in your possession.

Rev No.	Date	Pages	Remarks
0	March 1998	21	Original
1	May 2004	1	Revised Cover Page
2	February 2007	23	Format, 1.00

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SECTION 22 13 16

PLUMBING PIPING

PART 1 GENERAL

1.00 The following sections are to be included as if written herein:

- A. Section 23 00 00 – Basic Mechanical Requirements
- B. Section 23 05 29 – Sleeves, Flashings, Supports and Anchors
- C. Section 23 05 53 – Mechanical Identification

1.01 SECTION INCLUDES

- A. Pipe and Pipe Fittings
- B. Valves

1.02 RELATED SECTIONS

- A. Section 31 23 16 - Excavating
- B. Section 31 23 23.13 - Backfilling
- C. Section 31 23 16.13 - Trenching
- D. Section 33 13 00 - Disinfection of Water Distribution System
- E. Section 08 31 13 - Access Doors
- F. Section 09 91 00 - Painting
- G. Section 23 20 00.A - Piping, Valves and Fittings
- H. Section 23 05 16 - Expansion Compensation
- I. Section 23 05 48 - Vibration Isolation
- J. Section 23 07 19 - Piping Insulation

- K. Section 22 13 16.A - Plumbing Specialties
 - L. Section 22 40 00 - Plumbing Fixtures
 - M. Section 22 11 23 - Plumbing Equipment
- 1.03 REFERENCES
- A. See Section 23 20 00
- 1.04 SUBMITTALS
- A. Submit under provisions of Section 23 00 00.
 - B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- 1.05 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of Section 23 00 00.
 - B. Record actual locations of valves, etc., and prepare valve charts.
- 1.06 OPERATION AND MAINTENANCE DATA
- A. Submit under provisions of Section 23 00 00.
 - B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- 1.07 QUALITY ASSURANCE
- A. See Section 23 20 00.A
- 1.08 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
 - B. Installer: Company specializing in performing the work of this section with minimum of three years documented experience.
- 1.09 REGULATORY REQUIREMENTS
- A. Perform Work in accordance with Uniform Plumbing Code.

- B. Conform to applicable code for installation of backflow prevention devices.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 23 00 00.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.12 EXTRA MATERIALS

- A. Furnish under provisions of Section 23 00 00.
- B. Provide two repacking kits for each size valve.

PART 2 PRODUCTS

2.01 WALL, FLOOR AND CEILING PLATES:

See Section 23 05 29.

2.02 SLEEVES, INSERTS, AND FASTENINGS:

See Section 23 05 29.

2.03 VALVES:

- A. See Section 23 20 00.A

2.04 UNIONS:

- A. See Section 23 20 00.A.

- B. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type equal to EpcO.
- C. In all domestic water lines where the material of the pipe is changed from ferrous to copper or brass, a dielectric coupling shall be used at the transition.

2.05 FLANGES:

- A. See Section 23 20 00.A.

2.06 STORM WATER SYSTEM:

- A. A complete system of storm water drainage piping shall be installed as indicated on the Drawings. Storm water systems shall be installed with the materials and methods as specified in Section 23 20 00.A.

B. PIPE & FITTINGS:

1. All interior downspouts and interior storm drainage piping, and all such piping up to a point five feet (5') outside the building walls, or to any other point indicated on the Drawings, shall be service weight cast iron soil pipe, hub and spigot for pipe ten inch (10") and larger and hubless for eight inch (8") and smaller. Each piece of pipe and each fitting shall be coated at the factory with asphaltum or coal tar pitch and with the manufacturer's mark or name cast on it. Piping shall be Type DWV copper pipe with wrought copper sweat joints where indicated on the Drawings. Where roof drains are 50 or more feet above the horizontal runout at grade level, all the downspout piping system 50' below the roof line shall be constructed of Schedule 40 black steel pipe with weld fittings.
2. Exterior storm water drainage piping from a point five feet (5') outside building walls or to point shown shall be precast concrete sewer pipe. Where piping passes under specific areas noted on Drawings, it shall be service weight cast iron up to fifteen inches (15") in size.

C. INSTALLATION OF PIPING:

1. All piping shall be run in the most direct manner. Horizontal pipes shall have a grade of one-quarter inch (1/4") per foot, wherever possible, and not less in any case than one-eighth inch (1/8") per foot, unless otherwise noted on Drawings.
2. Cleanouts shall be provided at the bottom of each downspout, at each change of direction and at intervals not exceeding 95 feet in horizontal runs. Interior cleanouts shall be brass caulked into the lines, and where they occur in walls or floors of finished areas, shall be provided with nickel-bronze tops or access plates.

All interior cleanouts shall be of the same size as the pipe served up to four inch (4") size and four inches (4") for all larger lines.

3. Exterior cleanouts shall consist of a concrete encased wye in the line with sewer pipe extending upward therefrom and terminating in a concrete slab below grade. A standard cast iron cleanout casting shall be set on this slab in such manner as to be flush with finished grade and to provide access through its cover to the cleanout. A removable concrete stopper shall be set in the open top of the cleanout pipe.
4. All storm drain bodies, the first 10' feet of pipe from the drain and all horizontal runs of storm drainage piping within the building, except in crawl space shall be insulated as described in the insulation specifications.
5. All sizes of all underground storm drain piping within the building shall be cast iron hub and spigot type, with Tyseal (or approved equal) neoprene gaskets, coated at the factory with asphaltum or coal tar pitch, and with the manufacturer's mark or name cast on it. Hubless piping systems shall not be used in a directly buried, underground application.

D. ROOF AND AREA DRAINS:

1. All roof and area drains will be furnished and installed with all accessories required for the particular construction in which they are to be mounted. Area drains shall be as indicated on the Drawings and as specified in other sections.

E. TREE WELL DRAINS AND CATCH BASINS:

1. All tree well drains and catch basins shall be furnished and installed by the Mechanical Contractor with all accessories as indicated on the Drawings and as specified in other sections.

F. SUB-SOIL DRAINAGE:

1. Excavation to bottom of grade beam is by General Contractor. Final fine grading for sub-soil pipe is by Mechanical Contractor.
2. Material for backfill, twelve inch (12") both sides of pipe and twenty-four (24") above pipe bottom of excavation, shall be furnished by General Contractor and installed by Mechanical Contractor. Additional backfill is furnished and installed by General Contractor.
3. Where shown on Drawings and as detailed, furnish and install Perforated PVC Drain Pipe of the size as indicated on the Drawings.

NOTE TO SPECIFICATION WRITER: SHOW DRAIN PIPING ON PLUMBING DRAWINGS IF SUB-SOIL DRAINAGE PIPE IS IN PLUMBING SUBCONTRACT.

G. TESTS:

1. All storm drains shall be tested in vertical sections of approximately 50 feet each by filling leader with water and allowing to stand twenty-four (24) hours. Any leaks discovered shall be repaired and the test repeated. All tests shall be observed by the Owner's representative and the Architect/Engineer before tests are removed.

2.08 SANITARY DRAINAGE SYSTEM:

- A. The sanitary drainage system shall be installed as indicated on the Drawings complete with all fixtures, drains, traps and required connections. All fixtures and drains shall be properly vented and trapped. The Contractor shall complete the installation of the sanitary drainage system by making approved connections as indicated on the Drawings.

- B. Materials and installation of the system shall be as specified in the following paragraphs and Section 23 20 00.A.

C. PIPE AND FITTINGS:

1. All pipe used for interior, above ground sewer and drainage purposes, unless specifically shown to the contrary, shall be service weight cast iron soil pipe.
2. All pipe and fittings from the sump pumps and sewage ejectors shall be Schedule 80 PVC with PVC bolted flange connections at pump discharge and at each valve. PVC piping shall be run from the pumps to the exterior piping connection point within 6" of 5'-0" outside of the building.
3. Galvanized or black steel pipe shall not be used in any waste connection to a fixture or in any section of the soil or waste piping system.
4. All underground sanitary waste piping, of all sizes, shall be cast iron hub and spigot type, with Tyseal (or approved equal) neoprene gaskets. Hubless piping systems shall not be used in a directly buried, underground application.

D. INSTALLATION OF PIPING:

1. All piping shall be run in the most direct manner. Horizontal pipes shall have a grade of one-quarter inch (1/4") per foot, wherever possible, and not less in any case than one-eighth inch (1/8") per foot, unless otherwise noted on Drawings.

2. Cleanouts shall be provided at the bottom of each riser, at each change of direction and at intervals not exceeding 95 feet in horizontal runs. Interior cleanouts shall be brass caulked into the lines, and where they occur in walls or floors of finished areas, shall be provided with nickel-bronze tops or access plates. All interior cleanouts shall be of the same size as the pipe served up to four inch (4") size and four inches (4") for all larger lines.
3. Exterior cleanouts shall consist of a concrete encased wye in the line with sewer pipe extending upward therefrom and terminating in a concrete slab below grade. A standard cast iron cleanout casting shall be set on this slab in such manner as to be flush with finished grade and to provide access through its cover to the cleanout. A removable concrete stopper shall be set in the open top of the cleanout pipe.

E. FLASHINGS:

1. All vent pipes passing through the roof shall be provided with roof flashings per Section 23 05 29.

F. TESTING:

1. After the vertical lines of soil pipe, waste, and other parts of the sanitary system have been set from the basement to the top of the building, all outlets shall be temporarily "plugged up", except as are required for testing as described herein. One floor level of the building shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention period, there shall be no perceptible lowering of the water level in the system being tested.
2. A final test shall be conducted after all vertical and horizontal pipes and "rough-ins" have been complete but before the sewer connection is made. The test procedure shall be identical with that described above except that the entire plumbing system, i.e., the vertical and horizontal pipe and "rough-in", shall be subjected to water under the head imposed by filling the system to the top of the building. After all testing operations have been completed, all waste lines shall be cleaned.

3. Should the completion of these tests leave any reasonable question of a doubt relative to the integrity of the installation, additional tests or measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

G. FABRICATION METHODS FOR SEWAGE AND DRAINAGE PIPE LINES:

1. Install promptly all sewers, drains and piping after excavating, chasing or cutting for them has been done to keep the openings for such piping open as short a time as possible. No piping shall, however, be permanently closed up, furred in or covered before the examination of same by the authorities having jurisdiction.
2. Waste pipes shall be sized to conform to the sizes indicated on the Drawings. Under no circumstances shall any drain line be smaller than two inches. The waste pipes from water closets shall not be smaller than four inches.
3. The drilling and tapping of soil or waste lines or the use of saddle joints or the welding or brazing of hubs or pipe to any soil, waste or vent lines is prohibited.
4. Wastes must be brought up directly in back of each fixture. Horizontal branch arms of lead or brass will not be allowed.
5. No waste or soil lines shall enter the vertical part or heel of a lead or cast iron closet bend. Waste lines may enter the horizontal part of the lead or cast iron closet bend. No sink or lavatory waste line shall enter any other waste line of two inch (2") size.
6. All waste connections shall be made of heavy brass threaded nipples or with copper tube with appropriate screw to sweat adapters for connecting to sanitary tee. All fixtures used in connection with the conveying of any waste substance to the sanitary sewer, shall be connected by means of a trap, waste and overflow. Slip joints will be permitted only on the house side of the trap, waste and overflow, or appliance which has such slip joints embodied in their original manufacture. Fixtures which have waste opening connected to the soil or waste lines by the use of bolts or screws shall have such connections made by the use of the exact number of bolts or screws as provided for in their original manufacture.
7. Where waste and vents are exposed at fixtures, pipes shall be chrome plated brass or brass W.C.P. cover (iron pipe size) and shall have chrome plated escutcheons where they pass through floors, walls, or ceilings.

H. VENTS:

1. Vent pipes shall be carried up adjoining soil and waste pipes, and they shall be connected into the main stack at top and bottom as indicated on the plumbing riser diagrams on the Drawings.
2. Vent pipes shall be of hubless service weight cast iron pipe.
3. All vent lines shall be so constructed that they cannot be used for waste or soil lines. No fixture shall be double trapped.

I. CONNECTIONS FOR FLOOR MOUNTED WATER CLOSETS:

1. All connections for floor mounted water closets and waste piping shall be made with an appropriate cast iron closet flange and wax gaskets.

2.09 WATER SUPPLY SYSTEM:

A. A complete system of hot and cold water supply to all plumbing fixtures and mechanical equipment shall be supplied and installed as shown on the Drawings. The water supply system shall be installed using the materials and methods as specified in the following paragraphs.

B. UNDERGROUND WATER PIPING SYSTEMS:

1. Pipe: All pipe used for underground water piping mains shall be Class 52 centrifugally cast, close grained cast iron pipe or Class 50 DUCTILE iron pipe arranged with bell and spigot mechanical joints.
2. Fittings: See Section 23 20 00.A.
3. Valves: See Section 23 20 00.A.
4. Valve Boxes:
 - a. For each underground valve installed by the Contractor, the Contractor shall provide and install a two-piece, screw adjustable type valve box. These valve boxes shall be designed for heavy roadway service and they shall have a deep socket type of cover which prevents their being accidentally knocked out of position.
 - b. The word "**WATER**" shall appear on each cover. The installation of these members shall be such that by the use of the adjustable screw type bodies the tops are just flush with the finished grade. These valve boxes shall be Tyler Pipe Industries #6850, or approved equal.

5. Lead: It is forbidden that lead in any form be used in any water system other than waste. If lead is used in the fabrication or installation of any water system other than waste, then ALL of the installed equipment and material, which may have come in contact with the lead, shall be marked with bright red or orange spray paint, and shall be removed from the project site. The system(s) shall then be restored and reinstalled using ALL NEW MATERIALS.

C. FIRE HYDRANTS:

1. Furnish and install U.L. approved fire hydrants at locations indicated on the Drawings.
2. Fire hydrants shall be equal to Kennedy Valve Manufacturing Company with two (2) 2-1/2" and one (1) 4-1/2" threaded nozzles. Threads are to be per local Fire Department requirements. Each fire hydrant supply connection shall be preceded with a six-inch (6") gate valve and valve box as specified for underground water systems.
3. Fire hydrants shall be firmly supported underground all around the standpipe. Lower part of standpipe shall be surrounded with coarse gravel for drainage.

D. IRRIGATION PROVISIONS:

1. Furnish and install capped and/or valved water lines under paving, through retaining walls in paved plaza areas and as indicated on Drawings for connections and extensions under work of Section Irrigation (Sprinkler) System.

E. BUILDING ENTRANCE:

1. A metallic sleeve shall be inserted in the forms of the building wall through which the water service enters the building. The interior diameter of such sleeve shall be four inches (4") greater than the exterior diameter of the water service.
2. The water service pipe from within the building shall be extended to a point three feet outside the building wall through this sleeve. The position of the water service in this sleeve shall be concentric and the intervening space shall be packed in a flexible manner to avert the flow of water from outside of the building into the basement.
3. The interior pipe extended outside the building shall be provided with a protective wrapping of "Tape Coat" SP warmed with hand torch. This protective tape shall be applied with "half-lap" coverage in strict accordance with the manufacturer's published instructions. The cast iron pipe connected to the pipe extending from

the building wall shall contain two caulked joints within four feet of the union of the cast iron pipe and the interior pipe from the building.

2.10 INTERIOR DOMESTIC WATER PIPING SYSTEMS:

- A. ALL piping within confines of building walls shall be a part of the interior water piping system. Interior domestic water piping material and installation shall be as specified in the following paragraphs.
- B. PIPE:
1. Interior domestic water piping larger than six inches (6") shall be Schedule 40 galvanized steel pipe. See Section 23 20 00.A.
 - a) When approved by the Owner in writing, the use of roll-grooved copper pipe may be used.
 2. Unless otherwise shown on the Drawings, all interior domestic water piping four inches (4") and smaller shall be fabricated of Type K, hard drawn, copper pipe made of deoxidized copper (99.9% pure). See Section 23 20 00.A.
No pipe smaller than three-fourths inches (3/4") shall be used in this project except at local connections or as detailed for laboratory areas.
- C. FITTINGS:
1. See Section 23 20 00.A.
- D. HEADERS:
1. Suitable headers of the nature detailed on the accompanying Drawings shall be provided for the distribution of the cold water systems. These headers shall be fabricated by a fusion welding process by the use of extra strong black steel pipe and fittings of the same character. All flanges used in the case of such headers shall be dimensioned, faced, drilled and spot faced to conform to the Class 150 American Standard for Steel Pipe Flanges and Flanged Fittings (B16e-1939). The header outlets shall be effected by welding to the header full length welding couplings of the proper size. These header outlets shall be carefully aligned to be "square" and parallel.
 2. Upon being completed, these headers shall be subjected to a hydrostatic test of 300 pounds per square inch gauge. All defects noted upon inspecting the headers thus tested shall be repaired by chipping, machining and burning out defects, and re-welding. After repairs have been made, the headers shall be retested as described above.

3. After the headers have been tested and found to be tight, they shall be galvanized by a "double-dip" process. The manufacturer shall be required to provide certificates assuring the fact that the headers were so "double-dipped". Both exterior and interior surfaces shall receive a heavy zinc coating by a hot dipping process. Galvanized steel nipples shall be used to extend the various header outlets to the valves placed in each outgoing water line near the header. These nipples shall be of such a length that the valves in the outgoing water lines are neatly lined up in a horizontal plane. At a point just beyond these valves, a three-fourths inch (3/4") valved drain line shall be installed in each outgoing branch leaving the header. The purpose of such valve branches shall be to drain the system into which the flow of water is controlled by the valves previously mentioned. These three-fourths inch (3/4") drain line valves from the various branches leaving the headers shall be likewise lined up in a straight horizontal line. These three-fourths inch (3/4") drain lines shall terminate in a common "drain line". That one inch (1") drain line shall be the header drain line. Headers fabricated from copper pipe and roll grooved fittings may be substituted only with the written approval of the owner.

NOTE TO SPECIFICATION WRITER: AT ENGINEER'S OPTION THE HEADER SPECIFICATION MAY BE REWRITTEN TO USE GALVANIZED NIPPLES AND FLANGED FITTINGS ON SIX INCH (6") AND LARGER AND COPPER SWEAT ON FOUR INCH (4") AND SMALLER.

E. CONTROL VALVES:

1. Control valves shall be installed where indicated on Drawings and/or wherever necessary for controlling the several sections of the domestic water system. Valves shall be provided on all inlet (and outlet where applicable) connections to all kinds of apparatuses, all risers and all groups of fixtures. Groups of fixtures shall be arranged to have their group valves in one location. Access shall be provided to all concealed valves by means of an access door. Coordinate the location of valves with the architectural features of the building in order that the access doors will be located symmetrically with other features.
2. The hot and/or cold water supply lines to each and every fixture hereinafter specified shall be equipped with stop valves which shall be chromium plated where exposed chrome plated pipe is used.

F. CROSS CONNECTIONS:

1. Care shall be exercised in fabricating plumbing lines to avoid all cross connections and to construct the piping systems in a manner which eliminates the possibility of water contamination.

2. The piping systems have been designed in every case to avoid the possibility of reverse flow or back siphoning. Care shall be exercised in constructing plumbing lines to make certain that not only the letter, but the spirit, of these safety precautions is carried out to the fullest possible extent.

G. REQUIREMENTS OF INTERIOR WATER PIPING SYSTEMS:

1. All piping shall have reducing fittings used for reducing or increasing where any change in the pipe sizes occurs. No bushing of any nature shall be allowed in piping.
2. All exposed chrome plated, polished or enameled connections from fixtures shall be put up with special care, showing no tool marks or threads at fittings, and supported by neat racks or hangers with round head screws of same material and finish.
3. Wade Shokstop, or approved equal, sealed air chambers shall be provided in all water branches to fixtures, sized in accordance with manufacturer's recommendations, concealed, accessible, and located so as to protect each group of plumbing fixtures.
4. The fabrication of copper pipe and fittings shall in every detail conform to the recommendations and instructions of the fitting manufacturer. The tools used shall be the tools adapted to that specific purpose.
5. Refer to other parts of this Section and Section 23 00 00 and 23 20 00.A for other information concerning installation of piping.

H. TESTING AND STERILIZATION:

1. All water piping systems shall be properly tested to assure their being absolutely tight. In the case of pipes which are to be insulated, these tests shall be completed and the piping system proven to be absolutely tight before any insulation is applied. Wherever pipes are placed so that they will ultimately be concealed, these tests shall be conducted and the absolute tightness of each piping system shall be demonstrated before the system is concealed.
2. The procedure of these tests shall consist of subjecting a piping system to a hydrostatic pressure per Section 23 00 00. During the test period, all pipe, fittings and accessories in the particular piping system which is being tested shall be carefully inspected. If leaks are detected, such leaks shall be stopped by means designated by the Owner's duly authorized representative and the hydrostatic test shall again be applied. This procedure shall be repeated until, for an entire twenty-four hour period, no leaks can be found while the system being tested is subjected to the pressure mentioned above.

3. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five (5) days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period. Even though the completion of these tests is satisfactory, there is a continuing responsibility for the ultimate, proper, and satisfactory operation of such piping systems and their accessories.
4. After completion of the testing, the entire cold and hot water piping systems, with attached equipment, shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. The chlorinating materials shall be either liquid chlorine conforming to U. S. Army Specification No. 4-1 or calcium hypochlorite or chlorinated lime conforming to the requirements of Federal Specification O-C-114. The sterilizing solution shall be allowed to remain in the system for a period of eight (8) hours during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million.
5. The sterilization process shall be conducted as required by the Health Department of the City of _____, and the specifications above, and upon completion of the process, the Health Department shall test and certify the cleanliness of the water piping system. The Mechanical Subcontractor shall pay all costs and charges incidental to this test and certification.

2.11 NATURAL GAS DISTRIBUTION SYSTEM:

- A. The gas distribution system shall be installed as indicated on the Drawings, complete with all valves, regulators, meters and other required items.
- B. The Contractor shall make all arrangements and pay for all services and material which are required to have the gas company extend its gas main to the property line and to install the regulator and/or meter required for this project. This Contractor shall, moreover, pay all fees and deposits which are required to have the meter "set" by the Gas Company. This Contractor shall then extend the gas service into the buildings. This Contractor shall make all arrangements and pay all fees which are required for odorizing the entire gas distribution system. At every entrance of gas piping into a building, the piping shall first rise above grade on the building exterior to prevent upstream gas leaks from following the piping inside the building. Provide wrench operated shutoff valve in the horizontal portion of this exterior piping at each location.
- C. Verify and coordinate, with the actual various users on the site, all the times and timing involved with modification, additions to, or alterations thereof, of gas piping serving these users.

- D. The natural gas system shall be installed using the materials and methods as specified herein and in the following paragraphs.
- E. VALVES:
1. The gas regulator bypass globe valve shall be sized to pass only a slightly larger maximum flow rate than the gas regulator. It shall include provision for locking shut with a large padlock.
- F. GAS CUTOFFS:
1. On the inlet and discharge side of the meter and pressure regulators and at building entrance, install a wrench operated plug cock valve. The flanges of this stop valve shall be dimensioned, drilled, faced and spot faced to conform to the Class 125 American Standard for Cast Iron Flanges (B16.1-1948). Install zone valves on each floor accessible to occupants for shutting off areas of the building under emergency conditions. Gas piping shall be welded up to these zone valves.
- G. PIPING:
1. All pipe used for the fabrication of gas piping systems shall be Schedule 40 black steel pipe. See Section 23 20 00.A.
 2. Unless otherwise specifically required, all steel pipe provided for gas piping systems shall be provided with plain ends and assembled with weld fittings on all pipe 1-1/4" and larger and 3/4" and larger if before the emergency shut off valve. No pipe smaller than 3/4", except as detailed for laboratory furniture, shall be used. From the emergency shutoff valve to the outlets the pipe shall be assembled with threaded fittings provided all joints are exposed or within the confines of the laboratory furniture.
 3. All gas piping within the building shall be installed exposed to view.
 4. In lieu of wrapped steel pipe, poly pipe may be used for outside lines if it is the standard of the serving gas company. Installation standards and procedures of the utility company shall be strictly followed. At a point 6' from the building and the final riser to meter or building entrance point shall be wrapped steel.
- H. FITTINGS:
1. Unless otherwise specifically shown or called for, gas piping systems installed throughout the building shall be fabricated by a fusion welding process making use of welding fittings. These fittings shall be fittings as specified in other

Sections. In no case shall the wall thickness of a fitting incorporated in a gas piping system be less than that of the pipe to which it is jointed.

I. FLANGES:

1. In all instances in which flanges are required for the installation of flanged fittings for gas lines, the Contractor shall provide Crane or Walworth weld neck pattern, Class 150 forged steel flanges. See Section 23 20 00.A for additional requirements for flanges.

J. HEADERS:

1. The gas distribution header installed by this Contractor in the building shall be fabricated of Schedule 40 steel pipe. The pipe and welding materials for this header shall be carefully selected, and the welding operations shall be carefully supervised.
2. Welding nipples neatly aligned shall be provided for the outlets of the header. After the header has been completely fabricated, it shall be temporarily sealed and subjected to a pneumatic test pressure of 100 pounds per square inch. While the header is subjected to this pressure, all welded joints shall be given an application of soapy water for the purpose of detecting minute leaks which might not otherwise be observed. These leaks shall not be repaired by any peening operations. Such leaks shall be remedied by chipping and re-welding until the header is devoid of leaks at that pressure. The header shall then be subjected to a hydrostatic test pressure of 200 pounds per square inch. Under these circumstances, the test pressure of the water confined in the header shall not decrease in a four hour period of observation. If leaks are encountered, they shall be repaired and re-tested until proven tight.
3. The header shall be provided with a one-half inch (1/2") drain connection "taken off" the bottom of the header and terminated in a suitable stop cock. This one-half inch (1/2") drain connection shall have its origin in a 2" x 1/2" welding reducer having its two inch (2") end so welded to the header as to completely drain that member. Each outgoing branch from the header shall be provided with a gas stop valve or gas cock. The nature of the outgoing welding nipples shall be such that these cocks shall be aligned in a neat horizontal line.

K. COCKS:

1. Near the point at which each outgoing line leaves the gas header, the Contractor shall install a gas stop valve or gas cock. These wrench operated valves shall each be provided with an appropriate wrench. Cocks of the same type shall, moreover, be installed at each other point indicated on the Drawings.

L. DRIP PIPES:

1. Drip pipes shall be provided throughout the gas piping systems for the purpose of accumulating moisture and condensate. They shall be sized no smaller than the gas piping to which they are connected in each instance. These drip pipes shall be U-shaped providing an effective water seal of no less than twelve inches (12") of water. The extremity of each U-shaped drip pipe shall be threaded and capped with a suitably sized, screwed pattern, black, standard weight, malleable iron cap.
2. All drip pipes shall be located in an accessible position so that the condensate may either be pumped from the system or so that a water seal shall be provided in the event that the water forming the seal evaporates.

M. FABRICATION METHODS:

1. All interior gas piping shall, wherever possible, be installed so as to grade back toward the gas header in the basement. In all cases where such grading is impracticable and it is necessary to grade the house piping away from the inlet, drip pipes of adequate capacity must be installed where traps are formed by such changes in grade. Drip pipes shall terminate with a screwed pattern, malleable iron black cap. No drip pipes shall be used as outlets for the attachment of any fixture or gas appliance. Drip pipes must, moreover, be placed at the bottom of all vertical pipes which rise from and connect to the end of any horizontal pipe.
2. All house piping must be securely fastened in place in such a manner as to maintain its grading. Under no circumstances shall extension bars be used for supporting gas piping. Under no circumstances shall any gas piping be used to support any weight other than its own weight.
3. All branch outlet pipes shall be taken from the top or sides of running horizontal lines and not from the bottom. No crosses shall be installed in any horizontal gas line. No unions, gas cocks, or valves shall be used in any concealed location. Every gas cock and valve shall be accessible for inspection and repair.
4. The general arrangement of all gas piping shall be such that the number of threaded joints involved is reduced to an absolute minimum. If obstructions are encountered, pipe shall not be bent to circumvent such obstructions. Welding fittings shall be used for this purpose in the case of welded lines, and if threaded lines are involved, screwed fittings shall be used. Wherever gas pipes run through outside brick, stone, or other walls, the opening around the pipe shall be securely and rigidly sealed. Gas pipe sizes shall be at least one pipe size larger than the inlet of the gas appliance which they supply. No bushings shall be used in conjunction with any gas piping.
5. Refer to Section 23 00 00 for other information concerning installation of piping.

N. PROTECTIVE COATING:

1. Gas piping systems installed underground shall utilize pipe which has been factory coated with Scotchkote protective resin No. 212. All materials, surface preparation, application and testing shall conform to Federal Specification L-C-530 B-Type 2, dated June 4, 1970. This coating shall be applied by A&A Coating Company, Lone Star, Texas.
2. Underground welded joints and fittings shall be coated with Scotchkote No. 306 epoxy resin and taped with vinyl Scotchwrap-50 brand tape. Flanged joints shall be given two coats of Koppers Company No. 300M Catalyzed Coal Tar Epoxy. Flanged joints will not be allowed under ground.
3. Under no circumstances shall any backfilling operations be begun until these pipe protection operations have been completed.

O. TESTING:

1. All gas piping systems shall be completely tested by the Contractor. These piping systems shall first be subjected to a pneumatic test pressure per Section 23 00 00. All hydro and pneumatic tests shall be dead weighted, recorded, and countersigned by the project inspector. While the systems are subjected to this air pressure, all welded joints shall have a soapy water solution applied for the purpose of detecting minute, as well as larger leaks, and shall be witnessed by Owner. A final test shall be performed after casework and lab hook up are completed at 15 psi for a minimum of 4 hours. If leaks are found, they shall be repaired by chipping and re-welding operations. Alternate testing and re-welding operations shall be repeated until gas piping systems are absolutely tight at the pneumatic test pressure indicated above. If leaks occur in the case of threaded joints, such leaks shall be eliminated by legitimate means, i.e., either by replacing leaking fittings or by tightening them properly. Leaking flanged joints shall have flange bolts appropriately tightened or have gaskets causing leaks replaced.
2. Then the entire gas piping systems shall be re-subjected to a pneumatic test pressure per Section 23 00 00. Such gas piping systems must be demonstrated to be absolutely tight when subjected to this pressure for a period of twenty-four hours. In all instances in which leaks are then found, they shall be eliminated in the manner designated by the Owner's duly authorized representative. A one-half inch (1/2") test connection and cap shall be provided in each branch of the gas piping system.
3. After all pneumatic testing of the entire gas piping system has been completed and all leaks have been repaired and at a time deemed suitable by the Owner's duly authorized representative, the Contractor shall have the gas supply turned on

and the gas odorant chemical added by a representative of the gas company. The Contractor shall then bleed gas from every riser and every runout until the odor is present in the proper quantity at every gas outlet.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify excavations under provisions of Section 23 00 00.
- B. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not exposed. Coordinate access door location with architectural features.
- H. Establish elevations of buried piping outside the building to ensure a minimum of cover. Refer to Section 23 00 00.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide support for utility meters in accordance with requirements of utility companies.

- K. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Division 09.
- L. Excavate in accordance with Section 23 00 00 for work of this Section.
- M. Backfill in accordance with Section 23 00 00 for work of this Section.
- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Provide one plug valve wrench for every ten plug valves sized 2 inches and smaller, minimum of one. Provide each plug valve sized 2-1/2 inches and larger with a wrench with set screw.
- Q. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- C. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Install globe or plug valves for throttling, bypass, or manual flow control services.
- E. Provide spring loaded check valves on discharge of water pumps.
- F. Provide plug valves in Natural gas systems for shut-off service.
- G. Provide flow controls in water recirculating systems where indicated.

3.05 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to 1/8 inch per foot (one percent) minimum. Maintain gradients through each joint of pipe and throughout system.
- B. Slope water piping and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 EQUIPMENT CONNECTIONS:

- A. Under this section, water lines shall be run to and connected to the pumps, quick fills, and other items of equipment as indicated. Provide suitable shutoff valves, check valves, and, if required by the drawings, bypass valves at each and every such point of connection.

3.08 CONNECTIONS FOR GENERAL CONTRACTOR FURNISHED EQUIPMENT:

- A. Route lines as indicated on the Drawings to serve various items of equipment specified elsewhere. Rough-in accordance with detailed drawings furnished by the equipment supplier, and make final connections to the equipment when it is installed. Rough-in shall terminate where noted on Drawings. All pressure lines shall be provided with shutoff valves or cocks. Drain lines shall be provided where required. It shall be assumed that the equipment supplier will provide and install valves and pipe specialties, etc. only as specified herein or called for on the Drawings.
- B. Laboratory and/or other special equipment and trim are specified in another section under which the equipment shall be furnished and installed. Trim, sink strainers and tail pieces shall be furnished only as indicated to the contractor who shall receive, store and install them. In addition, furnish the sink P-traps and all materials and labor to rough-in and make final connections.

3.09 CONNECTIONS FOR OWNER FURNISHED EQUIPMENT:

- A. The Owner will be furnishing various pieces of equipment. The Contractor shall provide the rough-in indicated on the Drawings. Final connections are also included as part of this contract.

END OF SECTION

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OFPC Standard Specification

SECTION 22 13 16.A

PLUMBING SPECIALTIES

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Rev No.	Date	Pages	Remarks
0	March 1998	11	Original
1	May 2004	1	Revised Cover Page
2	February 2007	12	Format, 1.00

OFPC Standard Specification

SECTION 22 13 16.A

PLUMBING SPECIALTIES

PART 1 GENERAL

1.00 The following sections are to be included as if written herein:

- A. Section 23 00 00 – Basic Mechanical Requirements
- B. Section 23 05 29 – Sleeves, Flashings, Supports and Anchors
- C. Section 23 05 53 – Mechanical Identification

1.01 SECTION INCLUDES

- A. Roof and drains
- B. Cleanouts
- C. Backflow preventers
- D. Water hammer arrestors
- E. Interceptors
- F. Catch basins and manholes

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section [____ - _____]:

1.03 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 01 11 00 - Summary of Work: Owner furnished [Kitchen equipment] [Laboratory casework] [_____].
- B. Section [____ - _____]: Supply of grease interceptors for placement by this Section.
- C. Section 23 38 16 - Fume Hoods, [____ - _____]: Laboratory casework, for connection of sinks, fixtures, and drains.

- D. Section 11 53 23 - Environmental Rooms: Supply of environmental rooms, for connection of sinks, fixtures, and drains by this Section.

1.04 RELATED SECTIONS

- A. Section 01 11 00 - Summary of Work
- B. Section 33 05 13 - Manholes and Structures
- C. Section [] - [] Roofing: Roof Drains
- D. Section 22 13 16. - Plumbing Piping
- E. Section 22 40 00 - Plumbing Fixtures
- F. Section 22 11 23 - Plumbing Equipment

1.05 REFERENCES

- A. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers
- B. ANSI/ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent
- C. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle
- D. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types
- E. ANSI A112.21.1 - Floor Drains
- F. ANSI A112.21.2 - Roof Drains
- G. ANSI A112.26.1 - Water Hammer Arrestors
- H. ASTM C478 - Precast Reinforced Concrete Manhole Sections
- I. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types
- J. PDI WH-201 Water Hammer Arresters

1.06 SUBMITTALS

- A. Submit under provisions of Section 23 00 00.

- B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- C. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- D. Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- E. Manufacturer's Certificate: Certify that oil interceptors meet or exceed specified requirements.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 23 00 00.
- B. Record actual locations of equipment, cleanouts, backflow preventers, etc.

1.08 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 23 00 00.
- B. Operation Data: Indicate frequency of treatment required for interceptors.
- C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 23 00 00.
- B. Accept specialties on site in original factory packaging. Inspect for damage.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Section 23 00 00.
- B. Provide two loose keys for each type of manhole cover and valve box.

PART 2 PRODUCTS

2.01 ROOF AND AREA DRAINS:

- A. All roof and area drains will be furnished and installed by the Mechanical Contractor with all accessories required for the particular construction in which they are to be

mounted. Area drains shall be as manufactured by Wade, Josam, Zurn, or approved equal.

- B. Roof Drain Type A (RD "A"): Wade Series W-3000, cast iron, flashing clamp, mushroom cast iron dome strainer and large sump.
- C. Area Drain Type A (AD "A"): Wade No. 1100, cast iron drain body with clamping collar, 8" x 8" Type "J" polished bronze strainer, three inch (3") Type "EA" extension adapter.
- D. Area Drain Type B (AD "B"): Same as AD "A", except no extension or clamping collar.
- E. Area Drain Type C (AD "C"): Wade No. W-3220-PA area drain with brass screen on aluminum dome.
- F. Area Drain Type D (AD "D"): Wade No. 1100, cast iron drain body, six inch (6") diameter Type "K" bronze dome strainer.
- G. Area Drain Type E (AD "E"): Same as AD "A", except with six inch (6") Type "K" bronze dome strainer.

2.02 TREE WELL DRAINS AND CATCH BASINS:

- A. All tree well drains and catch basins shall be furnished and installed by the Mechanical Contractor with all accessories as indicated on the Drawings.
- B. Tree Well Drain: Wade No. W-3270 parapet scupper drain with oblique strainer, cast iron body and cast iron strainer.
- C. Catch Basin Type A (CB "A"): Neenah No. R4346 cast iron grate. Concrete work shall be provided under this section of the Specifications.
- D. Catch Basin Type B (CB "B"): McKinley No. JGL cast iron grate and frame. Concrete basin and stabilizer apron as detailed on the Drawings shall be provided under this section of the Specifications.

2.03 SUMP PUMP:

- A. Mechanical Contractor shall furnish and install duplex sump pump complete with a cast iron mounting cover and curb ring which will mount on the floor over the sump. Sump will be constructed by the General Contractor but this Contractor shall coordinate his work so that mounting cover will set properly on the floor opening provided.

- B. Sump pumps as scheduled on Drawings or approved equal. Each motor shall be provided with an across the line magnetic starter having three pole protection. Each pump shall be equipped with copper float and float switch for automatic operation. Provide mechanical or electrical alternator to switch the starting of the pumps from one to the other. Mechanical alternator is preferred, but if electrical alternator is used, it shall be Allen Bradley.
- C. Provide high level alarm switch complete with transformer, bell and one set of 120 volt A.C. rated normally open contact for connection to owners FCMS system.
- D. Provide a complete wiring diagram for this installation with submittal data.

2.04 FLOOR DRAINS:

- A. Floor drains (F.D.) shall be sized to conform to the information indicated on the Drawings or contained elsewhere in these Specifications. Extreme care shall be used to set the elevation of the drain to meet the low point elevation of the finished floor. Each floor drain shall be provided with a P-trap unless noted otherwise. Note that a deep seal type trap may be required under other Sections of these Specifications.
- B. All floor drains will be furnished and installed with all accessories required for the particular construction in which they are to be mounted; and shall be as manufactured by Wade, Josam, Zurn, or approved equal.
- C. Floor Drain (or Shower Drain) Type A (FD "A"): Wade W-1100, cast iron floor drain with integral reversible clamp device, caulk device, caulk outlet and round adjustable nickel brass strainer.
- D. Floor Drain (FD "B"): Wade W-1100-TS cast iron floor drain with integral reversible clamp device, caulk device, caulk outlet and seven inch (7") diameter adjustable cast iron strainer.
- E. Floor Drain Type C (FD "C"): Same as FD "B" except no trap.
- F. Floor Drain Type D (FD "D"): Wade W-1100-EF6 cast iron floor drain with integral reversible clamp device, caulk device, caulk outlet and round adjustable nickel brass strainer with six inch (6") diameter funnel.
- G. Floor Drain Type E (FD "E"): Wade W-1700 cast iron floor drain with flange, caulk outlet and hinged grate.
- H. Floor Drain Type (FD "F"): Wade W-1100-D cast iron floor drain with integral reversible clamp device, caulk outlet and six inch (6") diameter adjustable hinged nickel brass strainer.

2.05 HUB DRAINS (H.D.):

- A. Hub drains (H.D.) located at, or near, Owner furnished equipment shall be cast iron soil pipe hubs or hub adaptors set flush with finished floor. Install in all such hubs or hub adaptors a Wade WL-8450-R cast iron cleanout ferrule with slotted head plug and round stainless steel access cover. Each hub drain shall be provided with a P-trap.
- B. Hub drains for other services shall be cast iron soil pipe hubs or hub adaptors set with top of hub one-half inch (1/2") above finished floor. Each hub drain shall be provided with a P-trap.

2.06 CLEANOUTS:

- A. At each change in direction, at the end of each continuous waste line, at the foot of each riser in the building and at 50' intervals in long horizontal runs, of lines of four inch (4") size and smaller, and not more than 95' intervals for larger lines, cleanouts shall be placed in soil and waste lines. The size of the cleanouts shall be identical with the size of the soil or waste line in which they are placed for four inch (4") and smaller lines. The size of cleanouts in lines larger than four inches (4") shall be six inches (6") in all cases. All cleanouts shall be placed to be easily accessible for servicing. Where they occur in pipe chases, they shall be placed above the floor in such a location so they will be easily accessible through access doors, or they shall be brought through the walls and be provided with covers. All horizontal soil and waste lines shall have a cleanout placed in the end of the line by the use of a wye and a 1/8 bend, or by a combination tee-wye and made easily accessible by extending the cleanout through the wall and be covered as described above. The screw plug of all cleanouts shall be of cast brass.
- B. The bodies of floor cleanouts shall be tapped for iron pipe threads. The brass tap screws shall have flange caps with raised nuts. Wherever such cleanouts occur in finished floor slabs or terminate in finished walls, they shall be provided with scoriated nickel bronze cleanout covers of such a size as to make the plugs over which they are installed readily accessible. These cleanouts shall be cast iron floor cleanout with cut-off ferrule, tapered brass plug with eight inch (8") round screwed brass access cover with three-eighths inches (3/8") diameter Allen Head Screw.
- C. Finished Floors and Concrete Floors, Round Top. Primer coated cast iron floor cleanout with SV hub outlet, taper thread bronze plug, threaded adjustable housing and ferrule, membrane flange, secured/vandal proof, round-heavy duty satin finished nickel bronze scoriated top that adjusts to finished floor after concrete has set. For cleanouts located under carpet floors provide an integral carpet marker to indicate location after floor carpeting is installed. Reference Architectural drawings for areas with carpet floors. Jay R. Smith No. 4033L (service weight Speedi-Set hub outlet)-F-C-U (-Y, where applicable), Josam 5600-15-22-41-MODIFIED for Heavy Duty Top (-14, where applicable)-Y, Wade W-6030-D-X-5-26-75-Threaded/Machined for Clamp Device (-72, where applicable) or Zurn ZN-1400 (Neo-Loc)-BP-HD-KC-VP (-

CM, where applicable). Set top of floor cleanouts such that top is flush with finished floor.

- D. Outside Areas, Round Top. Primer coated cast iron, extra heavy traffic duty floor cleanout with taper thread bronze plug, threaded adjustable housing with flanged ferrule, secured/vandal proof, round, extra heavy duty, gasketed satin finished nickel bronze scoriated top that adjusts to finished grade in field after installation. Cast cleanouts flush in a 16" by 16" by 6" thick concrete pad. Concrete pad and cleanout shall be installed such that the top of pad and cleanout top are both set with top flush with finished grade. Jay R. Smith No.4113L~U (service weight Speedi-Set hub outlet), Josam 56040-1-15-22-Y, Wade W-6O30-Z-XS-1-5-75 or Zurn ZN-1400 (Neo-Loc)-BP-MODIFIED for Extra Heavy Duly Top-VP. Set top of exterior floor cleanouts such that top is flush with finished grade.
- E. Finished Walls. Primer coated cast iron cleanout tee with countersunk head, taper treaded bronze plug, No-Hub connections and 6-inch diameter-smooth-stainless steel secured access cover with secured/vandal proof screw. Jay R. Smith 4532S-U-Y, Josam 58790-15-MODIFIED for No Hub connections, Wade W-8460-R6-5-MODIFIED for No-Hub connections or Zurn Z-1446-NH-BP-VP.
- F. Unfinished Areas. Primer coated cast iron cleanout tee with countersunk head, taper thread bronze plug and No-Hub connections. Jay R. Smith 4512S-Y, Josam 58910-Z, Wade W-8560-MODWIED for No-Hub connections-D or Zurn-1445-NH-BP.
- G. Lab Waste Floor Cleanouts, Finished Floors, Outside Graded Areas and Exterior Cleanouts. 10 inch diameter, secured/vandal proof, round, heavy duty, satin finished nickel bronze scoriated top type cleanout access frame and cover. Jay R. Smith No. 4810-08-U, Josam 58610-MODIFIED for 10-inch diameter cover-10-15, Wade W-8300-C10-5 or Zurn ZNAB-1463-11-inch diameter cover-VP. Set top of floor cover such that top is flush with finished floor (including tile). Installation shall be exact, top of cleanout cover shall be set to the exact finished floor level, No tolerance will be allowed on this item. Extend lab waste cleanout to bottom of cleanout top, caulk annular space between cleanout and concrete floor watertight with sleeve, insulation, tape and Linkseal per Section 22 66 00. Secure cover to concrete floor with expansion bolts and - top flush with finished floor. Cleanout shall be same material as piping.
- H. Lab Waste Wall Cleanouts, Finished Walls. 8-inch square, secured/vandal proof, satin finished nickel bronze scoriaed face-of-wall cover type access frame and cover. Jay R. Smith No. 4730-08X08-NB-U, Josam 58631-15, Wade W-8480-ST8-5 or Zurn ZNAB-1462 (7-1/2 inch cover)-VP. Set on wall such that cover is flush with finished wall. Extend lab waste cleanout to within 3-inches (in depth) from access door and center in respect to access door opening for easy access. Installation shall be exact, cleanout cover shall be set exact, and no tolerance will be allowed on this item. Adequately secure frame and cover to wall studs or CMU block. Provide additional

blocking in wall to ensure a rigid and permanent installation Cleanout shall be same material as piping.

2.07 STRAINERS:

- A. Strainers, 2" and smaller, bronze body, screwed ends, No. 10 mesh strainer, screwed cap with bronze blow-off valve (size to be determined by standard tap size in cap). Cast iron body, 2 1/2" and larger, isolating type flanged ends where installed in copper lines, No. 7 perforated monel strainer, flanged cap with bronze ball blow-off valve (size of blow-off valve shall be determined by standard tap size in cap). Special Note: All strainers 6" and larger shall have studs mounted in the body flange in lieu of bolts for removal of cap. Baskets for strainers 6" and larger shall have stainless steel reinforcing bands at ends to prevent collapsing.
- B. Suction diffusers shall be Paco or approved equal, cast iron body and cover, steel diffuser, and stainless steel strainer, 125 pound ASA (flat face) flange for a working pressure of 175 psi and temperature of 300°F.

2.08 BACKFLOW PREVENTERS:

- A. Backflow preventers (BFP) shall be reduced pressure type, Febco 825, or approved equal. A BFP shall be installed to isolate all non-potable water requirements from the building domestic water system. (All BFP's shall be installed within the building.)

2.09 SEWAGE EJECTOR:

- A. Furnish and install a cast iron basin minimum forty-two inch (42") diameter and four feet (4') deeper than lowest inlet entering it. Furnish and install a steel basin cover with openings for pumps, float rods, full-size manhole and vent connection. All parts to be machine-fit, gasketed gas-tight.
- B. Duplex sewage ejector, as scheduled on Drawings, shall be as manufactured by Weil, or approved equal. Each motor shall be provided with an across the line magnetic starter having 3-pole overload protection. Each pump shall be equipped with enclosed drip-proof automatic float switches, pedestal mounted. Float switches to have complete automatic accessories, including a heavy copper float, a guided float rod and adjustable stop. Provide mechanical or electrical alternator to switch the starting of the pumps from one to the other. Mechanical alternator is preferred but if electrical alternator is used it shall be Allen Bradley Company.
- C. Provide high-level alarm switch complete with transformer, bell and one set of 120 VAC rated normally open contacts for connection to future Central Data Acquisition System.
- D. Provide a complete wiring diagram for this installation with submittal data.

E. Valve Boxes:

1. For each underground valve installed by the Contractor, the Contractor shall provide and install a two-piece, screw adjustable type valve box. These valve boxes shall be designed for heavy roadway service and they shall have a deep socket type of cover which prevents their being accidentally knocked out of position.
2. The word "**WATER**" shall appear on each cover. The installation of these members shall be such that by the use of the adjustable screw type bodies the tops are just flush with the finished grade. These valve boxes shall be Tyler Pipe Industries #6850, or approved equal.

2.10 MANHOLES:

- A. Manholes shall be constructed in accordance with the Drawings, of reinforced concrete or sewer brick. The flow channel shall be true to line and grade and shall be built of concrete or 1/2 section of pipe. If made of concrete, it shall be trowelled to a smooth, hard finish. Cast iron frames and covers shall be imbedded in a full bed of mortar and shall have a full bearing with top at the established grade. Cast iron steps shall be placed fifteen inches (15") on centers vertically, and staggered twelve inches (12") on centers horizontally, securely imbedded in the wall. Where pipe sewers are connected to manholes, the connection shall be made by cutting an opening into the wall of the structure, inserting the end of the pipe until it is flush with the inside face of the structure and completely filling the space between the pipe and structure with concrete or mortar.
- B. Reinforced concrete pipe shall conform to the current Specifications for "Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe", ASTM Designation C-76, Class III. Concrete shall have an average compressive strength at 28 days equal to or greater than 3000 psi (pounds per square inch). Proportion concrete shall be composed of one (1) part cement and twelve (12) parts aggregate.
- C. Sewer brick made from clay or shale shall conform to the current Specifications for "Sewer Brick," ASTM Designation C-32, Grade NA.
- D. Sewer brick made from concrete shall conform to the current Specifications for "Concrete Building Brick", ASTM Designation C-55, Grade A.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Pipe relief from back flow preventer to nearest drain.
- E. Install water hammer arrestors complete with accessible isolation valve [on hot and cold water supply piping to lavatories, sinks, and washing machine outlets].
- F. Lead: It is forbidden that lead in any form be used in any water system other than waste. If lead is used in the fabrication or installation of any water system other than waste, then all of the installed equipment and material, which may have come in contact with the lead, shall be marked with bright red or orange spray paint, and shall be removed from the project site. The system(s) shall then be restored and re-installed using all new materials.

END OF SECTION

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OFPC Standard Specification

SECTION 22 63 13

MEDICAL GAS SYSTEMS

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OFPC Standard Specification

SECTION 22 63 13

MEDICAL GAS SYSTEMS

PART 1 GENERAL

1.00 The following sections are to be included as if written herein:

- A. Section 23 00 00 – Basic Mechanical Requirements
- B. Section 23 05 29 – Sleeves, Flashings, Supports and Anchors
- C. Section 23 05 53 – Mechanical Identification

1.01 SECTION INCLUDES

- A. Medical Oxygen Gas System
- B. Medical Compressed Air System
- C. Medical Vacuum System
- D. Nitrous Oxide System
- E. Nitrogen System

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 01 11 00 - Summary of Work: Owner installed [oxygen tank] [_____].
- B. Section [_____ - _____]: Placement of [ceiling mounted outlets] [oxygen bulk storage facilities].

1.03 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 01 11 00 - Summary of Work: Owner furnished liquid oxygen bulk storage.
- B. Section [_____ - _____]: Supply of [bottled medical gases] [integrated wall systems] for placement by this section.

1.04 RELATED SECTIONS

- A. Section 31 23 16 - Excavating
 - B. Section 31 23 23.13 - Backfilling
 - C. Section [] - Hospital Equipment: Prefabricated Patient Bedside Units
 - D. Section 23 05 48.UT - Vibration Isolation
 - E. Section 23 07 19.UT - Piping Insulation
 - F. Section 22 13 16.UT - Plumbing Piping
 - G. Section 26 27 26.UT - Wiring Devices
 - H. Section 26 05 00 - Equipment Wiring Systems
- 1.05 ALLOWANCES
- A. Cash Allowance: Include under provisions of Section 23 00 00.
 - B. Allowance includes purchase and delivery of bottled gases. Installation is included in this section and is part of the Contract Sum/Price.
 - C. Allowance includes cost of testing and certifying systems in accordance with cross connection tests.
- 1.06 REFERENCES
- A. ANSI B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings
 - B. ANSI B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - C. ANSI B40.1 - Gauges, Pressure and Vacuum, Indicating Dial Type-Elastic Element
 - D. ASME Boiler and Pressure Vessel Code
 - E. ASTM A167 - Stainless and Heat-Resisting Chromium - Nickel Steel Plate
 - F. ASTM A269 - Stainless and Welded Austentic Stainless Steel Tubing for General Service
 - G. ASTM A403 - Wrought Austentic Stainless Steel Piping Fittings
 - H. ASTM B32 - Solder Metal

- I. ASTM B88 - Seamless Copper Water Tube
- J. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration field Service
- K. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- L. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- M. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- N. AWS A5.8 - Brazing Filler Metal
- O. CGA G-7 - Compressed Air for Human Respiration
- P. CGA P-2.1 - Medical-Surgical Vacuum Systems in Health Care Facilities
- Q. CGA V-5 - Diameter Index Safety System Non Interchangeable Low Pressure Connections for Medical Gas Applications
- R. FM - Factory Mutual System - Approval Guide
- S. FS TT-P-645 - Primer, Paint, Zinc Chromate, Alkyd Type
- T. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
- U. FS WW-V-35 - Valve Ball
- V. FS WW-V-54 - Valve, Gate, Bronze (125, 150 and 200 Pound, Screwed, Flanged, Solder End, For Land Use)
- W. MIL-R-36557 - Regulator, Pressure, Medical Gas Administration Apparatus
- X. MIL-V-82026 - Valves, Diaphragm, Stop
- Y. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture
- Z. MSS SP-69 - Pipe Hangers and Supports - Selection and Application
- AA. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- BB. NFPA 50 - Bulk Oxygen Systems at Consumer Sites

CC. NFPA 99 - Standard for Health Care Facilities

1.07 SUBMITTALS

- A. Submit under provisions of Section 23 00 00.
- B. Shop Drawings: Indicate general assembly of components, mounting and installation details, and general layout of control and alarm panels. Submit detailed medical wall assembly drawings.
- C. Product Data: Provide manufacturers literature and illustrations for all components indicating size, dimensions and configuration.
- D. Samples: Submit [two] [] of [each outlet] [each valve] [].
- E. Independent Testing Agency Reports: Indicate systems are complete, zone valves installed, alarm systems functional, and pressure and cross connections tests performed. Document tests.
- F. Manufacturer's Installation Instruction: Indicate requirements for equipment and systems.

1.08 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 23 00 00.
- B. Record actual locations of piping, valving, and outlets.

1.09 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 23 00 00.
- B. Operation Data: Include installation instructions, assembly views, lubrication instructions, and assembly views.
- C. Maintenance Data: Include maintenance and inspection data, replacement part numbers and availability, and service depot location and telephone.

1.10 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 99 **and these specifications.**
- B. Maintain one copy of each document on site.

1.11 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.
- B. Installer: Company specializing in performing the work of this Section with minimum three years documented experience. **All installing mechanics shall hold current (within six months) certification for medical gas as issued by the State Board of Plumbing Examiners. Evidence of certification shall be presented to the OFPC RCM prior to any work on the medical gas systems.**
- C. Testing Laboratory: Company specializing in performing the testing of this Section with minimum three years documented experience.

1.12 REGULATORY REQUIREMENTS

- A. Conform with applicable codes for medical gas systems.
- B. Provide certificate of compliance from [_____] indicating approval of systems.

1.13 MOCKUP

- A. Provide mockup of typical medical wall unit under provisions of Section 23 00 00.
- B. Mockup may [not] remain as part of the Work.

1.14 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, store, protect and handle products to site under provisions of Section 23 00 00.
- B. Accept material on site in factory containers and packing. Inspect for damage.
- C. Protect from damage and contamination by maintaining factory packaging and caps in place until installation.

1.15 SCHEDULING

- A. Schedule work under the provisions of Section 23 00 00.
- B. Schedule Work to ensure equipment is installed and systems tested and certified prior to substantial completion.

1.16 EXTRA MATERIALS

- A. Furnish under provisions of Section 23 00 00.

- B. Provide [two] [] of [each size of valve] [].

1.17 SCOPE:

- A. Provide all labor, materials, equipment, tools and services and perform all operations required in connection with or properly incidental to the installation and testing of oxygen, nitrogen, nitrous oxide, compressed air and vacuum piping systems including fittings, valves, medical gas outlets, air compressors, nitrogen and nitrous oxide manifolds, vacuum pumps, alarms, etc. for complete operable systems.
- B. The stock and model numbers of equipment listed hereinafter identify equipment manufactured by NCG Division of Chemetron Corp., Chicago, Ill. Equal equipment by Nash Engineering Company will be acceptable.

PART 2 PRODUCTS

NOTE TO SPECIFICATION WRITER: CONSIDERABLE EDITING WILL BE REQUIRED FOR THIS SECTION TO DELETE REFERENCES TO INAPPLICABLE EQUIPMENT AND TO ADD DETAILED SPECIFICATIONS FOR APPLICABLE EQUIPMENT NOT INCLUDED IN THIS GUIDELINE.

2.01 PIPING:

- A. All piping for vacuum and gases of every character shall be ASTM Specification B-88, Type L, hard drawn, seamless copper tubing with wrought copper solder fittings. No ferrous piping will be permitted in the system. Where threaded nipples are required these shall be I.P.S. brass. All vacuum and oxygen piping shall be purged with dry nitrogen while being soldered.
- B. All piping shall be pitched back so as to drain to the point shown on the Drawings. All branch takeoffs shall be made from the top of the mains.
- C. Oxygen piping buried in the ground shall be Type K, hard drawn and installed in trenches not less than 42" deep.
- D. Fittings for copper tube shall be wrought copper fittings and attached with silver solder alloy containing not less than 50% silver. All **joining operations** shall be done with **pure** dry nitrogen flowing through the pipe to prevent oxidation and scale information. **During joining operations, nitrogen flow shall be verified by an oxygen sensor at the free end of the piping and by a pressure alarm on the nitrogen supply. When there are no active joining operations being performed, the system shall be securely sealed and maintained with a nitrogen charge in the sealed system.**

- E. Before erection, all pipe, tubing, valves and fittings (except those supplied expressly cleaned for oxygen, nitrogen, nitrous oxide, air-and-vacuum service by manufacturer) shall be thoroughly cleansed of all grease, oil and other combustible materials by washing in a hot solution of sodium carbonate or trisodium phosphate mixed in equal proportions of one pound to three gallons of water. Scrubbing and continuous agitation of the parts shall be employed where necessary to remove all deposits and to insure complete cleansing. After washing, all materials shall be rinsed thoroughly in clean, hot water. After rinsing, great care must be exercised in the storage and handling of all materials and in the condition of tools used in cutting and reaming to prevent oil or grease being introduced into the tubing. Where such contamination is known to have occurred, the materials affected must be rewashed and then rinsed.
- F. Where screwed connections are required at equipment, suitable adapters shall be provided with threaded connections. A thin paste of litharge and glycerin shall be applied to the external threads only.
- G. After erection of pipe and tubing, but prior to installation of the service outlet valves, each system shall be blown clear of moisture and foreign matter by means of dry nitrogen or oil free air.
- H. After installing service outlet valves, each system shall be subjected to a test pressure of 150 psig by means of water-pumped (oil free) nitrogen or air. This test pressure shall be maintained until each joint has been thoroughly examined for leaks by means of soapy water. A soap solution mixed in the following proportions should be used: one ounce of Castile or palm oil soap, eight ounces of water, and four ounces of glycerin. Dissolve the soap in the water, add the glycerin and mix thoroughly. Wipe joints clean after test. All leaks shall be properly repaired and the system retested.
- I. A final test shall be 24 hours standing pressure test with water pumped (oil free) air or dry nitrogen at 150 psig to check the completeness of prior joint pressure tests. If water pumped nitrogen is used, particular care must be exercised to assure that it is all flushed out with oxygen before placing the system in service.
- J. Oxygen, nitrogen, nitrous oxide, and medical air systems shall be finally cleaned using the high-pressure pulse-purge procedure described in NFPA 99. During this procedure, sufficient volume of dry nitrogen shall be provided to insure a minimum velocity of 2000 fpm in the largest section of pipe being cleaned. Note: It is not required that the entire system be tested at one time. The system can be divided into convenient sections. Upon the successful completion of the operation on a section, it shall be sealed and left with a holding charge of dry nitrogen.

2.02 SERVICE OUTLETS:

- A. Wall type service outlets shall be installed where indicated on Drawings approximately 50" above finished floor unless otherwise directed. Outlets shall be modified NCG 378

D.I.S.S. series, quick release type as listed by Underwriters Laboratories, designed for recessed piping. Each service shall be housed in a special designed back box, assembled complete with special stainless steel cover plate, plaster flanges and tubing guards ready for rough wall mounting, and with an 8" of 1/4" nominal I.D. Type "K" copper tubing for completing the connection to the service line. Check Units shall be safety keyed to prevent interchangeability of services. They shall have a self sealing dust plug and a primary and secondary check, both of which shall seal simultaneously when equipment is not attached. The Check Units for each service shall be pressure tested at the factory and furnished completely assembled except for the stainless steel cover plates. A color coded nameplate identifying the gas service shall be affixed to each Check Unit to minimize the possibility of interchanging gas services during installation. Check Units shall be furnished with a protective cover imprinted with installation instructions and covering the inlet to prevent plaster dust or other foreign matter from contaminating the internal parts of the unit during installation. Check Units shall be designed so as to be completely serviceable from the front including removal of the secondary check and the filter screen without the use of special tools. Check Units shall be so designed that attachment or removal of equipment is a one hand operation and release mechanism shall be such that inadvertent pushing or bumping of the attached equipment will not tend to release it. The outlet, when installed, shall have no projections beyond the finishing cover plate. Where more than one service is indicated at a single location, they shall be combined into a multiple unit under a single cover plate. See Drawings for details of special cover plates and for special service panels which combine gas service outlets and electrical items.

- B. Ceiling type recessed service outlets shall be installed where indicated on Drawings. Outlets shall be modified NCG 376 D.I.S.S. series and shall meet the requirement for wall type service outlets specified hereinbefore, including special cover plates, back boxes, pin indexing between fascia and matching, keyed slot in channel slot box saddle. Coupler for attachment of hose and adaptor connecting thereto, shall be threaded type meeting Compressed Gas Association (CGA) D.I.S.S. specifications. Hose shall be of plastic, conductive type, color coded for identity of service and terminating at a point 7'-0" above finished floor, in quick release, color coded female couplers, safety keyed for gas service supplied. (Note: Ceilings in new addition at 10'-0", ceilings in remodel building at 9'-0".) Outlet back boxes shall be supported from overhead structure utilizing anti-sway bars as required to prevent movement of the outlets. Connect all ceiling outlets to an established common ground.
- C. High pressure ceiling or wall type recessed nitrogen outlets shall be installed where indicated on Drawings. Outlets shall be modified NCG 239590-64 and shall meet requirements for ceiling type recessed service outlets hereinbefore specified, including special cover plates, back boxes, etc. Outlet stations are to incorporate a quick disconnect valve mechanism functioning as follows:
1. Service attachment without opening pressure.

2. Pressure actuation in a succeeding mechanical function.
3. Pressure shutoff and bleed of entrapped pressure while holding hose secure.
4. Release of adapter and hose, a succeeding mechanical function, without high pressure entrapment. Provide a NCG No. 000606-63 nitrogen hose assembly with DynaCon male and female adapters. Length as required for termination at a point 7'-0" above finished floor.

2.03 MEDICAL GASES VALVES:

- A. Valves not in boxes shall be NCG bronze bodied, double seal, full flow ball type, with Teflon seat seals and O-ring packing designed for working pressures up to 300 psi with a chrome plated brass ball which seals in both directions. The valves shall be so designed that only a quarter turn of the lever type handle is necessary between the open and closed positions. Valves shall be supplied and properly washed for oxygen service. Gas service labels shall be provided for each service as required.
- B. Shutoff valves in recessed boxes shall be installed in boxes with back box constructed of 18 gauge Paintlok steel with a gray baked on semi gloss finish and with plaster flanges on all four sides for securing to wall. The valves shall be bronze bodied, double seal, full flow ball type with Teflon seat seals, O-ring packing designed for working pressures up to 300 psi, chrome plated bronze balls which seal in both directions, and adjustable Teflon stem seals and bearings, self compensating to guard against leakage due to wear. Tubing extensions shall be factory soldered to the valve flanges for connection to piping outside the box. Valves and tubing extensions shall be chrome plated, preassembled, pressure tested and rigidly mounted to the box for ease of installation. The valves shall require only a quarter turn of the handle to completely open or close. A color coded gas label shall be supplied with each valve, which can be marked to indicate the area controlled. The cover shall be of 18 gauge stainless steel with No. 4 brushed finish, and shall incorporate an internal service identification cover and shield, providing shutoff directions. The combination internal and external fascia shall attach to the box assembly without the use of screws, and shall compensate for variations in plastic thickness. Mounted in the finishing frame shall be a clear, rigid, vinyl window for easy access to the valve. Window shall contain a caution label reading: "CAUTION, CLOSE ONLY IN EMERGENCY" and "PULL RING TO BREAK WINDOW".

2.04 OXYGEN SUPPLY:

- A. The bulk oxygen storage and control equipment are existing. This Contractor shall connect to existing oxygen main and reroute as shown on the Drawings and extend as required to serve the new building. The system shall be complete in every respect.

2.05 NITROUS OXIDE MANIFOLD:

- A. The central supply of nitrous oxide shall be Chemetron Nitrous Oxide Manifold 90049.62, and shall consist of a wall mounted M800HF control unit and the necessary header connections and pigtailed for 20 cylinders. The controls shall be so arranged as to have 10 cylinders in service and 10 cylinders in reserve. Automatic switchover from service to reserve bank shall be accomplished without fluctuation in the hospital line pressure. Design and operation shall be consistent with good engineering practice and with current NFPA regulations. Three pressure gauges shall indicate bank and hospital line pressures. A green indicator light shall indicate when the service bank is in use and a red light shall indicate when the reserve bank is in use. Terminal block connections shall be provided for remote alarms. A visible indicator shall designate the service bank.

2.06 NITROGEN MANIFOLD:

- A. Shall be a Chemetron Duplex Nitrogen Manifold, 900010-62, and shall consist of a wall mounted M800HF control unit and the necessary header connections and pigtailed for 10 cylinders. The controls shall be so arranged as to have 5 cylinders in service and 5 cylinders in reserve. Automatic switchover from service to reserve bank shall be accomplished without fluctuation in the hospital line pressure. Design and operation shall be consistent with good engineering practice and with current NFPA regulations. Three pressure gauges shall indicate bank and hospital line pressures. A green indicator light shall indicate when the service bank is in use and a red light shall be provided for remote alarms. A visible indicator shall designate the service bank.

2.07 VACUUM PUMP AND ACCESSORIES:

- A. Provide vacuum pumping units for hospital service as scheduled on the drawings. Each unit shall be arranged for duplex operation and shall be complete with driving motors, tanks, automatic controls including alternates and accessories as hereinafter specified.
- B. Pumps shall have capacity as scheduled on the Drawings and shall be rotary liquid sealed type, cast iron body, bronze fitted; Nash Series OV, Ohmeda, or approved equal.
- C. Tank shall be welded steel, hot dipped galvanized after fabrication, inside and out; size as scheduled with gauge and necessary taps for pipe connections.
- D. Provide automatic control consisting of tank mounted adjustable vacuum switches, motor starters and disconnect switches, automatically starting and stopping vacuum pumps in duplex operation. Provide controls as required for automatic alternating of each pump.
- E. Provide vacuum relief valve, silencer and solenoid valve for water seal line to each vacuum pump. Wire solenoid valve to open and close with starting and stopping of

motor. Install Crane No. 8H-550 backflow preventer in water seal line to vacuum pump.

- F. Pipe air and water discharge from each pump to nearest floor drain with silencer and pipe trap installed as shown on the Drawings.
- G. A vacuum exhaust line shall be installed to exhaust vapors and odors to outside of building to point approved by Architect/Engineer. The exhaust line shall terminate adjacent to pumps in a drip leg of minimum 10" length with cock valve drain, for purpose of trapping condensates. Flexible hose connections and in-line exhaust mufflers shall be installed as shown on Drawings.

2.08 AIR COMPRESSOR AND ACCESSORIES:

- A. Provide central compressed air units for hospital service, each consisting of single stage rotary air compressors with driving motors, control tanks, automatic controls, and accessories as specified and scheduled.
- B. Each compressor shall be rotary liquid sealed positive displacement type cast iron pump bronze fitted; Nash Series OC or approved equal.
- C. Provide welded steel control tank hot dipped galvanized after fabrication, inside and out, for each unit. Provide vertical tank, size as scheduled; with gauge and necessary taps for pipe connections, equipment with gauge glass, pressure gauge and constant pressure valve.
- D. Provide automatic controls consisting of tank mounted adjustable pressure switches, motor starters, and disconnect switches automatically starting and stopping pumps between desired limits in duplex operation. Provide controls as required for automatic alternating of compressors.
- E. Filter and dehydrate air by non-cycling mechanical refrigeration type dehydrator, as scheduled, Hankinson Refrigifilter, or approved equal for each addition. Provide hydrator complete with heat exchanger, condenser evaporator integral moisture and oil separator, mechanical cartridge of acetate fiber construction enclosed in an ASME coded pressure vessel designed for maximum operating pressure of 200 psig. Furnish unit complete with automatic condensate discharge valve, temperature and pressure gauges, running lights and compound gauge to indicate chiller performance. Dehydrator shall be capable of reducing the dew point to 35 degrees F. at pressure, with minimum pressure drop across the unit.

2.09 AIR AND VACUUM VALVES:

- A. Stop valves at compressors, tanks, vacuum pumps, and in air and vacuum piping shall be Jenkins 32A bronze ball valves with screwed connections and Teflon seats.

2.10 FINAL CHECKING AND OPERATING INSTRUCTIONS:

- A. A representative of the equipment manufacturer shall periodically check with the Contractor during initial installation of the pipeline systems equipment. He shall assist the Contractor in final check to make certain that all systems are in perfect operating condition. The equipment manufacturer's representative shall provide 8 hours of instruction to the personnel in the use of the piping systems and the related equipment which is operated from those systems.

2.11 LABORATORY FITTINGS:

- A. Laboratory fittings will be furnished to the job site by the laboratory equipment supplier, with necessary holes cut in the laboratory equipment. The Mechanical Contractor shall receive, store and install the fittings and make all necessary connections thereto.

2.12 STANDARDS AND CODES:

- A. The recommendations of the National Fire Protection Association (NFPA) as set forth in Pamphlet No. 56, 565 and 566, and the "Standard for Medical/Surgical Vacuum Systems in Hospitals" as set forth in Compressed Gas Association (CGA) Pamphlet No. P-2.1, Second Edition 1967, shall apply to this installation and shall be adhered to in all respects.

2.13 ALARM SYSTEMS:

- A. The alarm systems for all services shall be consolidated into one integrated panel and shall be installed complete with all necessary sensing, sending and display devices. All signals shall be flush mounted with facility for job site service identification and shall incorporate:
 1. Brushed stainless steel fascia.
 2. Visual indication of whether circuit is energized.
 3. Audible buzzer recording of all signal impulses.
 4. Not Used.
 5. Reset permitting silencing of audible buzzer but not allowing cancellation of visual identify until situation has been corrected.
 6. Shall be listed as an assembly by Underwriters Laboratories, Inc.

7. Ability to receive and properly record by audible buzzer of any combination of sequential signal.
8. The signal panel shall be equipped with a "test" button which shall actuate for test, all visual and audible alarms.
9. The panel shall be of modular construction, facilitating service and maintenance.
10. Power supply boxes shall remain mounted and connected as required by manufacturer.
11. Pressure switches shall be mounted in the pipe lines to be sensed and shall be connected as required by manufacturer.

NOTE TO SPECIFICATION WRITER: SEVERAL ALARM PANELS WITH MORE OR LESS SIGNALS MAY BE REQUIRED BY CODE FOR DIFFERENT SECTIONS OF THE BUILDING. THE FOLLOWING IS AN EXAMPLE AND IS NOT INTENDED TO BE REPRESENTATIVE OF THE NEEDS FOR THE PROJECT.

B. Signal panel with ten alarms:

1. Signal panel with ten alarms shall NCG No. 180210-64 and shall contain the following alarms:

NOTE TO REVIEWER: YOU WILL SEE THAT TWO SETS OF ALARM POINTS ARE LISTED BELOW. THE FIRST SET IS INCLUDED IN THE ORIGINAL FORM OF THE U.T. SYSTEM MECHANICAL GUIDELINE SPECIFICATION. THE SECOND IS SUGGESTED BY CSI, AND MAY BE WORTH CONSIDERING. PLEASE SUBMIT YOUR THOUGHTS WITH YOUR COMMENTS.

ORIGINAL

Oxygen line pressure	high
Oxygen line pressure	low
Nitrous Oxide line pressure	high
Nitrous Oxide line pressure	low
Nitrous Oxide reserve supply	reorder
Nitrogen line pressure	high
Nitrogen line pressure	low
Nitrogen reserve supply	reorder
Air line pressure	low
Vacuum line pressure	low
Push to test	

CSI Suggested

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- a. Oxygen reserve supply in use.
- b. Oxygen line pressure high.
- c. Oxygen line pressure low.
- d. Air line pressure high.
- e. Air line pressure low.
- f. Air lag pump on.
- g. Vacuum line pressure above normal.
- h. Vacuum line pressure below normal.
- i. Vacuum lag pump on
- j. Nitrous oxide reserve supply in use.
- k. Nitrous line pressure high.
- l. Nitrous line pressure low.
- m. Nitrogen reserve supply in use.
- n. Nitrogen line pressure high.
- o. Nitrogen line pressure low.

A. Monitoring Gauges:

- 1. Monitoring gauges shall be NCG No. 480991-64 and shall be complete with brushed stainless steel fascia with services identified, plastic protective dial free, back box, check valves, and 3/8" sensing line. Provide valves to isolate gauge from pressure line. These gauges shall be installed in the locations as required by NFPA Code and where indicated on the Drawings.

PART 3 EXECUTION

- 3.01 Install in complete compliance with governing Codes and manufacturers instructions.

- 3.02 Except for piping and pipe fittings, all components shall be supplied by a single manufacturer and shall be fully compatible with Owner's existing system and service devices.
- 3.03 Tests to include procedures described in NFPA 99, Sections 4-3 through 4-10 and the procedures contained elsewhere in these specifications. See 2.01 G-J. Provide to Owner a notarized letter of certification from equipment manufacturer certifying the following:
- A. No cross connections exist.
 - B. Alarm system is adjusted and performing to manufacturer's design.
 - C. All components have been installed, adjusted and are functioning in accordance with manufacturer's recommendations.
- 3.04 Verify compatibility of all new components with existing system and services.

END OF SECTION

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OFPC Standard Specification

SECTION 22 67 13.19

DEIONIZED WATER SYSTEM

This Standard Specification Section is controlled by the Office of Facilities Planning and Construction, UT System. It is to be used as guideline on all UT System projects, unless deviations are approved in writing by the Project Manager. It is not to be used for bidding, permitting, construction or any other purpose. This document is the property of UT System, and use of this document, in part or in whole, for any purpose other than for a UT System project may not be done without written permission of UT System.

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The issuance and revision history of this section is tabulated below. Please destroy any previous copy in your possession.

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0	March 1998	10	Original
1	May 2004	1	Revised Cover Page
2	February 2007	11	Format, 1.00

OFPC Standard Specification

SECTION 22 67 13.19

DEIONIZED WATER SYSTEM

PART 1 GENERAL

1.00 The following sections are to be included as if written herein:

- A. Section 23 00 00 – Basic Mechanical Requirements
- B. Section 23 05 29 – Sleeves, Flashings, Supports and Anchors
- C. Section 23 05 53 – Mechanical Identification

1.01 SECTION INCLUDES

- A. Pipe and Pipe Fittings

1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 01 11 00 - Summary of Work: Owner furnished purified water polishers, [_____].

1.03 RELATED SECTIONS

- A. Section 03300 - Cast-in-Place Concrete
- B. Section 21 05 48.UT - Vibration Isolation
- C. Section 22 13 16.UT - Plumbing Piping
- D. Section 26 05 19 - Cable, Wire and Connectors, 600 Volt: Electrical characteristics, cable, wire, materials
- E. Section 26 27 26.UT - Wiring Devices and Floor Boxes: Wiring connections

1.04 REFERENCES

- A. ASME - Boiler and Pressure Vessel Code
- B. ASME B16.3 - Malleable Iron Threaded Fittings

- C. ASME B16.18 - Cast Bronze Solder-Joint Pressure Fittings
 - D. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings
 - E. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes
 - F. ASME B31.9 - Building Services Piping
 - G. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
 - H. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses
 - I. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
 - J. ASTM B32 - Solder Metal
 - K. ASTM B88 - Seamless Copper Water Tube
 - L. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe
 - M. NFPA 70 - National Electrical Code
- 1.05 SUBMITTALS
- A. Submit under provisions of Section 23 00 00.
 - B. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.
 - C. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.
 - D. Test Reports: Submit inspector's certificate for air receiver for inclusion in Operating and Maintenance Manuals.
 - E. Manufacturer's Installation Instructions: Indicate hoisting and setting requirements, starting procedures.
- 1.06 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of Section 23 00 00.

- B. Record actual locations of equipment and components. Modify shop drawings to indicate final locations.
- 1.07 OPERATION AND MAINTENANCE DATA
- A. Submit under provisions of Section 23 00 00.
 - B. Operation Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.
 - C. Maintenance Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.
- 1.08 REGULATORY REQUIREMENTS
- A. Conform with applicable ASME codes for installation of pressure vessels.
 - B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.
- 1.09 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site under provisions of Section 23 00 00.
 - B. Accept delivery of packaged deionized water equipment, storage vessel, etc. on site in factory fabricated containers with shipping skids and pipe end protectors in place. Inspect for damage.
 - C. Protect piping and equipment from weather and construction traffic.
- 1.10 WARRANTY
- A. Provide five-year warranty under provisions of Section 23 00 00.
 - B. Warranty: Include coverage for deionized water system, storage tank, [_____].
- 1.11 MAINTENANCE MATERIALS
- A. Provide maintenance materials under provisions of 23 00 00.
- PART 2 PRODUCTS
- 2.01 The Reverse Osmosis Unit shall be furnished and installed by Continental Water Conditioning Corporation who shall also furnish and install the miscellaneous pipe and electrical work from points shown on the Drawings to complete the installation.

2.02 The deionized water cartridge units shall be furnished and installed by Continental Water Conditioning Corporation who shall also furnish the water quality controller that operates solenoid valves, local alarm for used-up cartridge bank, solenoid valves, miscellaneous piping and electrical work from points on the Drawings to complete the installation.

2.03 The Contractor's work shall include furnishing and installing the following items:

Fiberglass Storage Tanks and Fittings
 Level Controllers
 Pumps
 Pressure Tanks
 Pressure Switch
 Pressure Gauges
 Valves
 Piping and Sleeving
 Mechanical Pump Alternator

2.04 SYSTEM CAPACITY:

- A. System shall have a capacity of [] gallons per day in a [] hour period and shall be capable of [] GPM maximum flow rate.
- B. Reverse Osmosis Unit shall have a capacity of [] GPM, requires [] PSI minimum entering pressure, power for [] volt, 3 phase, 60 Hz, [] HP motor, power from a [] amp, 115 volt single phase control circuit and provision for [] GPM to drain when unit is operating.
- C. Deionized cartridge system shall have a capacity of [] GPM [] PSI maximum pressure drop and requires power from a [].
- D. The Mechanical Contractor will not be responsible for system capacity or system water quality since he does not furnish the prime equipment. He shall be responsible for the equipment piping, etc., that he furnishes and installs to meet the provision of Drawings and Specifications.

2.05 PIPING, VALVES AND FITTINGS (Polypropylene):

- A. Pipe valves and fittings for purified water service shall be Schedule 40, virgin, unpigmented polypropylene.
- B. Installation practices, including support spacing and joint fusion, shall be in compliance with manufacturer's printed recommendations.

- C. Materials from which pipe, fittings and valves are manufactured shall have been tested and approved for conveying potable water by the National Sanitation Foundation (NSF). All pipe, fittings and valves shall bear the NSF hallmark indicating that the material has been tested and approved for conveying deionized water by the national Sanitation Foundation, and shall be as manufactured by Enfield Industrial Corporation, GSR R&G Sloane Manufacturing Company ("PPRO-SEAL") or approved equal.
- D. To ensure installation uniformity, all system piping components shall be the products of one manufacturer.
- E. All piping shall be thoroughly rinsed and flushed to remove all dirt and debris before installation. After installation the Contractor shall flush the entire piping system with deionized water to the satisfaction of the Owner.
- F. The piping shall be sleeved only in return air plenums. Contractor shall provide a sleeved system through the installation of grooved Schedule 10 galvanized piping and couplings. The sleeve piping shall be no less than 2 inches greater diameter than the polypropylene piping contained within it. Only rolled groove piping may be used. The Victaulic "Fit" fittings and piping system, or any similar set screw type fitting system is specifically prohibited. Vic-Let and Vic-O-Well or similar type fittings are specifically prohibited for use on this project. Where a reduced tee fitting is required, then a reducing tee or regular tee with bell reducer shall be used. If any of the above described prohibited materials or installation methods are used, then the material or installation method shall be corrected at the contractor's expense.
- G. Valves shall be ball valve type and shall be manufactured of the same virgin, unpigmented molding compound as the fittings to assure compatibility.
- H. All ball valves shall have Viton seals, and PTFE seats. Ball valves shall carry a pressure rating of 150 psi at a minimum of 68F, and shall be of True Union design as manufactured by Enfield Industrial Corporation, GSR R&G Sloane Manufacturing Company ("PPRO-SEAL") or approved equal.
- I. The contractor shall supply a fusion welding machine to the owner prior to completion of the project. The contractor shall also furnish training for a minimum of two of the owners personnel on the operation of the fusion machine, installation of the piping and fittings, and the maintenance required for the machine and piping systems. The training shall consist of a minimum of 4 hours at a location convenient to the owner, preferably on the owner's premises at the Physical Plant of the institution where this project is constructed. The training shall consist of actual course material designed for the training of maintenance and installation personnel, where actual hands-on training is involved. This training shall not be a sales session consisting of only sales literature and without hands-on training.

2.06 PIPING, VALVES AND FITTINGS (PVC):

- A. Pipe and fittings shall be polyvinyl chloride (PVC) Schedule 80, Type 1.
- B. Pipe, fittings and valves shall be manufactured from a PVC compound which meets the requirements of Type 1, Grade 1 polyvinyl chloride as outlined in ASTM D-1784. A Type 1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.
- C. Compound from which pipe is produced shall have a design stress rating of 2000 psi at 73 degrees F., listed by the Plastics Pipe Institute (PPI).
- D. Materials from which pipe, fittings and valves are manufactured shall have been tested and approved for conveying potable water by the National Sanitation Foundation (NSF).
- E. Pipe shall conform to the requirements of ASTM D-1785, as manufactured by Cabot Piping Systems, Louisville, Kentucky, or approved equal.
- F. Fittings shall conform to the requirements of ASTM D-2464 for solvent type, as manufactured by Cabot Piping Systems, Louisville, Kentucky, or approved equal.
- G. Manual valves shall be stainless steel ball type with Teflon seats, packing and gasket, Jenkins Figure 1336 or approved equal.
- H. Solenoid valve is to be especially designed for pure water service. Body is stainless steel with ethylene propylene elastomers. ASCO No. 8210C87E or approved equal.
- I. Installation practices, including support spacing and joint threading, shall comply with manufacturer's printed recommendations. In general, socket weld joints are preferred over threaded joints.
- J. To insure installation uniformity, all system piping components shall be the products of one manufacturer.
- K. The piping shall be sleeved only in return air plenums. Contractor shall provide a sleeved system through the installation of grooved Schedule 10 galvanized piping and couplings. The sleeve piping shall be no less than 2 inches greater diameter than the polypropylene piping contained within it. Only rolled groove piping may be used. The Victaulic "Fit" fittings and piping system, or any similar set screw type fitting system is specifically prohibited. Vic-Let and Vic-O-Well or similar type fittings are specifically prohibited for use on this project. Where a reduced tee fitting is required, then a reducing tee or regular tee with bell reducer shall be used. If any of the above described prohibited materials or installation methods are used, then the material or installation method shall be corrected at the contractor's expense.

2.07 DEIONIZED WATER PUMPS:

- A. Pumps shall be heavy duty plastic centrifugal type.
- B. Pump heads, sleeve and impeller shall be polypropylene. Seal shall be mechanical type.
- C. Capacity of each of the pumps shall be _____ GPM (to be filled in by Engineer) at _____ foot head (to be filled in by Engineer). Pump motor shall be _____ HP (to be filled in by Engineer), _____ volt (to be filled in by Engineer), 3 phase, 60 Hz.
- D. Each pump shall be provided with a fused safety switch and a magnetic starter providing overload and under voltage protection. A mechanical alternator shall automatically alternate the operation of the pumps.
- E. Pumps shall be furnished completed with Vanton, or approved equal, suction and discharge pressure gauge isolator-activators to separate gauge from deionized water.

2.08 LEVEL CONTROLLER:

- A. Level controller shall be full plastic body type with no metal parts in contact with deionized water. Controls shall be as manufactured by Plastomatic, or approved equal.

2.09 PRESSURE TANKS:

- A. Furnish and install four (4) heavy duty plastic pressure tanks with interior rubber sleeve. Each tank shall be approximately _____" diameter (to be filled in by Engineer) and _____" long (to be filled in by Engineer).
- B. Tanks shall be suitable for 75 psi pressure and 120 degree F. temperature.
- C. Tanks shall be Hydro-cell tanks as manufactured by Jacuzzi Brothers, or approved equal.

2.10 FLOW CONTROL VALVES:

- A. The Mechanical Contractor shall furnish and install a 3/8" PVC flow control valve in each and every deionized water outlet that limits the flow to 1/2 GPM. The Contractor shall supply and install a 2 GPM a natural, virgin, un-pigmented polypropylene flow control valve in each deionized water connection to washers.
- B. Flow control valves shall maintain a constant flow regardless of inlet pressure changes between 15 and 100 psig. No metal shall be in contact with the liquid.

- C. The flow control valves shall be Series "FC," as manufactured by Plastomatic Valves, Inc., or approved equal.

2.11 PRESSURE REGULATING VALVES

- A. Contractor shall supply and install, where shown on the drawings, socket fusion natural, virgin, un-pigmented polypropylene pressure regulating valves.
- B. Valves shall accurately reduce and regulate steady or varying inlet pressures and maintain a constant predetermined outlet pressure.
- C. Pressure regulating valves shall be Series "PR", as manufactured by Plastomatic Valves, Inc., or approved equal.

2.12 PRESSURE GAUGES

- A. Pressure gauges shall be 2-1/2" diameter, dual calibrated for 0 to 100 psi and SI units, having 316 stainless steel bourdon tube. The gauges supplied and/or installed for the service specified shall be manufactured by Ashcroft, Fig. No. 1079-S or approved equal.

NOTE TO THE ENGINEER: THE FOLLOWING TWO PARAGRAPHS MUST BE EITHER EDITED OR DELETED TO APPLY TO THE CURRENT PROJECT AT HAND.

2.13 PURIFIED WATER STORAGE TANK (Type "A"):

- A. Tank shall be vertical cylindrical type, stainless steel or FRP-jacketed polyethylene, of _____ gallon/_____ liter capacity (to be filled in by Engineer), with dished or conical bottom. Tank shall have a tight-fitting removable cover, a steel floor stand, an air filter capable of removing particles as small as 0.5 micron, and rounded interior corners. All tank penetrations shall be factory made. Stainless steel tanks shall be No. 4 finish; polyethylene tanks shall be made of FDA approved resin. Tank shall be Nalgene Series 17000, United Utensils Series VT, or approved equal. Air filter shall be American Sterilizer No. P-41648091 or approved equal.

2.14 PURIFIED WATER STORAGE TANKS (Type "B"):

- A. Tank capacities for each of two vertical closed top atmosphere tanks with manway is _____ diameter (to be filled in by Engineer) by _____ high (to be filled in by Engineer), and _____ gallons (to be filled in by Engineer).
- B. Manway shall be 18" round and fittings shall be of size and location shown on the Drawings.

- C. Tanks shall be as manufactured by RAMCO, Beatle Plastics Manufacturing Company, or approved equal. Mandrel tanks with oriented fiber construction, as manufactured by Owens-Corning, Justin, or approved equal, will be acceptable.

2.15 LEVEL SENSORS

- A. Level sensors shall have only stainless steel and Viton in contact with the fluid. Each shall have a snap action switch rated for 125 volts, with an adjustable dead band initially set by the Contractor at 3 inches (8 cm). ASCO Tri-Point Catalog No. SAxOA1/TAxOA32 _____ (Engineer to fill in complete number) or approved equal.
- B. One level sensor, as shown on the Drawing, shall be wired with the solenoid valve to automatically maintain the liquid level in the tank. The other is to be connected to the Central Data Acquisition System.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install equipment on concrete housekeeping pad. Refer to Section 23 00 00.
- C. Install line size isolation and check valves on circulation pump discharge.
- D. Install valved bypass around purification equipment.
- E. Install manual air vent valves at all high points of piping system, including piping direction changes from horizontal to vertical drops (ells only).
- F. Install take offs to outlets with shut off valve after take off. Slope take-off piping to outlets.
- G. Identify piping system and components. Refer to Section 23 05 53.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 23 00 00.
- B. Repair or replace piping as required to eliminate leaks, and retest to demonstrate compliance.
- C. Cap (seal) ends of piping when not connected to mechanical equipment.

END OF SECTION

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OFPC Standard Specification

SECTION 23 00 00

BASIC MECHANICAL REQUIREMENTS

This Standard Specification Section is controlled by the Office of Facilities Planning and Construction, UT System. It is to be used as guideline on all UT System projects, unless deviations are approved in writing by the Project Manager. It is not to be used for bidding, permitting, construction or any other purpose. This document is the property of UT System, and use of this document, in part or in whole, for any purpose other than for a UT System project may not be done without written permission of UT System.

To receive current updates of standard specification sections, please go to the OFPC web site at: www.utsystem.edu/fpc or contact the Office of Facilities Planning and Construction.

The issuance and revision history of this section is tabulated below. Please destroy any previous copy in your possession.

Rev No.	Date	Pages	Remarks
0	March 1998	36	Original
1	May 2004	1	Revised Cover Page
2	February 2007	36	Format, 1.13B, 2.01
3	June 2010	4	1.13B, 3.01A

OFPC Standard Specification

SECTION 23 00 00

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Mechanical Requirements specifically applicable to Division 23 sections, in addition to Division 01 - General Requirements.

1.02 RELATED DOCUMENTS

- A. THE UNIFORM GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, and Division 01 of the specifications apply to the work specified in this section.
- B. All work covered by this section of these specifications shall be accomplished in accordance with all applicable provisions of the Contract Documents and any addenda or directives which may be issued herewith, or otherwise.

1.03 GENERAL

- A. The Contractor shall execute all work hereinafter specified or indicated on accompanying drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the drawings.
- B. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation.
- C. The mechanical, electrical, and associated drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All

exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

- D. When the mechanical and electrical drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure. The drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas.

1.04 DEFINITIONS (Note: These definitions are included here to clarify the direction and intention of this specification. The list given here is not by any means complete. For further clarification as required, contractor shall contact the designated Owner's representative.)

- A. Concealed/exposed: Concealed areas are those that cannot be seen by the building occupants. Exposed areas are all areas that are exposed to view by the building occupants, including under counters, inside cabinets and closets, plus all mechanical rooms.
- B. General Requirements: The provisions of requirements of other Division 01 sections apply to entire work of contract and, where so indicated, to other elements that are included in project. Basic contract definitions are included in the General Conditions.
- C. Indicated: The term "indicated" is a cross reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements on contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping reader locate the cross reference, and no limitation of location is intended except as specifically noted.
- D. Directed, requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect/Engineer," "requested by Architect/Engineer" and similar phrases. However, no such implied meaning will be interpreted to extend Architect's/Engineer's responsibility into Contractor's area of construction supervision and job safety.
- E. And/Or: Where "and/or" is used in these specifications or on the drawings, it shall mean "that situations exist where either one or both conditions occur or are required and shall not be interpreted to permit an option on the part of the Contractor."

- F. Approve: Where used in conjunction with Architect's/Engineer's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations to Architect's/Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Architect/Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of contract documents or to extend Architect's/Engineer's responsibility into Contractor's area of construction supervision and job safety.
- G. As required: Where "as required" is used in these specifications or on the drawings, it shall mean "that situations exist that are not necessarily described in detail or indicated that may cause the contractor certain complications in performing the work described or indicated. These complications entail the normal coordination activities expected of the Contractor where multiple trades are involved and new or existing construction causes deviations to otherwise simplistic approaches to the work to be performed. The term shall not be interpreted to permit an option on the part of the Contractor to achieve the end result."
- H. Furnish
1. The term "furnish" is used to mean "supply and deliver to project site, ready for unloading, unpacking, assemble, installation, and similar operations."
 2. Where "furnish" applies to work for which the installation is not otherwise specified, "furnish" in such case shall mean "furnish and install."
- I. Install: The term "install" is used to describe operations at project site including "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operation."
- J. Provide: The term "provide" means "to furnish and install, complete and ready for intended use."

1.05 PERMITS, UTILITY CONNECTIONS AND INSPECTIONS

- A. General: Refer to Division 01 for construction phasing and time increments.
- B. Fees and Costs: If, during the course of the construction, a need arises to buy utilities, the Contractor shall pay all fees attendant thereto. If city or privately owned utility piping or electrical cable needs to be extended, relocated, or terminated, the Contractor will pay all permits and construction/inspection fees associated with that particular work.
- C. All work performed on this project is under the authority of the State of Texas, therefore no local construction fees or construction permits will be required except

as may be required for new service taps, or new or modified connections to city controlled services. If inspections by city personnel are specifically required by this document, then the Contractor is responsible for any fees or permits in connection to those requirements.

- D. Compliance: The Contractor shall comply in every respect with all requirements of National Fire Protection Association, local Fire Department regulations and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these specifications and drawings where specified conditions are of higher quality than the requirements of the above-specified authorities. Where requirements of the specifications and drawings are more lenient than the requirements of the above authorities having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities with no extra compensation.

1.06 CONTRACT DOCUMENTS

- A. All dimensional information related to new structures shall be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.
- B. The interrelation of the specifications, the drawings, and the schedules are as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics. If the Contractor requires additional clarification, he shall request it in writing, following the contractually prescribed information flow requirements.
- C. Should the drawings or specifications conflict within themselves, or with each other, the better quality, or greater size or quantity of work or materials shall be performed or furnished.

1.07 WORK BY OWNER

- A. The Owner [has awarded] [will award] [a contract] [contracts] which [will commence] [commences] on [_____]. Specifically this work [will include] [includes]:
1. Refrigerated Coolers: Supply and installation of compressor/condenser units, integral controls, heat recovery refrigerant diverting valves.
 2. [[_____]:] [_____].]

1.08 OWNER FURNISHED PRODUCTS

A. Products furnished to the site and paid for by Owner:

1. Centrifugal chillers.
2. [_____].]

1.09 WORK SEQUENCE

A. Install work in [stages] [phases] [to accommodate Owner's occupancy requirements] [_____] during the construction period coordinate mechanical schedule and operations with [Owner] [Architect/Engineer]:

1. [Stage] [Phase] 1: [_____].]
2. [Stage] [Phase] 2: [_____].]

1.10 FUTURE WORK

- A. Provide for future work under requirements of Section 01 11 00.
- B. Project is designed for future expansion of [_____] system [as specified] [and] [as indicated].
- C. [_____].]

1.11 ALLOWANCES

- A. Cash Allowance: Refer to Division 01 of the Construction Documents for information and requirements.

1.12 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner Contractor Agreement.
- B. Coordinate related work and modify surrounding work as required.
- C. Schedule of Alternates: See "Special Conditions" and Bid Form.
- D. Any Alternate Proposals are summarized in Division 01 of the specifications. The Contractor is directed to refer to all sections of the specifications and drawings for this project to determine the exact extent and scope of the various Alternate Proposals as each pertains to the work of all trades.

1.13 SUBMITTALS

- A. Refer to Uniform General Conditions.
- B. Proposed Products List: Include Products specified in the following sections:

NOTE TO SPECIFICATION WRITER: DELETE THE SECTIONS BELOW THAT DO NOT APPLY TO THE PROJECT, AND ADD ANY THAT MAY BE NEEDED. SECTION NUMBERS SHALL FOLLOW CSI MASTERFORMAT, LATEST EDITION.

1. Section 11 53 23 – Environmental Rooms
2. Section 11 53 53 – Biological Safety Cabinets
3. Section 13 48 00 - Sound Attenuators
4. Section 21 13 13 - Fire Protection Systems
5. Section 21 30 00 - Fire Pumps
6. Section 22 11 23 - Plumbing Equipment
7. Section 22 13 16 - Plumbing Piping
8. Section 22 13 16.A - Plumbing Specialties
9. Section 22 15 13 - Compressed Air System
10. Section 22 15 19.13 - Reciprocating Air Compressors
11. Section 22 40 00 - Plumbing Fixtures
12. Section 22 63 13 - Medical Gas System
13. Section 22 66 00 – Lab Waste System
14. Section 22 67 13.19 - Deionized Water System
15. Section 23 05 13 - Motors
16. Section 23 05 16 - Expansion Compensation
17. Section 23 05 29 - Sleeves, Flashings, Supports and Anchors

18. Section 23 05 48 - Vibration Isolation
19. Section 23 05 53 - Mechanical Identification
20. Section 23 05 93 – Testing, Adjusting, and Balancing
21. Section 23 05 93.A – Testing, Adjusting, and Balancing – Contractor Responsibilities
22. Section 23 06 20.13 - Hydronic Specialties
23. Section 23 07 13 - Ductwork Insulation
24. Section 23 07 16 - Equipment Insulation
25. Section 23 07 19 - Piping Insulation
26. Section 23 09 23 - Direct Digital Control Systems
27. Section 23 09 43 - Pneumatic Controls
28. Section 23 11 13 - Fuel Oil Piping System
29. Section 23 20 00 - HVAC Pumps
30. Section 23 20 00.A - Piping, Valves and Fittings
31. Section 23 21 00 - Hydronic Piping
32. Section 23 22 00 - Steam and Steam Condensate Piping
33. Section 23 22 00.A - Steam and Steam Condensate Specialties
34. Section 23 29 23 – Variable Frequency Drives
35. Section 23 31 00 - Ductwork
36. Section 23 33 00 - Ductwork Accessories
37. Section 23 34 16 - Fans
38. Section 23 36 00 - Air Terminal Units
39. Section 23 36 00.A – Air Terminal Units (FPVAV)

40. Section 23 37 00 - Air Inlets and Outlets
 41. Section 23 38 16 – Fume Hoods
 42. Section 23 41 00 – Filters
 43. Section 23 57 00 - Heat Exchangers
 44. Section 23 73 00 - Air Handling Units (Up to 10,000 CFM)
 45. Section 23 73 23 - Air Handling Units
 46. Section 23 73 23.A – Built Up Air Handling Units (Above 50,000 CFM)
 47. Section 23 81 23 - Computer Room Air Conditioning Units
 48. Section 23 81 23.A – Computer Room Air Conditioning Units –
Unitary Cooling
 49. Section 23 82 16 - Air Coils
 50. Section 23 82 19 - Terminal Heat Transfer Units
 51. Section 23 84 13 - Steam Grid Humidifiers
- C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
- D. Mark dimensions and values in units to match those specified.
- E. Submit fabrication drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the drawings, thus causing rearrangement of equipment space, (2) where tight spaces require extreme coordination between ductwork, piping, conduit, and other equipment, (3) where called for elsewhere in these specifications; and (4) where specifically requested by the Architect/Engineer. Fabrication drawings shall be made at no additional charge to the Owner or the Architect/Engineer.
- F. All required fabrication drawings, except as noted otherwise, shall be prepared at a scale of not less than 1/4" = 1'-0." Fabrication drawings for ductwork, air handling units, and sections in Mechanical Rooms shall be drawn at a minimum scale of 3/8" = 1'-0." Submit three blue-line prints of each fabrication drawing to the Architect/Engineer for review. Reproduction and submittal of the Construction

Documents is not acceptable. The Architect/Engineer will review the drawing and return one print with comments.

1.14 SUBSTITUTION OF MATERIALS AND EQUIPMENT

- A. Refer to General Conditions for substitution of materials and equipment.
- B. General: Within thirty days after the date of contract award or work order, whichever is later, and before purchasing or starting installation of materials or equipment, the Contractor shall submit for review, a complete list of suppliers, contractors and manufacturers for all materials and equipment that will be submitted for incorporation into the project. The list shall be arranged in accordance with the organization of the specifications. This initial list shall include the manufacturer's name and type or catalog number as required to identify the quality of material or equipment proposed. This list will be reviewed by the Engineer and the Owner and will be returned to the Contractor with comments as to which items are acceptable without further submittal data and which items will require detailed submittal data for further review and subsequent approval. The initial list shall be submitted as herein specified. Materials and equipment requiring detailed submittal data shall be submitted with sufficient data to indicate that all requirements of these specifications have been met and samples shall be furnished when requested. All manufacturers' data used as part of the submittal shall have all inapplicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.
- C. It is not the intent of the drawings and/or specifications to limit products to any particular manufacturer nor to discriminate against an "APPROVED EQUAL" product as produced by another manufacturer. Some proprietary products are mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. When a manufacturer's name appears in these specifications, it is not to be construed that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).
- D. The specified products have been used in preparing the drawings and specifications and thus establish minimum qualities with which substitutes must at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the designer is final.
- E. When requested by the Architect/Engineer, the Contractor shall provide a sample of the proposed substitute item. In some cases, samples of both the specified item and the proposed item shall be provided for comparison purposes.
- F. Timeliness: The burden of timeliness in the complete cycle of submittal data, shop drawings, and sample processing is on the Contractor. The Contractor shall allow a minimum of six (6) weeks time frame for review of each submission by the office of

the design discipline involved after receipt of such submissions by that design discipline. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all resubmittal cycles on unacceptable materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not be considered in any request for scheduled construction time extensions and/or additional costs to the Owner.

- G. All equipment installed on this project shall have local representation, local factory authorized service, and a local stock of repair parts.
- H. Acceptance of materials and equipment will be based on manufacturer's published data and will be tentative subject to the submission of complete shop drawings indicating compliance with the contract documents and that adequate and acceptable clearances for entry, servicing, and maintenance will exist. Acceptance of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Architect/Engineer has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.
- I. Certification: The Contractor shall carefully examine all data forwarded for approval and shall sign a certificate to the effect that the data has been carefully checked and found to be correct with respect to dimensions and available space and that the equipment complies with all requirements of the specifications.
- J. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of specified manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.
- K. Materials and Equipment Lists: Eight (8) copies of the list of materials and equipment, the name of manufacturer, trade name, type, and catalog number shall be submitted to the Architect/Engineer. The lists shall be accompanied by eight (8) sets of pictorial and descriptive data derived from the manufacturers' catalogs, sales literature, or incorporated in the shop drawings. Such lists shall include but will not be limited to the following items:
- L. Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended within the guarantee period, this material or equipment shall be replaced with the material or equipment specified at no additional cost to the Owner.

1.15 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be new, free from all defects, suitable for the intended use, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall provide a neat, precise appearance. Materials and/or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site but shall be replaced with new materials and/or equipment.
- B. The responsibility for the furnishing of the proper equipment and/or material and seeing that it is installed as intended by the manufacturer, rests entirely upon the Contractor who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.16 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to NFPA Standard 255, "Method of Test of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

1.17 REGULATORY REQUIREMENTS

- A. The "Authority Having Jurisdiction" over the project described by these documents is the Owner, as an Agency of the State of Texas. As such, it is required that the installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of these specifications. All referenced codes and standards shall be those current at the date of issue of the design documents.

NOTE TO SPECIFICATION WRITER: THE 'CURRENT AT THE DATE OF ISSUE' ABOVE SHALL APPLY UNLESS OTHER DATES ARE SPECIFICALLY APPROVED BY THE OFPC PROJECT MANAGER.

- B. National Fire Protection Association Standards (NFPA)
 - 1. NFPA No. 13, Sprinkler System, Installation
 - 2. NFPA No. 14, Standpipes and Hose Systems
 - 3. NFPA No. 20, Centrifugal Fire Pumps
 - 4. NFPA No. 37, Stationary Combustion Engines & Gas Turbines

5. NFPA No. 45, Fire Protection for Laboratories Using Chemicals
 6. NFPA No. 51, Welding & Cutting, Oxygen-Fuel Gas Systems
 7. NFPA No. 54, Gas Appliances, Piping, National Fuel Gas Code
 8. NFPA No. 70, National Electrical Code
 9. NFPA No. 72D, Proprietary Signaling Systems
 10. NFPA No. 78, Lightning Protection Code
 11. NFPA No. 88A, Standard for Parking Structures
 12. NFPA No. 90A, Air Conditioning Systems
 13. NFPA No. 91, Blower & Exhaust Systems
 14. NFPA No. 99, Health Care Facilities
 15. NFPA No. 101, Life Safety Code
 16. NFPA No. 200, Series, Building Construction
 17. NFPA No. 211, Chimneys, Fireplaces, Vent Systems
 18. NFPA No. 241, Standard for Safeguarding Construction, Alteration and Demolition Operations
 19. NFPA No. 255, Method of Test of Surface Burning Characteristics of Building Materials
 20. NFPA No. 258, Standard Research Test Method for Determining Smoke Generation of Solid Materials
- C. American National Standards Institute (ANSI)
1. A40.8, National Plumbing Code
 2. B31.1, Power Piping
 3. B9.1, Safety Code for Mechanical Refrigeration
- D. American Gas Association Publications (AGA): Directory of Approved Gas Appliances and Tested Accessories

- E. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Codes
- F. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these specifications.
- G. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA): All current editions of applicable manuals and standards (See Sections 23 31 00 and 23 33 00.UT).
- H. Air Moving and Conditioning Association (AMCA): All current editions of applicable manuals and standards.
- I. American Society of Testing Materials (ASTM): All current editions of applicable manuals and standards.
- J. American Water Works Association (AWWA): All current editions of applicable manuals and standards.
- K. National Electrical Manufacturers' Association (NEMA): All current editions of applicable manuals and standards.
- L. City of [__*__], Fire Department as may be applicable to construction on this site.

NOTE TO THE SPECIFICATION WRITER: DELETE ASTERISK AND FILL IN NAME OF APPLICABLE DEPARTMENT.

- M. Uniform Building Code, (Includes the International Mechanical and International Plumbing Codes)
- N. Texas Occupational Safety Act: All applicable safety standards
- O. Occupational Safety and Health Act (OSHA)
- P. ADA and ANSI Standards: All work shall be in accord with all regulations and requirements of the Standards and Specifications for Handicapped and Disabled for the Construction of Public Buildings and Facilities in the State of Texas Usable by Physically Handicapped and Disabled persons, ANSI Standards and the requirements of the American Disabilities Act.
- Q. Refer to specification sections hereinafter bound for additional Codes and Standards.

- R. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. In all cases where Underwriters Laboratories, Inc. has established standards for a particular type material, such material shall comply with these standards. Evidence of compliance shall be the UL "label" or "listing" under Re-Examination Service.
- S. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Architect/Engineer in writing of said discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by Division 01 of these Contract Documents, providing no work of fabrication of materials has been accomplished in a manner of noncompliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.18 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Storage at Site: The Contractor shall not receive material or equipment at the job site until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.
- B. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.
- C. Conformance with Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of the Underwriters Laboratories, Inc., applied to the item will be acceptable as sufficient evidence that the items conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.
- D. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.

- E. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number; otherwise, surfaces of ferrous metal shall be given a rust inhibiting coating. The treatment shall withstand 200 hours in salt spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8" on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified except that coal tar or asphalt type coating will not be acceptable unless so stated for a specific item. Where steel is specified to be hot dip galvanized, mill galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.
- F. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting set screws, keys, and other rotating parts shall be fully enclosed or properly guarded for personnel protection.
- G. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and become thoroughly familiar with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect/Engineer of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner or the Architect/Engineer.

1.19 WALL, FLOOR AND CEILING PLATES

- A. See Section 23 05 29 – Sleeves, Flashings, Supports and Anchors.

1.20 SLEEVES, INSERTS, AND FASTENINGS

- A. See Section 23 05 29 – Sleeves, Flashings, Supports and Anchors.

1.21 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other sections. Obtain permission of [Owner] [Architect/Engineer] before proceeding.

1.22 MANUFACTURER'S RECOMMENDATIONS

- A. The manufacturer's published directions shall be followed in the delivery, storage, protection, installation, piping, and wiring of all equipment and material. The Contractor shall promptly notify the Architect/Engineer, in writing, of any conflict between the requirements of the Contract Documents and the manufacturer's directions, and shall obtain the Architect/Engineer's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect/Engineer, he shall bear all costs arising in connection with the deficiencies.

1.23 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of mechanical and electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Fabrication drawings shall be prepared when required by the Architect/Engineer or Owner to indicate a suitable arrangement.
- B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

1.24 LARGE APPARATUS

- A. Any large piece of apparatus that is to be installed in any space in the building, and that is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.25 PROTECTION

- A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering; the installation of electric heaters in electrical switchgear and similar equipment to prevent moisture damage. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.
- B. Take particular care not to damage the building structure in performing work. All finished floors, step treads, and finished surfaces shall be covered to prevent any

damage by workers or their tools and equipment during the construction of the building.

- C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these specifications.

1.26 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

- A. Each trade, subcontractor, and/or Contractor must work in harmony with the various other trades, subcontractors and/or Contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or Contractor must pursue its work promptly and carefully so as not to delay the general progress of the job. This Contractor shall work in harmony with Contractors working under other contracts on the premises.

1.27 ELECTRICAL WIRING OF MOTORS AND EQUIPMENT

- A. The Contractor shall note that the electrical design and drawings are based on the equipment scheduled and indicated on the drawings, and should any mechanical equipment be provided requiring changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.
- B. The electrical trades shall provide all interconnecting wiring for the installation of all power. The electrical trades shall provide all disconnect switches as required for proper operation, as indicated on the drawings or required by applicable code. All combination starters, individual starters, and other motor starting apparatus not specifically scheduled or specified as provided by the equipment manufacturer under the scope of Division 23, shall be provided under the scope of Division 26.
- C. The Mechanical Trades shall provide complete wiring diagrams indicating power wiring and interlock wiring. Diagrams shall be submitted to the Architect/Engineer for review within thirty (30) days after the submittals for equipment have been reviewed. Diagrams shall be based on accepted equipment and shall be complete full phase and interlock control drawings, not a series of manufacturer's individual diagrams. After these diagrams have been reviewed by the Architect/Engineer, copies shall be transmitted to the electrical trades by the Contractor. They shall be followed in detail. See Section 15E, TEMPERATURE CONTROLS, for additional clarification.

1.28 SUPERVISION

- A. Each Contractor and subcontractor shall keep a competent superintendent or foreman on the job at all times. (Refer to the Uniform General Conditions for additional information concerning supervision.)
- B. It shall be the responsibility of each superintendent to study all drawings and familiarize himself with the work to be done by other trades. He shall coordinate his work with other trades and before material is fabricated or installed, make sure that his work will not cause an interference with another trade. Where interferences are encountered, they shall be resolved at the job site by the superintendents involved. Where interferences cannot be resolved without major changes to the drawings, the matter shall be referred to the A/E for ruling.

1.29 SITE OBSERVATION

- A. Site observation by the Architect/Engineer is for the express purpose of verifying compliance by the Contractor with the Contract Documents, and shall not be construed as construction supervision nor indication of approval of the manner or location in which the work is being performed as being a safe practice or place.

1.30 PRECEDENCE OF MATERIALS

- A. The specifications determine the nature and setting of materials and equipment. The drawings establish quantities, dimensions and details.
- B. The installation precedence of materials shall be as follows. Note that if an interference is encountered, this shall guide the contractor in the determination of which trade shall be given the "Right-of-Way."

Building lines
 Structural Members
 Soil and Drain Piping
 Condensate Drains
 Vent Piping
 Supply, Return, and Outside Air Ductwork
 Exhaust Ductwork
 HVAC Water and Steam Piping
 Steam Condensate Piping
 Fire Protection Piping
 Natural Gas Piping
 Domestic Water (Cold and Hot)
 Refrigerant Piping
 Electrical Conduit

1.31 CONNECTIONS FOR OTHERS

- A. The Mechanical Contractor shall rough in for and make all gas, water, steam, sewer, etc. connections to all fixtures, equipment, machinery, etc., provided by others in accordance with detailed roughing in drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.
- B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, etc.
- C. Provide all air gap fittings required, using materials hereinbefore specified. In each service line connected to an item of equipment or piece of machinery, provide a shutoff valve. On each drain not provided with a trap, provide a suitable trap.
- D. All pipe fittings, valves, traps, etc., exposed in finished areas and connected to chrome plated lines provided by others shall be chrome plated to match.
- E. Provide all sheet metal ductwork, transition pieces, etc., required for a complete installation of vent hoods, fume hoods, etc., provided by others.

1.32 INSTALLATION METHODS

- A. Where to Conceal: All pipes, conduits, etc., shall be concealed in pipe chases, walls, furred spaces, or above the ceilings of the building unless otherwise indicated.
- B. Where to Expose: In mechanical rooms, janitor's closets tight against pan soffits in exposed "Tee" structures, or storage spaces, but only where necessary, piping may be run exposed. All exposed piping shall be run in the most aesthetic, inconspicuous manner, and parallel or perpendicular to the building lines.
- C. Support: All piping, ducts and conduits shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.
- D. Maintaining Clearance: Where limited space is available above the ceilings below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, rather than hung below them in a manner to provide maximum above floor clearance. Sleeves shall be as herein specified. Approval shall be obtained from the Architect/Engineer for each penetration.
- E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that piping shall be sloped to obtain the proper pitch. Piping, ducts and conduits run in furred ceilings, etc., shall be similarly

installed, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.

1. All piping not directly buried in the ground shall be considered as "interior piping."
2. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the construction inspector so that arrangement can be made for an inspection of the above ceiling area about to be "sealed" off. The Contractor shall give as much advance notice as possible no less than 10 working days.
3. All above ceiling areas will be subject to a formal inspection before ceiling panels are installed, or installation is otherwise concealed from view. All mechanical and electrical work at and above the ceiling, including items supported by the ceiling grid, such as air inlets or outlets and lighting fixtures, shall be complete and installed in accordance with contract requirements, including power to lighting fixtures, fans, and other powered items. Adequate lighting shall be provided to permit thorough inspection of all above ceiling items. The inspection will include representatives of the following: General Contractor and each Subcontractor having work above the ceiling, Architect/Engineer, Physical Plant, Resident Construction Manager's Construction Inspector(s), the Resident Construction Manager, and Office of Facilities Planning and Construction (OFPC). Areas to be included and time of inspection shall be coordinated with the Construction Inspector.
4. The purpose of this inspection is to verify the completeness and quality of the installation of the air conditioning systems, the electrical systems, the plumbing systems, and any other special above ceiling systems such as pneumatic tube, vacuum systems, fire sprinkler piping and cable tray systems. The ceiling supports (tee bar or lath) shall be in place so that access panel and light fixture locations are identifiable and so that clearances and access provisions may be evaluated.
5. No ceiling materials may be installed until the resulting deficiency list from this inspection is worked off and the Construction Inspector has given approval.

1.33 RECORDS FOR OWNER

NOTE TO THE ENGINEER: COORDINATE THIS SECTION WITH DIVISION 01 REQUIREMENTS FOR RECORDS AND "AS BUILTS."

- A. The Contractor shall maintain a set of "blueline" prints in the Field Office for the sole purpose of recording "installed" conditions. Daily note all changes made in these drawings in connection with the final installation including exact dimensioned locations of all new underground utilities, services and systems and all uncovered existing active and inactive piping outside the building.
- B. At contract completion, the Contractor shall provide a set of reproducible photographic mylar drawings, plus the photo negatives of the revised drawings. The contractor shall transfer the information from the "blueline" prints maintained as described above, and turn over this neatly marked set of reproducible drawings representing the "as installed" work to the Architect/Engineers for verification and subsequent transmittal to the Owner. The Contractor shall refer to Division 01 of these specifications, and to the Uniform General Conditions, for additional information. These drawings shall include as a minimum:
1. Addendum written drawing changes.
 2. Addendum supplementary drawings.
 3. Accurate, dimensioned locations of all underground utilities, services and systems.
 4. Identification of equipment work shown on Alternates as to whether alternates were accepted and work actually installed.
 5. Change Order written drawing changes.
 6. Change Order supplementary drawings.
- C. Electronic Media
1. In lieu of the drawings described above in 1.33B, it is preferred the contractor submit one set of blueline prints, one set of vellum reproducible, and one set of discs containing all the drawings in AUTOCAD 12 or 14 format.
- D. "As installed" mylars shall bear a stamp, "stick-on decal" or lettered title block generally located in lower right hand corner of drawing entitled "AS INSTALLED DRAWING" with Company name of the installing trade Subcontractor and with a place for the date and the name of the responsible company representative.
- E. In addition to the above, the Contractor shall accumulate during the progress of the job the following data, in duplicate, prepared in a neat brochure or packet folder and turn over to the Architect/Engineer for review, and subsequent delivery to the Owner.

1. All warranties and guarantees and manufacturers' directions on equipment and material covered by the Contract.
 2. Two sets of operating instructions for heating and cooling and other mechanical and electrical systems. Operating instructions shall also include recommended preventative maintenance and seasonal changeover procedures.
 3. Valve tag charts and diagrams specified herein.
 4. Approved wiring diagrams and control diagrams representing "as installed" conditions.
 5. Copies of approved shop drawings.
 6. Any and all other data and/or drawings required as submittals during construction.
 7. Repair parts list of all major items and equipment including name, address and telephone number of local supplier or agent.
- F. All of the above data shall be submitted to the Architect/Engineer for approval, and shall be corrected as instructed by the Architect/Engineer prior to submission of the final request for payment.

1.34 CUTTING AND PATCHING

- A. General: Cut and patch walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.
- B. Methods of cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer. Impact type equipment shall not be used except where specifically acceptable to the Architect/Engineer. Openings in precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled to exact size.
- C. Restoration: All openings shall be restored to "as new" condition under the appropriate specification section for the materials involved, and shall match remaining surrounding materials and/or finishes.
- D. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the

proper size and shape, and shall be installed in a manner acceptable to the Architect/Engineer.

- E. Plaster: All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.
- F. Special Note: No cutting, boring, or excavating that will weaken the structure shall be undertaken.

1.35 ROOF PENETRATIONS AND FLASHING

- A. Pipe, conduit and duct sleeves, pitch pockets, and flashings compatible with the roofing installation shall be provided and installed by a qualified contractor for all roof penetrations. This shall be the responsibility of the General Contractor.

1.36 EXCAVATION, TRENCHING AND BACKFILL

- A. Excavation (See Divisions 00 and 01 for special requirements related to excavation and trenching.):
 1. The mechanical and electrical subcontractors shall perform all excavations of every description, for their particular installations and of whatever substances encountered, to the depths indicated on the drawings and/or required for the installation of piping, conduit, utility systems, etc. All exterior lines shall be installed with a minimum cover of 24," unless otherwise indicated. Generally, more cover shall be provided if grade will permit. All excavation materials not required for backfill or fill shall be removed and wasted as acceptable to the Construction Inspector. All excavations shall be made only by open cut. The banks of trenches shall be kept as nearly vertical as possible and where required, shall be properly sheeted and braced. Trenches shall be not less than 12" wider nor more than 16" wider than the outside edges of the pipe to be laid therein, and shall be excavated true to line so that a clear space not less than 6" nor more than 8" in width is provided on each side of the pipe. For sewers, the maximum width of trench specified applies to the width at and below the level of the pipe, and may be made as wide as necessary for sheeting and bracing and proper installation of the work.
 2. The bottom of trenches shall be accurately graded to provide proper fall and uniform bearing and support for each section of the pipe on undisturbed soil or 2" of sand fill at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Bell holes shall be dug after the trench bottom has been graded. Where inverts are not shown, grading shall be determined by the National Plumbing Code for the service intended and the size used. Bell holes

for lead pipe joints shall be 12" in depth below the trench bottom and shall extend from a point 6" back of the face of the bell. Such bell holes shall be of sufficient width to provide ample room for caulking. Bell holes for sewer tile and water pipe shall be excavated only to an extent sufficient to permit accurate work in the making of the joints and to insure that the pipe, for a maximum of its length, will rest upon the prepared bottom of the trench. Depressions for joints other than bell-and-spigot shall be made in accordance with the recommendations of the joint manufacturer for the particular type of joint used. In general, grading for electrical ductbanks and conduits shall be from building to manhole, and from a high point between manholes to each manhole. Special pipe beds shall be provided as specified hereinafter.

3. The lower 4" of the pipe trenches measuring from an overhead line set parallel to the grade line of the sewer shall be excavated only a few feet in advance to the pipe laying, by workers especially skilled in this type of work. Where damage is likely to result from withdrawing sheeting, the sheeting shall be left in place. Except at locations where excavation of rock from the bottom of trenches is required, care shall be taken not to excavate below the depths required. Where rock excavation is required, the rock shall be excavated to a minimum overdepth of 6" below the trench depths specified. The overdepth rock excavation and all excess trench excavation shall be backfilled with sand. Whenever wet or otherwise unstable soil is incapable of properly supporting the pipe is encountered in the trench bottom, such soil shall be removed to a depth and for the trench lengths required, and then backfilled to trench bottom grade, as hereinafter specified, with sand.
4. All grading in the vicinity of excavation shall be controlled to prevent surface ground water from flowing into the excavations. Any water accumulated in the excavations shall be removed by pumping or other acceptable method. During excavation, material suitable for backfilling shall be stacked in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted and removed from the job site as directed by the Construction Inspector.
5. All shoring and sheeting required to perform and protect the excavations and to safeguard employees and/or adjacent structures shall be provided.
6. Excavate as required under the building in order that all piping, ductwork, etc., shall clear the ground a minimum of 12" for a distance of 24" on either side. Edges of such excavations shall slope at an angle of not over 45 degrees with the horizontal unless otherwise approved by the Construction Inspector. The bottom of such excavation shall be graded to drain in a manner acceptable to the Construction Inspector.

7. Trenches for cast iron drain, storm water and sewer lines inside the building shall be properly excavated, following, in general, the procedures set out for exterior lines. Where floors are to be poured over these lines, they shall be backfilled, tamped and settled with water. Where no flooring is to cover the lines, they shall be backfilled to form a level grade.
8. All surplus materials removed in these trenching operations becomes the property of the contractor, and shall be disposed of at the expense of the contractor, at a legal disposal site, off of the campus.

B. Backfilling

1. Trenches shall not be backfilled until all required tests are performed and until the piping, utilities systems, etc., as installed are certified by the Owner's inspector to conform to the requirements specified hereinafter. The trenches shall be carefully backfilled with sand to a depth of 12 inches above the top of the pipe. The next layer and subsequent layers of backfill may be excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel, soft shale, or other approved materials free from large clods of earth or stones larger than 1 1/2" in diameter, flooded until the pipe has cover of not less than one foot. The remainder of the backfill material shall then be thrown into the trenches, moistened, and tamped or flooded in one-foot layers. Blasted rock, broken concrete or pavement, and large boulders shall not be used as backfill material. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and mounded over, and smoothed off.
2. Backfill under concrete slabs-on-fill shall be as specified above, shall be gravel, or shall be other such materials more suitable for the application. Installation and compaction shall be as required for compatibility with adjacent materials.

C. Opening and Re-closing Pavement and Lawns: Where excavation requires the opening of existing walks, streets, drives, other existing pavement, or lawns, such surfaces shall be cut as required to install new lines and to make new connections to existing lines. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new work is completed and the excavation has been backfilled and flooded, the area shall be patched, using materials to match those cut out. The patches shall thoroughly bond with the original surfaces and shall be level with them, and shall meet all the requirements established by the authorities having jurisdiction over such areas.

D. Excavation in Vicinity of Trees: All trees including low hanging limbs within the immediate area of construction shall be adequately protected to a height of at least 5 ft. to prevent damage from the construction operations and/or equipment. All

excavation within the outermost limb radius of all trees shall be accomplished with extreme care. All roots located within this outermost limb radius shall be brought to the attention of the Construction Inspector before they are cut or damaged in any way. The Construction Inspector will give immediate instructions for the disposition of it. All stumps and roots encountered in the excavation, which are not within the outermost limb radius of existing trees, shall be cut back to a distance of not less than 18" from the outside of any concrete structure or pipeline. No chips, parts of stumps, or loose rock shall be left in the excavation. Where stumps and roots have been cut out of the excavation, clean compacted dry bank sand shall be backfilled and tamped.

NOTE TO SPECIFICATION WRITER: COORDINATE THE FOLLOWING WITH DIVISION 08 REQUIREMENTS.

1.37 ACCESS DOORS

- A. General: This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed items of mechanical equipment or devices.
- B. Doors: Access doors mounted in painted surfaces shall be of Milcor (Inland-Ryerson Construction Products Company) manufacture, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surface of the adjacent finishes. Access doors mounted on tile surfaces shall be of similar construction as noted above, except they shall be of stainless steel materials. Access doors shall be a minimum of 12" x 12" in size.

1.38 OPERATION PRIOR TO COMPLETION

- A. When any piece of mechanical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly supervises the operation, and has the Construction Inspector's written permission to do so. The warranty period shall, however, not commence until the equipment is operated for the beneficial use of the Owner, or date of substantial completion, whichever occurs first.
- B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.

NOTE TO SPECIFICATION WRITER: PARAGRAPHS 1.39 AND 1.40 SHALL BE EDITED TO SUIT PROJECT. COORDINATE OUTAGES (1.39E) WITH DIVISION 11 REQUIREMENTS.

1.39 EXISTING FACILITIES

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workers, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.
- B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.
- C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall them upon completion of work in the areas affected.
- D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall in locations approved by the Architect/Engineer all devices required for the operation of the various systems installed in the existing construction. This is to include but is not limited to temperature controls system devices, electrical switches, relays, fixtures, piping, conduit, etc.
- E. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.40 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be

delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workers skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.
- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

1.41 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

- A. Before the work is accepted, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation and operation of his materials and/or equipment to determine that it is properly installed and in proper operating order. The qualifications of the representative shall be appropriate to the technical requirements of the installation. The qualifications of the representative shall be submitted to the owner for approval. The decision of the owner concerning the appropriateness of the representative shall be final. Testing and checking shall be accomplished during the course of the work where required by work being concealed, and at the completion of the work otherwise. In addition, the Contractor shall submit to the Architect/Engineer a signed statement from each representative certifying as follows: "I certify that the materials and/or equipment

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listed below have been personally inspected by the undersigned authorized manufacturer's representative and is properly installed and operating in accordance with the manufacturer's recommendations."

- B. Check inspections shall include plumbing equipment, heating, air conditioning, insulation, ventilating equipment, controls, mechanical equipment and such other items hereinafter specified or specifically designated by the Architect/Engineer.

1.42 TESTS

- A. The Contractor shall make, at no additional cost to the Owner, any tests deemed necessary by the inspection departments having jurisdiction, and in the National Fire Protection Association, ASTM, etc. Standards listed. The Contractor shall provide all equipment, materials, and labor for making such tests. Reasonable amounts of fuel and electrical energy costs for system tests will be paid by the Owner. Fuel and electrical energy costs for system adjustment and tests that follow beneficial occupancy by the Owner will be borne by the Owner.
- B. Additional tests specified hereinafter under the various specification sections shall be made.
- C. The Construction Inspector shall be notified in writing at least 10 working days prior to each test and other specification requirements requiring action on the part of the Construction Inspector. All equipment shall be placed in operation and tested for proper automatic control requirements before the balancing agency starts their work.
- D. Maintain Log of Tests as hereinafter specified.
- E. See specifications hereinafter for additional tests and requirements.

1.43 LOG OF TESTS

- A. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test conditions, test results, specified results, and other pertinent data. Data shall be delivered to the Architect/Engineer as specified under "Requirements for Final Acceptance." All Test Log entries shall be legibly signed by the Project Contractor or his authorized job superintendent.

1.44 COOPERATION AND CLEANUP

- A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment and materials

and shall clean his debris from the job. Upon the completion of the job, each trade shall immediately remove all of his tools, equipment, any surplus materials and all debris caused by that portion of the work.

1.45 CLEANING AND PAINTING

- A. All equipment, piping, conduit, ductwork, grilles, insulation, etc., furnished and installed in exposed areas under Divisions 23 and 26 of these specifications and as hereinafter specified shall be cleaned, prepared, and painted according to the following specification. In the event of a conflict between the specifications referenced, the provisions of this specification shall prevail only for Division 23 and Division 26 work.
- B. All purchased equipment furnished by the mechanical and electrical subcontractors shall be delivered to the job with a suitable factory protective finish with the colors hereinafter specified. The following materials shall not be painted: copper, galvanized metal, stainless steel, fiberglass, PVC, and PVDF.
- C. Before painting, materials and equipment surfaces shall be thoroughly cleaned of cement, plaster, and other foreign materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metalwork shall be carefully brushed down with the steel brushes to remove rust and other spots and left smooth and clean.
- D. Color of finish painting in Mechanical Rooms shall be painted in accordance with The University of Texas Standard Color Schedule for machinery spaces using Pratt and Lambert, Inc.'s "Effector" enamel, or approved equal. For painting purposes, the equipment and piping inside of built-up air handling units shall be painted the same as if they were within the walls of a Mechanical Room. Two coats shall be applied with a light tint first coat and deep color for final coat. Colors shall be as follows:

(NOTE TO ENGINEER: MODIFY THE MATERIAL OF THIS SECTION TO ACRYLIC LATEX IF PAINTING IS TO BE DONE IN A HAZARDOUS ENVIRONMENT.)

<u>ITEM</u>	<u>COLOR</u>	<u>"P and L" PAINT NUMBER</u>
Equipment Bases	Light Green	YG493M (Winter Pear)
Equipment	Green	YG511Y (Biscay Green)
Piping (Insulated and Uninsulated)	Light Gray	B798M (London Fog)
Hanger Rods	Same as "Piping" above	
Steam Traps and Metal Exposed to High Temperatures	Same as "Piping" above, high temp rated	
Atmospheric Relief Line	Same as "Piping" above	
Ductwork, AHU, Fans and Insulation	Buff	Y354M (Tawny Gold)
Valve Hand Wheels	Blue	B726M (Siam Blue)
Pump Couplings and Fuel Gas Piping (including natural gas, LPG, etc.)	Safety Yellow	Y361M (Daisy Yellow)
Fire Protection Equipment and Piping	Safety Red	R131R (Vibrant Red)

NOTE THAT THE PAINT SPECIFIED ABOVE IS INCLUDED FOR PURPOSES OF ESTABLISHING A QUALITY THAT SHALL BE USED ON THIS PROJECT. THE PROPOSED PAINT SHALL BE SUBMITTED, AND ALTERNATIVES WILL BE CONSIDERED USING THE SUBMITTAL PROCEDURES SPECIFIED IN THIS DOCUMENT.

**THE FOLLOWING PAINT SCHEME SHALL APPLY TO UT HEALTH SCIENCE CENTER
- SAN ANTONIO ONLY:**

Medical Air Tank & Compressors - White
Alkyd Semi-Gloss Enamel

Walls & Duct - Non-Yellowing White
Semi-Lustre Interior Acrylic Latex Enamel

Primer- Rust Inhibitive Metal Primer
Red Oxide

Motors - Dark Blue
Polyurethane Rust Inhibitive Enamel

Floor & Hot Water Pumps - Medium Gray
Polyurethane Gloss Enamel

Chilled Water Handles - Velour Interior Alkyd Semi-Gloss Green Enamel
Ultra Deep Base

Steam Lines & Air Compressor - Heavy Duty Aluminum
Industrial Enamel

Sewage & Drains, Steam Handles - Black
Satin Finish

Pump Guards & Fire Pumps - Fire Engine Red
Gloss Finish Oil Base

Base of Pumps & Air Handlers - Seminole Red
Oil Base Gloss

Air Handlers - Lime Green Base 4071 4A
Oil Base Semi-Gloss

Chilled Water Pumps - Tan Brown Base
Oil Base - Gloss

Laboratory Air Tank & Compressor - Safety Orange
Enamel - Semi-Gloss

Vacuum Pumps - Yellow
Oil Base - Gloss

- E. Jacketing on insulation shall not be painted.
- F. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible due to the painting operation.
- G. Scope of painting for Divisions 23 and 26--work in areas other than those defined as "exposed" is as follows:
 - 1. All uncovered steel pipe, supports, exposed pipe and hanger rod threads, and hangers in underfloor spaces shall be cleaned and painted with two coats of Tropical Paint Co. No. 77-black asphaltic emulsion. Galvanized steel and copper lines in these spaces shall not be painted.
 - 2. All canvas finishes including those underfloor and in concealed spaces shall be painted with one sizing coat if not already sized, containing mildew resistant additive and Arabol adhesive prior to any other specified finish paint.
 - 3. All fuel piping (natural gas, LPG, etc.) and all fire protection piping shall be painted whether concealed or exposed, in all areas of the project without exception. Fuel piping shall be painted safety yellow, and fire protection piping shall be painted safety red. These "safety" colors shall be as defined by OSHA.
 - 4. If insulated, the piping shall be primed, only, prior to insulation, and the insulation jacketing shall be painted as specified for piping. The requirements of this paragraph are "primary" and have priority over any conflicting specification or instruction, should a conflict in the Construction Documents exist.
- H. In addition to painting in mechanical rooms, materials, piping, ductwork, conduit, gear, supports, foundations, equipment and appurtenances installed by the mechanical and electrical subcontractors in exposed areas shall be finish painted with two coats of Pratt and Lambert, Inc.'s "Effector" enamel of color selected by the Architect/Engineer.
- I. Additional areas to be defined as "exposed" for purposes of painting, are defined as follows: (Note that paragraph 1.3.10 of this section defines exposed areas for the balance of the project. The areas listed below are to be painted in addition to exposed areas as previously defined.)

SPECIFICATION WRITER: DEFINE AREAS WHERE FINISH PAINTING IS DESIRED OUTSIDE OF MECHANICAL ROOMS.

- J. The surfaces to be finish painted shall first be prepared as follows:
1. On canvas finishes pretreat as specified above. Insulated surfaces having vapor barrier jacket exposed to view shall first be painted with one (1) coat of sealer.
 2. Galvanized and black steel surfaces shall first be painted with one (1) coat of P&L galvanized metal primer. Primer may be eliminated on concealed fire and gas piping.
 3. Aluminum surfaces shall first be painted with one (1) coat of P&L zinc chromate primer. (See Section 1.51.5)
 4. Cast iron pipe shall first be primed with a "non-bleed" primer.
 5. The underside of all cast iron sinks not recessed in a cabinet are included as items to be painted in exposed areas.
- K. Electrical switchgear, disconnect switches, contactors, etc., with suitable factory applied finishes shall not be repainted; except for aesthetic reasons where located in finished areas as directed by the Architect/Engineer and in a color selected by the Architect/Engineer. Where factory applied finishes are damaged in transit, storage or installation, or before final acceptance, they shall be restored to factory fresh condition by competent refinishers using the spray process.

NOTE TO SPECIFICATION WRITER: FOR PROJECTS IN THE COASTAL AREA, ADD THE FOLLOWING PARAGRAPH.

- L. All ferrous metal surfaces without a protective finish and not galvanized in exposed and concealed areas including chases, underfloor and above ceilings shall be painted with two (2) coats of P&L zinc chromate primer as the construction progresses to protect against deterioration.

PART 2 PRODUCTS

2.01 Not Used.

PART 3 EXECUTION**3.01 PIPE PRESSURE TESTS**

A. The following lines shall be tested at the stated pressure for the length of time noted:

NOTE TO SPECIFICATION WRITER: DELETE ANY INAPPLICABLE LINES AND ADD APPLICABLE LINES NOT ALREADY INCLUDED.

<u>Testing Service</u>	<u>Testing Medium</u>	<u>Pressure (PSIG)</u>	<u>Time in Hours</u>
Chilled Water / Heating Hot Water	Water	150	24
Steam M.P. & L.P.	Water	150	24
Steam Condensate M.P.	Water	150	24
Steam H.P.	Water	300	24
Steam Condensate H.P.	Water	300	24
Pumped Condensate Return	Water	150	24
Domestic Hot & Cold Water	Water	150	24
Sanitary & Storm Piping	Water	Fill to top	24
Natural Gas	Air	100	24
Compressed Air	Air	150	24
Medical Gases	Nitrogen	150	24
Medical Vacuum	Nitrogen	150	24

B. Where leaks occur, the pipe shall be repaired and the tests repeated. No leaks shall be corrected by peening. Defective piping and joints shall be removed and replaced.

END OF SECTION

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OFPC Standard Specification

SECTION 23 05 29

SLEEVES, FLASHINGS, SUPPORTS AND ANCHORS

This Standard Specification Section is controlled by the Office of Facilities Planning and Construction, UT System. It is to be used as guideline on all UT System projects, unless deviations are approved in writing by the Project Manager. It is not to be used for bidding, permitting, construction or any other purpose. This document is the property of UT System, and use of this document, in part or in whole, for any purpose other than for a UT System project may not be done without written permission of UT System.

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The issuance and revision history of this section is tabulated below. Please destroy any previous copy in your possession.

Rev No.	Date	Pages	Remarks
0	March 1998	16	Original
1	May 2004	1	Revised Cover Page
2	February 2007	17	Format, Spec Section #, 1.00

OFPC Standard Specification

SECTION 23 05 29

SLEEVES, FLASHINGS, SUPPORTS AND ANCHORS

PART 1 GENERAL

1.00 The following sections are to be included as if written herein:

- A. Section 23 00 00 – Basic Mechanical Requirements
- B. Section 23 05 53 – Mechanical Identification

1.01 SECTION INCLUDES

- A. Pipe and equipment hangers and supports
- B. Equipment bases and supports
- C. Sleeves and seals
- D. Flashing and sealing equipment and pipe stacks

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section [____ - _____]: Placement of [inserts] [sleeves] in concrete formwork.
- B. Section [____ - _____]: Placement of roofing [pipe] [duct] supports.
- C. Section [____ - _____]: Placement of equipment roof supports.
- D. Section [____ - _____]: Placement of roof sleeves, vents, and curbs.

1.03 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section [____ - _____]: Supply of roofing [pipe] [duct] [equipment] supports for placement by this Section.

1.04 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Equipment bases
- B. Section 07 84 00 - Firestopping: Joint seals for piping and duct penetration of fire rated

assemblies

- C. Section 09 91 00 - Painting
- D. Section 23 05 4 - Vibration Isolation
- E. Section 23 07 19 - Piping Insulation
- F. Section 23 07 16 - Equipment Insulation
- G. Section 23 07 16 - Ductwork Insulation
- H. Section 21 13 13 - Fire Protection Systems
- I. Section 22 13 16 - Plumbing Piping
- J. Section 23 21 00 - Hydronic Piping
- K. Section 23 22 00 - Steam and Steam Condensate Piping

1.05 REFERENCES

- A. ASME B31.1 - Power Piping
- B. ASME B31.2 - Fuel Gas Piping
- C. ASME B31.5 - Refrigeration Piping
- D. ASME B31.9 - Building Services Piping
- E. ASTM F708 - Design and Installation of Rigid Pipe Hangers
- F. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer
- G. MSS SP69 - Pipe Hangers and Supports - Selection and Application
- H. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- I. NFPA 13 - Installation of Sprinkler Systems
- J. NFPA 14 - Installation of Standpipe and Hose Systems
- K. UL 203 - Pipe Hanger Equipment for Fire Protection Service

1.06 SUBMITTALS

- A. Submit under provisions of Section 23 00 00.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data: Provide manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for support of plumbing, hydronic, steam and steam condensate piping.
- B. Supports for Sprinkler Piping: Shall be in conformance with NFPA 13.
- C. Supports for Standpipes: Shall be in conformance with NFPA 14.

PART 2 PRODUCTS

2.01 HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Grinnell.
 - 2. Kindorf
 - 3. B-Line
 - 4. Power Strut
 - 5. Other acceptable manufacturers offering equivalent products.
 - a) [_____] Model [_____].
 - b) [_____] Model [_____].
 - c) [_____] Model [_____].

- B. Supports, hangers, anchors and guides shall be provided for all horizontal and vertical piping. Shop Drawings shall be provided, indicating locations and details of anchors, guides, expansion loops and joints, hangers, etc. The hanger design shall conform to the ASME Code for Pressure Piping.
- C. All auxiliary steel required for supports, anchors, guides, etc. shall be provided by the Mechanical Trades unless specifically indicated to be provided by others.
- D. The supports, hangers, anchors, and guides for the chilled water supply and return piping, steam piping, condensate return piping, etc. of the Campus Loop System routed through utility tunnels and below buildings shall be provided as indicated on the Drawings.
- E. Contractor shall review all Drawings, including Structural Drawings, for details regarding pipe supports, anchors, hangers, and guides.
- F. All Supports shall be of type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.
- G. All rod sizes indicated in this Specification are minimum sizes only. This trade shall be responsible for structural integrity of all supports, anchors, guides, etc. All structural hanging materials shall have a minimum safety factor of 5 built in.
- H. Anchor points as indicated on Drawings or as required shall be located and constructed to permit the piping system to take up its expansion and contraction freely in opposite directions away from the anchored points.
- I. Guide points shall be located and constructed wherever required or indicated on Drawings and at each side of an expansion joint or loop, to permit free axial movement only.
- J. Supports, hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system.
- K. Hangers supporting and contacting brass or copper lines 3" in size and smaller shall be Grinnell Fig. CT-99c, adjustable, copper plated, tubing ring. Hangers supporting and contacting brass or copper lines 4" and larger shall be Grinnell Fig. 260, adjustable clevis, with a nut above and below the hanger, and approved neoprene isolating material between pipe (or tubing) and hanger on the support rod. For insulated copper or brass domestic water lines, hangers for all sizes of pipe shall be Grinnell Fig. 300, adjustable clevis, with a nut above and below the hanger, and approved neoprene isolating material between pipe (or tubing) and hanger on the support rod. Isolate all copper or brass lines from all ferrous materials with approved dielectric materials. Hangers supporting and contacting plastic or glass piping shall be of equal design, but shall be padded with neoprene material or equal. The padding material and the configuration of its installation shall be submitted for approval.
- L. Hangers supporting insulated lines where the outside diameter of the insulation is the

equivalent of 8" diameter pipe or smaller in size and supporting all ferrous lines 6" and smaller in size shall be Grinnell Fig. 260, adjustable clevis, with a nut above and below the hanger on the support rod.

- M. Hangers supporting and contacting ferrous lines larger than 6" in size and outside of insulation on lines with the outside diameter equivalent to 10" diameter pipe shall be Grinnell Fig. 260, adjustable clevis, with a nut above and below the hanger on the support rod.
- N. Other special type of hangers may be employed where so specified or indicated on the Drawings, or where required by the particular conditions. In any case, all hangers must be acceptable to the owner.
- O. Each hanger shall be properly sized to fit the supported pipe or fit the outside of the insulation on lines where specified. Hangers for dual or low temperature insulation pipes shall bear on the outside of the insulation, which shall be protected by support shields as specified in Section 23 07 19 - PIPING INSULATION. Protect insulation from crushing by means of a section of rigid insulation to be installed at hanger points. Hangers for high temperature insulated pipes and all insulated hot and cold domestic water pipes shall be encased in the insulation unless supported by trapezes in which case shield and rigid insulation shall be provided as specified above for low temperature insulated pipes.
- P. Supports for vertical piping in concealed areas shall be double bolt riser clamps, Grinnell Fig. 261, or other approved equal, with each end having equal bearing on the building structure, and located at each floor. Two-hole rigid pipe clamps at 4 ft. o.c. or Kindorf channels and Grinnell Fig. 261 riser clamps may be used to support pipe directly from vertical surfaces or members where lines are not subject to expansion and contraction. When piping is subject to expansion and contraction, provide spring isolators (see Section 23 05 48 - Vibration Isolation). Where brass or copper lines are supported on trapeze hangers or Kindorf channels the pipes shall be isolated from these supports with plastic tape with insulating qualities, or strut clamps as manufactured by Specialty Products Company, Stanton, California.
- Q. Supports for vertical piping in exposed areas (such as fire protection standpipe in stairwells) shall be attached to the underside of the building structure above the top of the riser, and the underside of the penetrated structure. The contractor shall use a drilled anchor as specified above, and use a Grinnell No. 595 Socket Clamp with Grinnell No. 594 Socket Clamp Washers, as a riser clamp. The top riser hanger shall consist of two (2) hanger rods (sized as specified) anchored to the underside of the building structure, supporting the pipe by means of the material specified. Risers penetrating floors shall be supported from the underside of the penetrated floor as specified for the top of the riser.
- R. Pipe Supports in Chases and Partitions: Horizontal and vertical piping in chases and partitions shall be supported by hangers or other suitable support. Pipes serving plumbing fixtures and equipment shall be securely supported near the point where pipes penetrate the finish wall. Supports shall be steel plate, angles, or special channels such as Unistrut mounted in vertical or horizontal position. Pipe clamps such as Unistrut P2426, P2008, P1109 or other approved

clamps shall be attached to supports. Supports shall be attached to wall or floor construction with clip angles, brackets, or other approved method. Supports may be attached to cast iron pipe with pipe clamp, or other approved method. All copper or brass lines shall be isolated from ferrous metals with dielectric materials to prevent electrolytic action.

- S. All electrical conduits shall be run parallel or perpendicular to adjacent building lines. Single conduits running horizontally shall be supported by "Caddy" or "Minerallac" type hangers from adequately sized rods (minimum 1/4") from the building structure. Where multiple conduits are run horizontally, they shall be supported on trapeze of "Unistrut" type channel suspended on rods or bolted to vertical building members. Conduit shall be secured to channel with galvanized "Unistrut" type conduit clamps or stainless steel "Unistrut" type "Uni-Clips." All hangers shall be fastened to the building structure in the same manner as specified above for pipe hangers. Spacing of hangers shall be adequate for the weight and rigidity of the conduits involved; in any case, no greater than 8' centers. Where feasible, conduits may be fastened to the concrete by one-hole straps thoroughly anchored to the concrete in an approved manner. Flexible conduit shall also be supported in an acceptable manner so as not to interfere with the maintenance of above-ceiling equipment, and to support it from touching the ceiling system. Conduit shall be located so as not to inhibit removal of ceiling tiles.

IMPORTANT EXCEPTION: If suspension system for the lay-in ceiling is of adequate strength, in the opinion of the Structural Engineer, one only, 3/4" maximum size flexible metallic conduit may be supported from a hanger wire by "Caddy" type clips. Conduit shall be so located so as not to inhibit removal of ceiling tiles.

NOTE TO SPECIFICATION WRITER: ADEQUACY OF CEILING SUSPENSION SYSTEM SHALL BE DETERMINED IN DESIGN PHASE. DO NOT INCLUDE ABOVE EXCEPTION IF INAPPROPRIATE.

Vertical conduits shall be supported as often as necessary for rigidity by clamps resting on adjacent beams or floor slabs, using a minimum of one support per floor.

- T. Perforated strap iron or wire will not, under any circumstances, be acceptable as hanger material.
- U. Vibration Isolation: Resilient hangers shall be provided on all piping connected to rotating equipment (pumps, etc.). Piping or ductwork that may vibrate and create an audible noise shall also be isolated. Spring hangers or supports shall be provided where indicated on the Drawings and/or specified under Section 23 05 48.
- V. Attachment:

1. The load and spacing on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including the concrete which holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required.
2. Inserts shall be of a type which will not interfere with reinforcing as shown on the structural Drawings and which will not displace excessive amounts of structural concrete.
3. All supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, etc. All piping shall be installed with due regard to expansion and contraction and the type of hanger method of support, location of support, etc. shall be governed in part by this Specification.
4. Hangers shall be attached to the structure as follows:
 - a) **Poured In Place Concrete:** Where pipes and equipment are supported under poured in place concrete construction, each hanger rod shall be fitted with a nut at its upper end, which nut shall be set into an Underwriters Laboratories, Inc. listed universal concrete insert placed in the form work before concrete is poured. Where inserts are placed in the bottom faces of concrete joists which are too narrow to provide adequate strength of concrete to hold the insert properly or where a larger insert would require displacement of the bottom joist steel, the hanger rod shall be suspended from the center of a horizontal angle iron, channel iron, I-beam, etc. spanning across two adjacent joists. The horizontal support shall be bolted to nonadjustable concrete inserts of the "spot" type, of physical size small enough to avoid the bottom joist steel.
 - b) **Steel Bar Joists:** Where pipes and loads are supported under bar joists, hanger rods may be run through the space between the bottom angles and secured with a washer and two nuts. Where larger lines are supported beneath bar joists, hanger rods shall be secured to angle irons of adequate size; each angle shall span across two or more joists as required to distribute the weight properly and shall be welded to the joists or otherwise permanently fixed thereto.
 - c) **Steel Beams:** Where pipes and loads are supported under steel beams, approved type beam clamps shall be used.
 - d) **Wood Framing:** Where pipes and loads are supported from wood framing, hanger rods shall be attached to framing with side beam brackets or angle clips.
 - e) **Pre-Cast Tee Structural Concrete:** Hanger supports, anchors, etc. required for mechanical systems attached to the precast, double tee, structural concrete system are to be installed in accord with approved shop Drawings only. Holes required for hanger rods shall be core drilled in the "flange" of the double tee only; impact type tools are not allowed under any circumstances. Core drilling in the "stem"

portions of the double tee is not allowed. Holes core drilled through the "flange" for hanger rods shall be no greater than 1/4" larger than the diameter of the hanger rod. Hanger rods shall be supported by means of bearing plates of size and shape acceptable to the Architect/Engineer, with welded double nuts on the hanger rod above the bearing plate. Cinch anchors, lead shields, expansion bolts, and studs driven by explosion charges are not allowed under any circumstances in the lower 15" of each stem and in the "shadow" of the stem on the top side of the "double tees."

- f) If it is necessary to install a method of fastening a hanger after the structure has been installed, then only clamps or drilled anchors shall be used.

Power-actuated fasteners (shooting) will not be acceptable under any circumstances.

Note: Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.

- W. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on trapezes of Kindorf, Uni-Strut, Power Strut, or approved equal, channel-suspended on rods or pipes. Trapeze members including suspension rods shall each be properly sized for the number, size, and loaded weight of the lines they are to support.
- X. Finishes: All hangers on piping including clevis hangers, rods, inserts, clamps, stanchions, and brackets, shall be dipped in Zinc Chromate Primer before installation. Rods may be galvanized or cadmium plated after threading, in lieu of dipping zinc chromate. Universal concrete inserts shall be cadmium plated.
- Y. Ductwork: All ductwork shall be supported in accordance with the SMACNA recommendation for the service involved; however, all horizontal ductwork shall be supported at intervals not to exceed the scheduled values indicated elsewhere in this section. Horizontal ducts shall be supported using galvanized steel bands extending up both sides and onto the construction above, where they shall turn over and be secured with bolts and nuts fitted in inserts set in the concrete bolted to angles secured to the construction above, or secured in another approved manner. For attaching methods for precast double tee structural concrete, refer to details on the Drawings and as specified herein.
- Z. Terminal units shall be supported by four 16 gauge, 1" wide sheet metal straps with ends turned under bottom of box at corners. Each band shall be secured by not over 3/4" in length, 1/4" diameter sheet metal screws - two on bottom of box and one on side. The other strap end shall be attached to the structure by 1/4" diameter threaded bolt into the concrete insert or into drilled-hole threaded concrete expansion anchor. Where interferences occur, overhead of the box, not allowing direct vertical support by straps, provide trapezes of Kindorf, Unistrut, or B-Line channel suspended by 1/4" diameter galvanized threaded rods providing such channels

do not block access panels of boxes. Threaded rods shall be supported from structure by concrete insert or by drilled-hole threaded concrete expansion anchor.

- AA. Miscellaneous: Provide any other special foundations, hangers and supports indicated on the Drawings, specified elsewhere herein; or required by conditions at the site. Hangers and supporting structures for suspended equipment shall be provided as required to support the load from the building structure in a manner acceptable to the Architect/Engineer.
- BB. Fire Protection Systems: All hangers and supports for fire standpipe systems and fire sprinkler systems shall be Factory Mutual and Underwriters Laboratories, Inc. listed and labeled. Construction of hangers shall be as described above for common piping, except for the above-mentioned requirements.

2.03 ACCESSORIES

- A. Hanger Rods: Galvanized mild steel threaded both ends, galvanized threaded one end, or galvanized continuous threaded.
- B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction. If the inserts are later found not to be in the proper location for the placement of hangers, then drilled anchors shall be installed. Drilled anchors in concrete or masonry shall be submitted for the approval by the Owner.

2.04 FLASHING AND EQUIPMENT CURBS

NOTE: Stainless steel to be used for Galveston projects only.

- A. Metal Flashing: 26 gauge galvanized (stainless steel) steel.
- B. Metal Counterflashing: 22 gauge galvanized (stainless steel) steel.
- C. Roofing Flashing: See specifications for Roofing, elsewhere in these Specifications.
- D. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.
- E. Curbs: Welded 18 gauge galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, factory installed wood nailer.

NOTE TO ENGINEER - DELETE THIS PARAGRAPH FOR UT AUSTIN PROJECTS.

2.07 CONCRETE FOUNDATIONS ("Housekeeping Pads"):

- A. Concrete foundations for the support of equipment such as floor mounted panels, pumps, fans, air handling units, etc., shall extend 4" on all sides beyond the limits of the mounted equipment unless otherwise noted and shall be poured in forms built of new dressed 6" nominal lumber. All corners of the foundations shall be neatly chamfered by means of sheet metal or triangular wood strips nailed to the form. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Each bolt shall be set in a sleeve of size to provide 1/2" clearance around bolt. Allow 1" below the equipment bases for alignment and grouting. After grouting, the forms shall be removed and the surface of the foundations shall be hand rubbed with Carborundum. Foundations for equipment located on the exterior of the building shall be provided as indicated. Foundations shall be constructed in accordance with Shop Drawings submitted by the Contractor for review by the Architect/Engineer.

2.08 WALL, FLOOR AND CEILING PLATES:

- A. Except as otherwise noted, provide C.P. (Chrome plated) brass floor and ceiling plates around all pipes, conduits, etc., passing exposed through walls, floors, or ceilings, in any spaces except underfloor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines which are insulated and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend 3/4" above finished floor. All equipment rooms are classified as finished areas. Round and rectangular ducts shall have closure plates (NOT chrome plated) made to fit accurately at all floor, wall and ceiling penetrations. Floor penetrations in exposed (except in stair wells) areas shall be finished using 'bell' fitting to fit pipe or insulation and sleeve and shall be painted to match the pipe. Penetrations in stairwells shall have flat floor plate painted to match pipe.

2.09 SLEEVES

- A. General: All openings through all floors, walls, and roofs, etc., regardless of material for the passage of piping, ductwork, conduit, cable trays, etc., shall be sleeved. All penetrations must pass through sleeves. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect/Engineer. If a penetration is cored into an existing vertical solid concrete, masonry or stone structure, then the installation of a sleeve will not be necessary.
1. Sleeve material for floors and exterior walls shall be Schedule 40 galvanized steel with welded water stop rings.
 2. Sleeves through interior walls to be galvanized sheetmetal with gauge as required by wall fire rating, 20 gauge minimum.

- B. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeve shall be 1/4", except that the minimum clearance shall accommodate a Thunderline Link-seal closure where piping exits the building, or penetrates a wall below ground level. Contractor shall be responsible for the accurate location of penetrations in the slab for his pipe, duct, etc. All penetrations shall be of ample size to accommodate the pipe, duct, etc., plus any specified insulation. Void between sleeve and pipe in interior penetrations shall be filled with Nelson Flameseal Firestop or approved equal caulk or putty.
- C. Floor sleeves shall extend above the finished floor as detailed on the drawings, except that floor sleeves in stairwells shall be flush with the finished floor. Sleeves in walls shall be trimmed flush with wall surface. Refer to the details on the project drawings. Where the details differ from these specifications, the drawings take precedence.
- D. Sleeves for penetrations passing through walls or floors on or below grade shall be removed, if practical, and after the pipes have been installed, the void space around the pipe shall be caulked with a suitable material to effect a waterproof penetration. Note that the practicality of the removal of the sleeve shall be the decision of the Construction Inspector. The decision of the Inspector shall be final.
- G. Vermin proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be vermin proofed in a manner acceptable to the Architect/Engineer.
- H. Waterproofing: The annular space between a pipe and its sleeve in interior floors shall be filled with polyurethane foam rods 50 percent greater in diameter than the space as backing and fill material and made watertight with a permanent elastic polysulfide compound. Seal both surfaces of floor.
- I. Air Plenums: The space around piping, ductwork, etc., passing through air plenums shall be made airtight in a manner acceptable to the Architect/Engineer.
- J. Fireproofing: Seal all cable trays, pipe, conduit, duct, etc., penetrations through roof, fire rated walls and floors with a foam or sealant as described below, that will form a watertight, vermin tight barrier that is capable of containing smoke and fire up to 2000° F for two hours. Sealing of cable trays and conduits that extend through rated walls from ends of cable tray shall be done after conductors have been installed. For wet locations, the foam material shall be a silicone RTV foam or an approved equal. For dry locations, a premixed putty equal to Nelson Flameseal Firestop putty may be used.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.03 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place hangers within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed, but shall be corrosion protected with galvanized plating. Repair any damaged galvanized plating with a coating of 'Galvalum'.

- L. Hanger Rods: (NOTE: All hanger rods shall be trimmed neatly so that no more than 1 inch of excess hanger rod protrudes beyond the hanger nut. In the event a rod is intentionally but temporarily left excessively long (for sloped or insulated lines for example), the contractor shall take appropriate measures to protect the pipe or other materials from damage.)

3.04 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counterflash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, shower, mop sink, and [] drains watertight to adjacent materials.
- E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.
- F. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.
- G. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.05 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors (except in stairwells) two inches above finished floor level. Sleeves through floors shall have welded waterstop rings. Sleeves shall be sealed watertight to floors and pipe.
- D. Where piping, ductwork or conduit penetrates floor, ceiling, or wall, close space between pipe or duct and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers, as appropriate, at both sides of penetration.

- E. Install chrome plated steel or stainless steel escutcheons at finished surfaces.

3.06 PIPE SUPPORT SCHEDULES

STEEL PIPE SIZE <u>Inches</u>	MAX. HANGER SPACING <u>Feet</u>	HANGER ROD DIAMETER <u>Inches</u>
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8
8 to 12	14	7/8
14 and Over	20	1
PP, PVDF, PVC, CPVC (All Sizes)	4	3/8
C.I. Bell and Spigot (or No-Hub), <u>and at all Joints</u>	5	5/8
Glass, <u>and at all Joints</u>	4	1/2

3.07 LOW PRESSURE DUCT SUPPORT SCHEDULE:

- A. All horizontal ducts up to and including 40 inches in their greater dimension shall be supported by means of No. 18 U.S. gauge band iron hangers attached to the ducts by means of screws, rivets, or clamps and fastened to above inserts with toggle bolts, beam clamps or other approved means. Duct shall have at least one pair of supports 8' 0" on centers. Clamps shall be used to fasten hangers to reinforcing on sealed ducts.
- B. Horizontal ducts larger than 40 inches in their greatest dimension shall be supported by means of hanger rods bolted to angle iron trapeze hangers. Duct shall have at least one pair of supports 8' 0" on centers according to the following:

<u>Angle Length</u>	<u>Angle</u>	<u>Rod Diameter</u>
4' 0"	1-1/2" x 1-1/2" x 1/8"	1/4"
6' 0"	1-1/2" x 1-1/2" x 1/8"	1/4"
8' 0"	2" x 2" x 1/8"	5/16"
10' 0"	3" x 3" x 1/8"	3/8"

- C. Vertical ducts shall be supported where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60." Above 60", the angles must be increased in strength and sized on an individual basis considering space requirements.

3.08 MEDIUM PRESSURE DUCT SUPPORT SCHEDULE:

- A. All horizontal rectangular ducts shall have duct hanger requirements as follows:

<u>Max. Duct Dimen.</u>	<u>Minimum Hanger Size</u>				
	<u>Steel Rod</u>	<u>Galv. Steel Strap Width</u>	<u>Max. Spacing</u>	<u>Min.# Hngers</u>	<u>Trapeze Size</u>
0 through 18"	--	1" x 16 ga.	10'	2	--
19" through 36"	--	1" x 16 ga.	10'	2	--
37" through 60"	3/8"	1" x 16 ga.	8'	2	2" x 2" x 1/4"
61" through 120"	3/8"	1-1/2" x 12 ga.	8'	2	2" x 2" x 1/4"
121" through 240"	3/8"	--	4'	3	2-1/2" x 2-1/2" x 3/16"

- B. All horizontal round ducts shall have ducts hangers spaced 10' 0" maximum with requirements as follows:

<u>Duct Diameter</u>	<u>Min. Hanger Size</u>	<u>No. Hangers</u>	<u>Hanger Ring Size</u>
Up through 18"	1" x 16 gauge	1	1" x 16 ga.
19" to 36"	1" x 12 gauge	1	1" X 12 ga.
37" to 50"	1-1/2" x 12 gauge	1	1-1/2" x 12 ga.
51" to 84"	1-1/2" x 12 gauge	2	Support Bracing Angle

3.09 DUCT HANGERS - GENERAL NOTES (all pressures)

- A. Hanger straps on duct width of 60 inches and under shall lap under the duct a minimum of 1 inch and have minimum of one fastening screw on the bottom and two on the side.
- B. Hanger straps on duct widths over 60 inches shall be bolted to duct reinforcing with 3/8" bolts minimum.
- C. Use 3/8" minimum bolts for securing duct hanger to band straps.
- D. All round ducts shall be supported within 3 feet of all horizontal or vertical turns.

END OF SECTION

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OFPC Standard Specification

SECTION 23 07 13

DUCTWORK INSULATION

This Standard Specification Section is controlled by the Office of Facilities Planning and Construction, UT System. It is to be used as guideline on all UT System projects, unless deviations are approved in writing by the Project Manager. It is not to be used for bidding, permitting, construction or any other purpose. This document is the property of UT System, and use of this document, in part or in whole, for any purpose other than for a UT System project may not be done without written permission of UT System.

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The issuance and revision history of this section is tabulated below. Please destroy any previous copy in your possession.

Rev No.	Date	Pages	Remarks
0	March 1998	8	Original
1	May 2004	1	Revised Cover Page
2	February 2007	9	Format, 1.00

OFPC Standard Specification

SECTION 23 07 13

DUCTWORK INSULATION

PART 1 GENERAL

1.00 The following sections are to be included as if written herein:

- A. Section 23 00 00 – Basic Mechanical Requirements
- B. Section 23 05 29 – Sleeves, Flashings, Supports and Anchors
- C. Section 23 05 53 – Mechanical Identification

1.01 SECTION INCLUDES

- A. Ductwork insulation
- B. Insulation jackets

1.02 RELATED SECTIONS

- A. Section 09 91 00 - Painting: Painting insulation jackets
- B. Section 23 31 00 - Ductwork: Duct liner
- C. Section 23 33 00 - Ductwork Accessories: Duct liner

1.03 REFERENCES

- A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate
- B. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- C. ASTM C553 - Mineral Fiber Blanket and Felt Insulation
- D. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation
- E. ASTM E84 - Surface Burning Characteristics of Building Materials
- F. ASTM E96 - Water Vapor Transmission of Materials

- G. NFPA 255 - Surface Burning Characteristics of Building Materials
- H. SMACNA - HVAC Duct Construction Standards - Metal and Flexible
- I. UL 723 - Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

- A. Submit under provisions of Section 23 00 00.
- B. Product Data: Provide product description, list of materials and thickness for each service, and locations.
- C. Samples: Submit two samples of any representative size illustrating each insulation type.
- D. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with NFPA 255.

1.06 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 23 00 00.
- B. Deliver materials to site in original factory packaging, labeled with manufacturer's density and thickness.
- C. Store insulation in original wrapping and protect from weather and construction traffic.
- D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 Insulation A:

- A. Three pound per cubic foot minimum density glass fiber semi-rigid board insulation with fiber perpendicular to the surface and with factory applied white foil reinforced vapor barrier jacket (ASJ). Insulation shall be equal to E.O. Woods Company "Rigid-Wrap".
- B. The insulation shall be secured to the ducts with mechanical fasteners; "Stick-clips", Graham Pins or Speed Clips, and shall be spaced approximately 12" on center on bottom of duct and where required elsewhere to hold insulation securely against the duct as noted in the published recommendations of the Insulation Manufacturer.
- C. After insulation is in place, all joints and seams shall be sealed with Foster 30-35 white vapor barrier emulsion applied over a 3" wide strip of Duramesh Glass Fabric. All protrusions through the vapor barrier shall be thoroughly sealed.
- D. On ducts that are reinforced with standing seams or angle iron stiffeners 1" and over in height, the Contractor shall apply a strip of fiberglass board 1" thick by 6" wide, sealing same to the other insulation with mastic.
- E. Vapor sealing of joints and seams is not required on hot duct application where concealed.

2.02 Insulation B:

- A. Three pound per cubic foot minimum density glass fiber rigid board insulation with factory applied white foil reinforced All Service Jacket (ASJ).
- B. Insulation B shall be applied as specified for Insulation A.
- C. Contractor at his option may substitute Insulation A where Insulation B is called for.

2.03 Insulation C:

- A. Blanket insulation with a thermal conductivity (K) of 0.27 or less similar in construction to Owens-Corning Fiberglass Series one pound per cubic foot minimum density with foil reinforced Kraft (FRK) vapor barrier facing. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a

minimum of 2". Adhere insulation to metal with 4" strips of insulation bonding adhesive at 8" on center. On circumferential and longitudinal joints, the 2" flange of the facing shall be secured using 9/16" flare door staples applied 6" on center and taped with 4" wide fiberglass tape embedded in Foster 30-35 white vapor barrier Emulsion and covered with Foster 30-35 white vapor barrier Emulsion until the tape is completely covered. All pin penetrations or punctures in facing shall also be taped. Vapor sealing of joints is not required on hot duct application where concealed.

- 2.04 All ductwork in the building and in the crawl spaces except toilet exhaust and fume hood exhaust ducts shall be insulated externally unless specifically excluded. Only sound attenuated return ducting may be insulated internally, if specifically designated as such.
- 2.05 Where ducts are lined internally, (see Drawings for Scope) no exterior insulation will be required, except where specifically stated otherwise. Where internal and external insulation join, they shall lap at least 24 inches.
- 2.06 Low pressure supply duct taps to ceiling diffusers shall be externally insulated including top of ceiling diffuser with 2" Insulation C.
- 2.07 Flexible round ducts are specified in Section 23 31 00.UT as factory insulated.
- 2.08 All kitchen hood exhaust ductwork connected to both inlet and discharge sides of Fans shall be insulated. Insulation shall be 1" insulation A or B.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ductwork has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Insulated ductwork conveying air below ambient temperature:
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor barrier jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. For ductwork exposed in mechanical equipment rooms or in finished spaces, finish with aluminum jacket.
- E. For exterior applications, provide insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
- F. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive to match jacket.
 2. Secure insulation without vapor barrier with staples, tape, or wires.
 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
 3. Seal and smooth joints.
 4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
- 3.03 All piping, equipment, ductwork, all plenums including metal and masonry construction, fans, etc., shall be insulated as indicated on the Drawings, as specified herein, and as required for a complete system. In each case, the insulation shall be equal to that specified and materials applied and finished as described in these Specifications.
- 3.04 All insulation shall be applied by mechanics skilled in this particular work and regularly engaged in such occupation. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy work will not be acceptable, and all such work shall be removed and replaced as many times as necessary to achieve an acceptable installation.
- 3.05 All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application, and is stated as an exception to this requirement. Certificates to this effect shall be submitted along with Contractor's submittal data for this section of the Specifications. No material may be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.
- 3.06 All surfaces to be insulated shall be clean and dry before applying the insulation. All sections of molded pipe covering shall be firmly butted together. Where an insulation covering is applied, it shall lap the adjoining section of insulation by at least three inches (3"). Where insulation terminates, it shall be neatly beveled and finished. No insulation shall be applied until the pipe, duct, etc., have been pressure tested and found tight. Piping, flexible connections, flanges, valves, strainers, and unions shall be covered unless specifically noted otherwise. Flexible connections on duct shall not be covered. All materials used shall be fire retardant or nonflammable. Refer to Section 15A.
- 3.07 Where vapor barriers are required, the vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall all be sealed. Where insulation with a vapor barrier terminates, it shall be sealed off with the vapor barrier being continuous to the surface being insulated. Ends shall not be left raw.
- 3.08 Extreme care shall be taken in covering high and medium pressure (high and medium pressure ductwork shall be all ductwork between the fan discharge and all mixing boxes) ductwork to insure the duct is not pierced with sheet metal screws or other

fasteners. All high and medium pressure ducts in these specifications are classified as high velocity ductwork.

- 3.09 Where specified, aluminum bands shall be used on piping insulation. The bands shall be applied three (3) to a section of pipe. Fittings, valves, etc., shall have bands on each side.
- 3.10 Where canvas finish is specified, use Arabol lagging adhesive to prevent mildew in securing canvas. Do not use wheat paste. In addition, cover all canvas insulation with a fire retardant coating.
- 3.11 For purpose of definition in this Specification: "concealed" areas are those areas which cannot be seen by the building occupants, and "exposed" areas are all areas which are exposed to view by the building occupants, including under counter and inside cabinet areas, plus all mechanical rooms.
- 3.12 The handling and installation of all insulation materials shall be performed in strict accordance with the manufacturer's recommendations.
- 3.13 TOLERANCE
- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.
- 3.14 DUCT INSULATION SCHEDULE:

<u>Duct Type</u>	<u>Insulation Type</u>
Cold Supply Round	1 1/2" Insulation A
Hot Supply Round	1" Insulation A
Cold Supply Flat Oval	1 1/2" Insulation A
Hot Supply Flat Oval	1" Insulation A
Cold/Hot/or Combination Rectangular	1 1/2" Insulation B
Hot and Cold Combination Supply Round	2" Insulation C
Outside Air	1" Insulation B

END OF SECTION

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OFPC Standard Specification

SECTION 23 33 00

DUCTWORK ACCESSORIES

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4	Sept. 2010	1	2.01

OFPC Standard Specification

SECTION 23 33 00

DUCTWORK ACCESSORIES

PART 1 GENERAL

1.00 The following sections are to be included as if written herein:

- A. Section 23 00 00 – Basic Mechanical Requirements
- B. Section 23 05 29 – Sleeves, Flashings, Supports and Anchors
- C. Section 23 05 53 – Mechanical Identification

1.01 WORK INCLUDED

- A. Manual and Automatic Volume Control Dampers
- B. Fire Dampers
- C. Combination Fire/Smoke Dampers
- D. Backdraft Dampers
- E. Air Turning Devices
- F. Flexible Duct Connections
- G. Duct Access Doors
- H. Duct Test Holes

1.02 RELATED WORK

- A. Products installed, but not furnished under this section include airflow stations and automatic control dampers to be provided by Controls Contractor under section 23 09 23.
- B. Section 23 05 48 - Vibration Isolation
- C. Section 23 31 00 - Ductwork

- D. Section 23 36 00 - Air Terminal Units: Medium and High Pressure Damper Assemblies

1.03 REFERENCES

- A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
- B. SMACNA - Low Pressure Duct Construction Standards
- C. UL 33 - Heat Responsive Links for Fire Protection Service
- D. UL 555 - Fire Dampers and Ceiling Dampers

1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 23 00 00.
- B. Provide shop drawings for shop fabricated assemblies indicated, including manual volume dampers, automatic control dampers, duct access doors, and duct test holes. Provide product data for hardware used.
- C. Submit manufacturer's installation instructions under provisions of Section 23 00 00 for fire dampers and combination fire and smoke dampers.

PART 2 PRODUCTS

NOTE TO THE ENGINEER: ALL MANUAL AND AUTOMATIC VOLUME DAMPERS KNOWN TO BE REQUIRED, INCLUDING IN THE VERTICAL, SHALL BE SHOWN IN THE PLANS.

2.01 DAMPERS

- A. Furnish and install manual volume dampers where shown on the drawings and wherever necessary for complete control of the air flow, including all supply, return and exhaust branches, "division" in main supply, return and exhaust ducts, each individual air supply outlet and fresh air ducts. Where access to dampers through a fixed suspended ceiling is necessary, the Contractor shall be responsible for the proper location of the access doors.

NOTE TO SPECIFICATION WRITER: IN GALVESTON, OUTSIDE AIR DAMPERS SHALL BE 316L STAINLESS STEEL. MODIFY THIS SPECIFICATION AND DIRECT DIGITAL CONTROL SYSTEM SPECIFICATION 23 09 23 TO SUIT.

- B. Splitter dampers shall be fabricated of steel not lighter than 16-gauge. The leading edge of the damper shall be hemmed. Each splitter shall be a minimum of 12" long or 1-1/2 times the width of the smaller of the two branches it controls, whichever is greater. Dampers shall be carefully fitted, and shall be controlled by locking quadrants equal to Ventlok No. 555 on exposed uninsulated ductwork, No. 644 on exposed externally insulated ductwork and No. 677 (2-5/8" diameter) chromium plated cover plate for concealed ductwork not above lay-in accessible ceilings. Furnish and install end bearings for the damper rods on the end opposite the quadrant when No. 555 or No. 644 regulators are used, and on both ends when No. 677 regulators are used.
- C. On concealed ductwork above lay-in accessible ceilings use Ventlok No. 555 or No. 644 locking quadrant for splitter dampers.
- D. Dampers larger than three (3) square feet in area shall be controlled by means of rods hinged near the leading edge of the damper with provisions for firmly anchoring the rod and with end bearings supporting the axle.
- E. Manual volume dampers shall be equal to Ruskin, or approved equal. Blades shall not exceed 48 inches (48") in length or twelve inches (12") in width and shall be of the opposed interlocking type. The blades shall be of not less than No. 16-gauge galvanized steel supported on one-half inch (1/2") diameter rust-proofed axles. Axle bearings shall be the self-lubricating ferrule type.
- F. Install all automatic control dampers, furnished by the Temperature Control Manufacturer, in strict accordance with the manufacturer's recommendations and requirements of these Specifications.
- G. All adjustable dampers installed in externally insulated ductwork shall be installed with Ventlok No. 639, or equal, elevated dial operators. Insulation shall extend under the elevated dial. All adjustable dampers installed in internally insulated ductwork shall be installed with Ventlok No. 635, or equal, dial operators. All damper shaft penetrations in the ductwork shall be installed with Ventlok #609 end bearings.

2.02 FIRE AND FIRE/SMOKE DAMPERS

NOTE TO DESIGNER: ALL FIRE AND FIRE/SMOKE DAMPERS MUST BE SHOWN ON THE DRAWINGS. USE FIRE/SMOKE DAMPERS FOR SMOKE DAMPER APPLICATIONS.

- A. Fire Dampers
 - 1. Furnish and install where shown on the drawings or required by the Specifications, fire dampers meeting the following requirements.

2. Each fire damper shall be constructed and tested in accordance with Underwriters Laboratories Safety Standard 555. All dampers shall possess a 1-1/2 hour or 3 hour (as appropriate for the construction shown in the architectural drawings) protection rating, 165 or 212 degree F fusible link, and shall bear a U.L. label in accordance with Underwriters Laboratories labeling procedures. Fire dampers shall be constructed such that the damper frame material and the curtain material shall be galvanized.
3. Fire dampers shall be curtain blade or multi-blade type and the damper shall be so constructed that the blades are either out of the air stream or installed in an oversized sleeve to provide a 100 percent free area of the duct in which the damper is housed.
4. The damper manufacturer's literature submitted for approval prior to the installation shall include performance data developed from testing in accordance with AMCA 500 Standards and shall show the pressure drops for all sizes of dampers required at anticipated airflow rates. Maximum pressure drop through fire damper shall not exceed 0.05 inch water gauge.
5. Fire dampers shall be equipped for vertical or horizontal installation as required by the locations shown in the drawings. Fire dampers shall be installed in wall and floor openings utilizing steel sleeves, angles and other material and practices required to provide an installation equivalent to that utilized by the manufacturer when the respective dampers were tested by Underwriters Laboratories. Mounting angles shall be a minimum of 1 1/2 inch by 1 1/2 inch by 14-gauge and bolted, tack welded or screwed to the sleeve at maximum spacing of 12 inches and with a minimum of two connections at all sides. Mounting angles shall overlap at least equal to the gauge of the duct defined by the appropriate SMACNA Duct Construction Standard, latest edition, and as described in NFPA 90A. The entire assembly, following installation, shall be capable of withstanding 6" water gauge static pressure.
6. The damper installation shall be in accordance with the damper manufacturer's instructions.
7. All fire dampers shall comply with the specification as written above and shall be Ruskin model DIBD2 (Style C, CR or CO), Greenheck model DFD-150 or DFDR-150 (Type C, CR or CO), or Pottorff model VFD-10D-A.
8. The contractor shall completely seal the assembly to the building components using Hardcast 1602 sealant tape to allow for expansion and contraction of the sleeve and damper assembly.

9. Dampers shall be UL labeled for use in dynamic systems. Closure reading shall be 110% of the maximum design airflow at the point of installation. The minimum closure pressure rating shall be 8" wg for airflow in either direction.

B. Combination Fire/Smoke Dampers

1. Furnish and install where shown on the drawings, or as required by the specifications, combination fire/smoke dampers meeting the following requirements.
2. Each combination fire/smoke damper shall be 1 1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to it. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and UL qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be no higher than Leakage Class I (4 cfm per square foot at one inch water gauge pressure and 8 cfm per square foot at 4 inches water gauge pressure). The maximum air pressure drop through each combination fire/smoke damper shall not exceed 0.10 inch water gauge at the design air quantity. (Note that this may require a larger damper than the connected duct size.)
3. The damper frame shall be a minimum of 20-gauge galvanized steel formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in an extruded hole in the frame or an extruded frame raceway. The dampers may be either parallel or opposed blade type. The blades shall be constructed with a minimum of 14-gauge equivalent thickness. The blade edge seal material shall be able to withstand 450 degrees F. The jamb seals shall be flexible stainless steel compression type or lap seal type.
4. In addition to the leakage ratings specified herein, the combination fire/smoke dampers and their operators shall be qualified under UL555S to an elevated temperature of 250 degrees F. Electric operators shall be installed by the damper manufacturer at the time of damper fabrication. The damper and operator shall be supplied as a single entity that meets all applicable UL555 and UL555S qualifications for both dampers and operators. The manufacturer shall provide a factory-assembled sleeve. The

sleeve shall be a minimum of either 20-gauge for dampers where neither width nor height exceeds 48 inches or 16-gauge where either dimension equals or exceeds 48 inches.

5. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4 inches water gauge in the closed position, and 2500 fpm air velocity in the open position.
6. Each combination fire/smoke damper shall be equipped with a UL Classified Firestat/releasing device. The Firestat/releasing device shall electrically and mechanically lock the damper in a closed position when the duct temperatures exceed 165 degrees F and still allow the appropriate authority to operate the damper as may be required for smoke control functions. The damper must be operable while the temperature is above 250 degrees F. The actuator/operator package shall include two damper position indicator switches linked directly to damper blade to provide capability of remotely indicating damper position. One switch shall close when the damper is fully open, and the other switch shall close when the damper is fully closed. The Firestat/releasing device and position indicator switches shall be capable of interfacing electrically with the smoke detectors, building fire alarm systems, and remote indicating/control stations.
7. The damper releasing device shall be mounted within the airstream. The device shall be activated and the damper shall close and lock when subjected to duct temperatures in excess of approximately 285 degrees F.
8. Motors for operation of smoke dampers shall be smoke system fail safe, spring return normally open supplies and normally closed returns, or as indicated in the plans, and shall be furnished and installed by the damper manufacturer as required by the U.L. rating mentioned above. Motors shall be electric or pneumatic to match the type of temperature control system specified elsewhere in this specification. All required relays, EP switches, wiring piping and other labor and material necessary to completely interconnect the smoke detector system shall be furnished by the Contractor.
9. Each damper shall be furnished in a square or rectangular configuration. The Contractor shall furnish and install sleeves manufactured by the approved damper manufacturer for each damper. The sleeves shall be constructed with square or rectangular to square, rectangular, round, or oval adapters as required. Dampers shall be installed in the sleeves in accordance with manufacturers U.L. installation instructions. The entire assembly, following installation, shall be capable of withstanding 6" W.G. static pressure.

10. All combination fire/smoke dampers shall comply with the specification as written above and shall be Ruskin Model FSD-60, Greenheck Model FSD-33, or Pottorff.
11. The contractor shall completely seal the assembly to the building components using Hardcast 1602 sealant tape to allow for expansion and contraction of the sleeve and damper assembly.
12. Dampers shall be UL labeled for use in dynamic systems. Closure reading shall be 110% of the maximum design airflow at the point of installation. The minimum closure pressure rating shall be 8" wg for airflow in either direction.

C. Submittal and Installation

1. The air quantity and free area through each fire and combination fire and smoke damper has been noted on the drawing adjacent to the duct size or wall opening size where such damper is required.

NOTE TO ENGINEER: IT SHOULD BE NOTED THAT THE ABOVE PARAGRAPH REQUIRES THAT CERTAIN INFORMATION BE FOUND ON THE DRAWINGS. BE SURE THAT THE INFORMATION REFERENCED DOES IN FACT APPEAR AS DESCRIBED TO AVOID CONFLICTS.

2. Submittal(s) for fire and combination fire/smoke dampers shall include the following:
 - a. Assign identification numbers for each damper with corresponding number noted on the drawings.
 - b. Provide air quantity, size, free area of damper, pressure drop and proposed velocity through each damper.
 - c. Provide manufacturer's data of damper and its accessories or options.
3. One sample 18" x 12" damper shall be furnished for the purpose of illustrating damper operation to the Owner's operating and maintenance personnel.
4. Access doors as specified elsewhere shall be provided to make all parts of the damper accessible. Doors shall open not less than 90 degrees following installation and shall be insulated type where installed in insulated ducts.

5. Contractor shall install each damper square and true to the building. The installation shall not place pressure on the damper frame, but shall enclose the damper as required by UL555.
6. After each fire damper and combination fire and smoke damper has been installed and sealed in their prescribed openings and prior to the installation of the ceilings, the Contractor shall, as directed by the Construction Inspector, activate part or all the dampers as required to verify "first-time" closure. Activation of the damper shall be accomplished by manually operating the resettable link, disconnecting the linkage at the fusible link of the fire damper, and manually operating the fire/smoke damper through the pneumatic or electronic controls as appropriate. Failure of the damper to close properly and smoothly on the first attempt will be cause to replace the entire damper assembly.

2.03 FLEXIBLE CONNECTIONS

- A. Where ducts connect to fans, including roof exhausters, flexible connections shall be made using Ventglas fabric that is fire-resistant, waterproof, mildew resistant and practically air tight, and shall weigh approximately thirty ounces (30 oz.) per square yard. There shall be a minimum of one-half inch (1/2") slack in the connections, and a minimum of two and one-half inches (2-1/2") distance between the edges of the ducts except that there shall also be a minimum of one inch (1") of slack for each inch of static pressure on the fan system. This does not apply to Air Handling Units with internal isolation.

2.04 ACCESS DOORS

- A. Furnish and install in the ductwork, hinged rectangular or round spin-in access doors to provide access to all fire dampers mixed air plenums, upstream of steam reheat coils, automatic dampers, etc. Where the ducts are insulated, the access doors shall be double skin doors with one inch (1") of insulation in the door. Where the size of the duct permits, the doors shall be eighteen inches (18") by sixteen inches (16"), or eighteen inches in diameter, and shall be provided with Ventlok No. 260 latches (latches are not required in round doors). Latches for rectangular doors smaller than 18" x 16" shall be Ventlok No. 100 or 140. Doors for zone heating coils shall be Ventlok, stamped, insulated access doors, minimum 10" x 12", complete with latch and two (2) hinges, or twelve inches (12") in diameter. Round access doors shall be "Inspector Series" spin-in type door as manufactured by Flexmaster USA, or approved equal. Doors for personnel access to ductwork shall be nominal twenty-four inches (24") in diameter.
- B. Where these access doors are above a suspended ceiling, this Contractor shall be responsible for the proper location of the ceiling access doors.

2.05 SCREENS

- A. Furnish and install screens on all duct, fan, etc., openings furnished by this Contractor that lead to, or are, outdoors. Screens shall be No. 16-gauge, one-half inch (1/2") mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

2.06 TEST OPENINGS

- A. Furnish and install in the return air duct and in the discharge duct of each fan unit Ventlok No. 699 instrument test holes. The test holes shall be installed in locations as required to measure pressure drops across each item in the system, e.g., O.A. louvers, filters, fans, coils, intermediate points in duct runs, etc.

2.07 LOW PRESSURE TAPS (Conical Bell Mouth Fittings)

- A. Conical fittings may be used for duct taps and shall include quadrant dampers on all lines to air devices (diffusers and grilles), even though a volume damper is specified for the air device. (This does not apply to medium pressure duct.) Spin-in fittings shall be sealed at the duct tap with a gasket, or compression fit, or sealed with sealant specified for medium pressure ductwork. The location of spin-in fittings in the ducts shall be determined after dual or single duct terminal units are hung or the location of the light fixtures is known to minimize flexible duct lengths and sharp bends.
- B. The conical fitting shall be made of at least 26-gauge galvanized sheet metal. The construction to be a two-piece fitting with a minimum overall length of 6 inches and shall be factory sealed for high pressure requirements. Average loss coefficient for sizes 6, 8, and 10 shall be less than 0.055.
- C. Each fitting shall be provided with a minimum 24-gauge damper plate with locking quadrant operator and sealed end bearings. Damper blade shall be securely attached to shaft to prevent damper from rotating around shaft.
- D. Provide flange and gasket with adhesive peel-back paper for ease of application. The fitting shall be further secured by sheet metal screws spaced evenly at no more than 4 inches on-center with a minimum of four screws per fitting.

- E. The conical bellmouth fitting shall be Series 3000G as manufactured by Flexmaster U.S.A., Inc., or Buckley Air Products, Inc., 'AIR-TITE'.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions.
- B. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Use splitter dampers only where indicated.
- C. Provide balancing dampers on medium and high pressure systems where indicated. Refer to Section 23 36 00 - Air Terminal Units.
- D. Provide fire dampers, and combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Demonstrate re-setting of fire dampers to Owner's representative.
- F. Provide backdraft dampers on exhaust fans or exhaust ducts where indicated.
- G. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Cover connections to medium and high pressure fans with leaded vinyl sheet, held in place with metal straps.
- H. Provide duct access doors for inspection and cleaning before and after duct mounted filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch (450 x 450 mm) size for shoulder access, and as indicated.
- I. Provide duct test holes where indicated and where required for testing and balancing purposes. Refer also to Section 23 05 93.B.

END OF SECTION

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OFPC Standard Specification

SECTION 26 00 00.UT (previously Section 16010)

BASIC ELECTRICAL REQUIREMENTS

This Standard Specification Section is controlled by the Office of Facilities Planning and Construction, UT System. It is to be used as guideline on all UT System projects, unless deviations are approved in writing by the Project Manager. It is not to be used for bidding, permitting, construction or any other purpose. This document is the property of UT System, and use of this document, in part or in whole, for any purpose other than for a UT System project may not be done without written permission of UT System.

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The issuance and revision history of this Section is tabulated below. Please destroy any previous copy in your possession

Rev No.	Date	Pages	Remarks
0	Jan. 28, 2002	10	Original Release as OFPC Std. by James Da
1	Feb. 2003	9	General revision per James Da
2	Jan. 2004	9	General revision per James Da
3	Apr. 2005	9	General revision per James Da
4	May 2005	9	General revision per James Da
5	Jan. 2006	9	Revised Specification Numbers (CSI 2004)

SECTION 26 00 00.UT
(previously Section 16010)

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 WORK INCLUDED

- A. General Requirements specifically applicable to Division 26.
- B. The Contractor shall be responsible for:
 - 1. The work included consists of furnishing all materials, supplies, equipment and tools, and performing all labor and services necessary for installation of a completely functional power, lighting, fire alarm and signaling systems. Complete systems in accordance with the intent of Contract Documents.
 - 2. Coordinating the details of facility equipment and construction for all Specification Divisions, which affect the work covered under this Division.
 - 3. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
 - 4. Temporary power service and lighting for construction. Coordinating all shutdown dates and schedules with Owner's Representative and obtain all work-permits required by Owner.
- C. Intent of Drawings:
 - 1. The Drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or every device or raceway in its exact location, unless specifically dimensioned. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the work in order to avoid interference between the various phases of work. The Contractor shall be responsible for the proper routing of raceway, subject to prior review by the Owner and Engineer. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
 - 2. The intent of the Drawings is to establish the type of systems and functions, but not to set forth each item essential to the functioning of the system. The drawings and specifications are cooperative, and work or materials called for in one and not mentioned in the other shall be provided. Review pertinent drawings and adjust the work to conditions shown. In case of doubt as to work intended, or here discrepancies occur between drawings, specifications, and

actual conditions, immediately notify the Architect/Engineer and the Owner's representative, and propose a resolution.

1.2 RELATED WORK

- A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total general requirements for the project electrical systems and equipment.
 - 1. Division 01 Sections included in the project specifications.
 - 2. The contract.

1.3 DESIGN CRITERIA

- A. Equipment and devices to be installed outdoors or in enclosures where the temperatures are not controlled shall be capable of continuous operation under such conditions per manufacturer's requirements.
- B. Compliance by the Contractor with the provisions of this Specification does not relieve him of the responsibilities of furnishing equipment and materials of proper design, mechanically and electrically suited to meet operating guarantees at the specified service conditions.
- C. Electrical components shall be UL listed and labeled.

1.4 REFERENCE CODES AND STANDARDS, REGULATORY REQUIREMENTS

- A. Standards of the following organizations as well as those listed in Division 01, may be referenced in the specification. Unless noted otherwise, references are to standards or codes current at the time of bidding.
 - 1. Association of Edison Illuminating Companies (AEIC)
 - 2. American National Standards Institute (ANSI)
 - 3. Institute of Electrical and Electronics Engineers (IEEE)
 - 4. Insulated Cable Engineers Association (ICEA)
 - 5. National Electrical Code (NEC)
 - 6. National Electrical Manufacturers Association (NEMA)
 - 7. Electrical Safety in the Workplace
 - 8. National Fire Protection Association (NFPA)
 - 9. Underwriter's Laboratories (UL)
 - 10. ASHRAE/IES 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
- B. Work, materials and equipment must comply with the latest rules and regulations of the following.
 - 1. National Electrical Code (NEC)
 - 2. Electrical Safety in the Workplace

3. Occupational Safety and Health Act (OSHA)
 4. American with Disability Act (ADA)
 5. American Society for Testing and Materials (ASTM)
 6. University of Texas (UT) System
 7. Applicable state and federal codes, ordinances and regulations
- C. Discrepancies. The drawings and specifications are intended to comply with listed codes, ordinances, regulations and standards. Where discrepancies occur, immediately notify the Owner's representative in writing and ask for an interpretation. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirements, provide those specified shown.
- D. Contractor shall obtain permits and arrange inspections required by codes applicable to this Section and shall submit written evidence to the Owner and Engineer that the required permits, inspections and code requirements have been secured.

1.5 SUBMITTALS

- A. Submit the following in addition to and in accordance with the requirements of Division 01 for submittal requirement.
1. Include inspection and permit certificates and certificates of final inspection and acceptance from the authority having jurisdiction.
 2. Manufacturer's standardized schematic diagrams and catalog cuts shall not be acceptable unless applicable portions of it are clearly indicated and non-applicable portions clearly deleted or crossed out.
 3. All schematic, connection and/or interconnection diagrams in accordance with the latest edition of NEMA.
 4. Provide submittals as required by individual specification Section.
- B. Provide the following with each submittal:
1. Catalog cuts with manufacturer's name clearly indicated. Applicable portions shall be circled and non-applicable portions shall be crossed out.
 2. Line-by-line specification review by equipment manufacturer and contractor with any exceptions explicitly defined.
- C. Equipment Layout Drawing: 1/8-inch scale minimum drawings indicating electrical equipment locations. Dimensions for housekeeping pads should be indicated on these drawings. Indicate routing of conduit 2 inches and over on these drawings.
- D. Within the specified time window after award of contract, submit list of equipment and materials to be furnished.

1. Itemize equipment and material by specification Section number; include manufacturer and identifying model or catalog numbers.
 2. Replace rejected items with an acceptable item within 2 weeks after notification of rejection.
 3. If a satisfactory replacement is not submitted within a two-week period, owner will notify contractor as to equipment manufacturer or type and make or material to be furnished. Provide designated items at no additional cost to owner.
- E. As-Built Record Drawings: The Contractor shall maintain a master set of As-Built Record Drawings that show changes and any other deviations from the drawings. The markups must be made as the changes are done. At the conclusion of the job, these As-Built Record Drawings shall be transferred to AutoCad electronic files, in a format acceptable to the Owner, and shall be complete and delivered to the Owner's Representative prior to final acceptance. Refer to 01210 Project Administration for other requirements.

1.6 SAFETY

- A. The Contractor shall follow the safety procedures in addition to, and in accordance with, the requirements of Project Safety Manual (PSM).
1. The Contractors shall be responsible for training all personnel under their employ in areas concerning safe work habits and construction safety. The Contractor shall continually inform personnel on hazards particular to this project and update the information as the project progresses.
 2. The Contractor shall secure all electrical rooms, to limit access, prior to energizing any high voltage (2.4KV or higher) switchgear and shall control access during the project after energization. The Contractor shall post and maintain warning and caution signage in areas where work is on going near energized equipment. The Contractor shall cover all energized live parts when work is not being done in the equipment. This includes lunch and breaks.
 3. The Contractor shall strictly enforce OSHA lock out/tag out procedures. Initial infractions shall result in a warning; a second infraction shall result in the removal of the workman and his foreman from the site. Continued infractions shall result in removal of the Contractor from the site.

1.7 SHORING AND EQUIPMENT SUPPORTS

- A. The Contractor shall provide all permanent and temporary shoring, anchoring, and bracing required to make all parts absolutely stable and rigid; even when such shoring, anchoring, and bracing are not explicitly called for.
- B. The Contractor shall adequately support all freestanding panels, motor control centers, enclosures, and other equipment. This shall include bolting to the floor or solid structural steel to prevent tipping. Install free-standing electrical equipment on 4" thick concrete housekeeping pads that are provided by others. Under no condition shall equipment be fastened to non-rigid building steel (i.e., removable platform steel gratings, handrails, etc.).

- C. The Contractor shall provide racks and supports, independently mounted at structure, to support electrical equipment and systems supplied and installed under this contract. At no time shall the Contractor mount or suspend equipment from other disciplines' supports.

1.8 TEMPORARY POWER REQUIREMENTS

- A. Provide power distribution system sufficient to accommodate construction operations requiring power, use of power tools, electrical heating, lighting, and start-up/testing of permanent electric-powered equipment prior to its permanent connection to electrical system. Provide proper overload protection. Ground fault circuit interrupters (GFCI) are to be used on all 120-volt, single-phase, 15 and 20 amp receptacle outlets where portable tools and equipment are used. Ground fault circuit interrupters shall be tested weekly by the Contractor.
- B. Temporary power feeders shall originate from a distribution panel. The conductors shall be multi-conductor cord or cable per NEC for hard and extra-hard service multi-conductor cord.
- C. Branch circuits shall originate in an approved receptacle or panelboard. The conductors shall be multi-conductor cord or cable per NEC for hard and extra-hard service multi-conductor cord. Each branch circuit shall have a separate equipment grounding conductor.
- D. All receptacles shall be of the grounding type and electrically connected to the grounding conductor.
- E. Provide temporary lighting by factory-assembled lighting strings or by manually-assembled units. All lamps for general lighting shall be protected from accidental contact or breakage. Protection shall be provided by installing the lights a minimum of 7 feet from the work surface or by lamp holders with guards. Branch circuits supplying temporary lighting shall not supply any other load. Provide sufficient temporary lighting to ensure proper workmanship by combined use of day lighting, general lighting, and portable plug-in task lighting. Comply with OSHA required foot-candle levels and submit plan for approval by the owner.
- F. For temporary wiring over 600 volts, suitable fencing, barriers, or other effective means shall be provided to prevent access of anyone other than authorized and qualified personnel.
- G. Temporary power cords shall be kept off the ground or floor. The Contractor shall provide temporary supports as required to keep temporary cords off the ground or floor.

1.9 SUBSTITUTION OF MATERIALS AND EQUIPMENT:

- A. Refer to Uniform General Conditions and Supplementary General Conditions for substitution of materials and equipment.
- B. The intent of the Drawings and/or Specifications is neither to limit products to any particular manufacturer nor to discriminate against an "APPROVED EQUAL" product as produced by another manufacturer. Some proprietary products are mentioned to set a definite standard for acceptance and to serve as a reference in

comparison with other products. When a manufacturer's name appears in these Specifications, it is not to be construed that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).

- C. The specified products have been used in preparing the Drawings and Specifications and thus establish minimum qualities with which substitutes must at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the designer is final.
- D. When requested by the Architect/Engineer, the Contractor shall provide a sample of the proposed substitute item. In some cases, samples of both the specified item and the proposed item shall be provided for comparison purposes.
- E. Timeliness: The burden of timeliness in the complete cycle of submittal data, shop Drawings, and sample processing is on the Contractor. The Contractor shall allow a minimum of six (6) weeks time frame for review of each submission by the office of the design discipline involved after receipt of such submissions by that design discipline. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all resubmittal cycles on unacceptable materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not be considered in any request for scheduled construction time extensions and/or additional costs to the Owner.
- F. All equipment installed on this project shall have local representation; local factory authorized service, and a local stock of repair parts.
- G. Acceptance of materials and equipment will be based on manufacturer's published data and will be tentative subject to the submission of complete shop Drawings indicating compliance with the contract documents and that adequate and acceptable clearances for entry, servicing, and maintenance will exist. Acceptance of materials and equipment under this provision shall not be construed as authorizing any deviations from the Specifications, unless the attention of the Architect/Engineer has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.
- H. Certification: The Contractor shall carefully examine all data forwarded for approval and shall sign a certificate to the effect that the data has been carefully checked and found to be correct with respect to dimensions and available space and that the equipment complies with all requirements of the Specifications.
- I. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of specified manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.
- J. Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended within the guarantee

period, this material or equipment shall be replaced with the material or equipment specified at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and Equipment: Labeled and/or listed as acceptable to the authority having jurisdiction as suitable for the use intended. Materials shall be of a standard industrial quality if no specifications or specific model numbers are given.
- B. Where two or more units of the same class of material are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.
- C. All materials shall be new and unused.
- D. Provide non-metallic material in corrosive areas or as otherwise specified.

PART 3 EXECUTION

3.1 WORKMANSHIP

- A. Install work in compliance with NEC latest edition.
- B. Install material and equipment in accordance with manufacturers' instructions. Provide calibrated torque wrenches and screwdrivers and tighten all terminals, lugs, and bus joints using it.
- C. Comply with startup procedures as defined by Construction Manager and Owner.
- D. Arrange electrical work in a neat, well-organized manner. Do not block future connection points of electrical service. Install all electrical work parallel or perpendicular to building lines unless noted otherwise, properly supported with purpose-designed apparatus, in a neat manner.
- E. Apply, install, connect, erect, use, clean, adjust, and condition materials and equipment as recommended by the manufacturers in their published literature.
- F. Make opening through masonry and concrete by core drilling in acceptable locations. Restore openings to original condition to match remaining surrounding materials.

3.2 SERVICE CONTINUITY

- A. Maintain continuity of electric service to all functioning portions of process or buildings during the hours of normal use. Phase construction work to accommodate Owner's occupancy requirements.
- B. Arrange temporary outages for cutover work with the Owner. Keep the outages to a minimum number and minimum length of time.
- C. All service outages shall be requested in writing a minimum of two weeks prior to the date. Owner reserves the right to postpone shutdowns up to 24 hours prior to the shutdown at no additional cost. Outage requests shall include a schedule of the work to be performed and the time requirements.

- D. The Contractor shall obtain all appropriate Owner permits for working in equipment.

3.3 HAZARDOUS LOCATIONS

- A. Equipment, wiring, devices, and other components located within hazardous areas to be of appropriate type per NFPA requirements.
- B. Ground exposed non-current carrying parts of entire electrical system in hazardous areas, in accordance with NEC and as instructed by Owner.

3.4 SLEEVES AND SEALS

- A. Provide sealing and/or fire stopping where electrical equipment passes through walls, ceilings, and floors. Seals shall be watertight and/or fire rated as applicable.

3.5 CONSTRUCTION REVIEW

- A. The Engineer or Owner's representative will review and observe installation work to insure compliance by the Contractor with requirements of the Contract Documents.
- B. Review, observation, assistance, and actions by the Engineer or Owner's representative shall not be construed as undertaking supervisory control of the work or of methods and means employed by the Contractor. The review and observation activities shall not relieve the Contractor from the responsibilities of these Contract Documents.
- C. The fact that the Engineer or Owner's representative do not make early discovery of faulty or omitted work shall not bar the Engineer or Owner's representative from subsequently rejecting this work and insisting that the Contractor make the necessary corrections.
- D. Regardless of when discovery and rejection are made, and regardless of when the Contractor is ordered to correct such work, the Contractor shall have no claim against the Engineer or Owner's representative for an increase in the Contract price, or for any payment on account of increased cost, damage, or loss.

3.6 WARRANTY

- A. Provide warranties in accordance with the requirements of Uniform General and Supplementary Conditions (UGC).

END OF SECTION