SECTION 23 05 01
HVAC GENERAL PROVISIONS

PART 1 – GENERAL

1.01 DESCRIPTION

A. The General and Supplementary Conditions and Division 1 are a part of the requirements for the work under this Division of the Specification.

1.02 WORK INCLUDED

A. Provide labor and materials required to install, test and place into operation the heating, ventilating, air conditioning, plumbing and fire protection systems as called for in the Contract Documents and according to applicable codes and regulations.

1.03 APPLICABLE CODES

A. 2018 International Building Code

B. 2018 National Electrical Code

C. 2018 International Mechanical Code

D. 2018 International Plumbing Code

E. 2018 International Energy Code

F. 2018 International Fire Code

G. All local jurisdiction amendments to these codes.

1.04 QUALITY ASSURANCE

A. Comply with current governing codes, ordinances and regulations of the Authority or Authorities Having Jurisdiction over any part of the work and secure all necessary permits. Comply with the regulations and requirements of the Owner's insurance underwriter.

B. Where codes or standards are referenced, the applicable portions apply.

C. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, apply the more stringent.

D. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. The Architect or Architect's Representative may conduct unannounced field reviews of

any work completed or in progress during the Contractor's working hours. A report will be issued to the Contractor if the field review of the mechanical, plumbing and fire protection systems construction has revealed elements of the work, which are inconsistent with the Contract Documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks and corrections in the field shall be made as directed.

1.05 STANDARDS ORGANIZATIONS ABBREVIATIONS AND DEFINITIONS

A. Abbreviations:

1.	AABC	Associated Air Balance Council
2.	ABMA	American Bearing Manufacturers Association
3.	ADC	Air Diffusion Council
4.	AGA	American Gas Association
5.	AHRI	Air Conditioning and Refrigeration Institute
6.	AMCA	Air Movement and Control Association
7.	ANSI	American National Standards Institute
8.	API	American Petroleum Institute
9.	ASA	Acoustical Society of America
10.	ASCE	American Society of Civil Engineers
11.	ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
12.	ASME	American Society of Mechanical Engineers
13.	ASTM	American Society for Testing and Materials
14.	AWWA	American Water Works Association
15.	BSI	British Standards Institution
16.	CTI	Cooling Tower Institute
17.	EPA	Environmental Protection Agency
18.	ETL	ETL SEMKO (formerly Edison Testing Laboratory)
19.	FM	Factory Mutual
20.	IEEE	Institute of Electrical and Electronic Engineers
21.	ISO	International Organization for Standardization
22.	MSS	Manufacturers Standardization Society
23.	NAAMM	National Association of Architectural Metal Manufacturers
24.	NEBB	National Environmental Balancing Bureau
25.	NEMA	National Electrical Manufacturers Association
26.	NFPA	National Fire Protection Association
27.	NIOSH	National Institute for Occupational Safety and Health
28.	NSF	National Sanitation Foundation
29.	OSHA	Occupational Safety and Health Administration
30.	OSHPD	Office of Statewide Health Planning and Development (California Health and Human Services Agency)
31.	SAE	Society of Automotive Engineers
32.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
33.	UL	Underwriters Laboratories Inc.
34.	ULC	Underwriters Laboratories of Canada

B. Definitions:

1. Where it is stated in the specifications to submit to Architect or Engineer for

review, refer to Architectural General and Special Conditions for proper procedures.

2. "PROVIDE" means to "Furnish" and "Install".
3. "INSTALL" means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.
4. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application.
5. "AS DIRECTED" means as directed by the Architect, or the Architect's Representative.
6. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed within hung ceilings.
7. "SUBMIT" means submit to the Architect for review.

1.06 GUARANTEE

A. Submit a single guarantee stating that the work is in accordance with Contract Documents. Guarantee work against faulty and improper material, fabrication, installation, start-up and commissioning for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, the longer term shall apply. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, at no additional cost to the Owner, to the satisfaction of the Owner. Obtain similar guarantees from subcontractors, manufacturers, suppliers and sub-trade specialists.

1.07 USE OF ARCHITECT'S AND ENGINEER'S DRAWINGS

A. The Contractor shall obtain, at the Contractor's expense, from the Architect or Engineer a set of digital data files in Revit BIM or compatible format architectural and engineering drawings on electronic media where desired by the Contractor and/or required by the Specifications for use in preparing the shop drawings, coordination drawings, and record drawings. The Contractor shall provide to the Architect and Engineer a written release of liability acceptable to the Architect and Engineer prior to receiving the electronic media files.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Provide products and materials that are new, clean, free of defects and free of damage and corrosion.

B. Products and materials shall not contain asbestos, PCBs or any other material that is considered hazardous by the Environmental Protection Agency or any other Authority Having Jurisdiction.

C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Architect.

D. Statically and dynamically balance rotating equipment for minimum vibration and lowest operating noise level.

E. Provide name/data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.

F. Install materials and equipment with qualified trades people.

G. Maintain uniformity of manufacture for equipment used in similar applications and sizes.

H. Applicable equipment and materials to be listed by Underwriters Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by Authorities Having Jurisdiction. The energy-using products shall be certified for use in the State of Utah and meet State energy efficient standards.

I. Fully lubricate equipment when installed.

J. Do not operate air systems until ductwork is complete, temporary filters are in place and construction debris is removed. Provide 1-inch thick fiberglass filter media across the face of each return air opening prior to start of each air system during temporary system operation and system clean-out.

K. Do not operate water or steam systems until piping has been cleaned and start-up strainers are in place.

L. Install floor-mounted equipment on a minimum 4-inch high concrete pad. Concrete work shall be provided by another trade. Coordinate size and location with actual equipment used and accepted layout shop drawings.

M. Secure equipment with bolts, washers and locknuts of ample size to support equipment. Embedded anchor bolts to have bottom plate and pipe sleeves. Grout machinery set in concrete under entire bearing surface. After grout has set, remove wedges, shims and jack bolts and fill space with grout.

N. Locate valves, traps, damper operators, dielectric unions, access doors, etc., to be easily accessible, either in mechanical spaces or through access panels specified. Obtain Architect's approval of access panel locations.

O. Follow manufacturers' recommendations and instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.

P. Pressure vessels and relief valves shall be selected, built and labeled in accordance with ASME.

Q. Equipment capabilities, etc., are scheduled or specified for job site operating conditions.

2.02 ALTERNATIVE EQUIPMENT AND MATERIALS

A. Contract Documents are based on materials specified and on equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the quality and performance as stated or implied in the Contract Documents.

B. Equipment manufacturers listed in individual sections are acceptable for this project,

subject to requirements of Contract Documents.

C. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule. Reimburse Owner for costs associated with the review of the proposed alternative whether alternative is accepted or rejected.

D. Include revisions required to adapt alternatives in such proposals, including revisions by other trades. No increase in the contract price will be considered to accommodate the use of alternative equipment.

E. Wherever quality standards (such as serviceability, energy efficiency, longevity or durability) and operating results (such as noise levels, quantity delivered or pressure obtained) are specified or scheduled, or when the manufacturer and size of equipment, for which such operating results are published or determinable, is specified, the substitution being proposed must conform substantially to the quality and quantities specified or implied. The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.

F. Proposed changes and substitutions of systems, equipment and manufacturers shall be submitted and include the following information with the proposal:

1. A description of the difference between the existing contract requirements and that proposed, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to other trades.
2. Schematic drawings and details to supplement the description.
3. A list of the contract requirements that must be revised if the change is accepted, including any specification revisions.
4. Complete list of materials and equipment proposed for use in the change.
5. Include a description and estimate of costs the Owner may incur in implementing the change, such as additional space requirements, permits, architectural and aesthetic impact, design costs, tests, permits evaluation, operating and support costs.
6. A projection of any effects the proposed change would have on collateral costs to the Owner.
7. A statement of the time by which a contract modification accepting the change must be issued, noting any effect on the contract completion time or the delivery schedule.
8. A statement indicating the reduction to the contract price if the Owner accepts the change. Be responsible for appropriate modifications to all trades.

PART 3 – EXECUTION

3.01 FEES

A. Pay all required fees and obtain required permits related to the mechanical installation.

B. Pay royalties or fees in connection with the use of patented devices and systems.

C. Provide controlled or witnessed inspection where required by Authorities Having Jurisdiction or by these specifications.

3.02 SUBMITTALS AND REVIEWS

A. Submit shop drawings, manufacturer's data, samples and test reports as specified.

B. After notice to proceed by the Owner or Owner's Representative, or after execution of Owner/Contractor Agreement, submit a complete typed list of all mechanical equipment manufacturers and material suppliers for the equipment proposed to be provided on this project as well as names of all subcontractors.

C. After notice to proceed by the Owner or Owner's Representative or after execution of Owner/Contractor Agreement, prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the specification sections or drawing number, and an item description. Prefix the submittal identification number by the specification sections to which they apply. Indicate, on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned submittal identification number.

D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submission, certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as required to comply with the Contract Documents and the shop drawings.

E. Review of submittals is for general compliance with the design concept and Contract Documents. Comments or absence of comments does not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

F. No part of the work shall be ordered, procured, started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted, reviewed and returned with either "No Exceptions Noted" or "Exceptions Noted" marked on the submission.

G. A minimum period of ten (10) working days, exclusive of transmittal time, will be required in the Architect/Engineer's office each time a shop drawing, product data and/or samples are submitted for review. Bulk submittals are unacceptable. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.

H. Submit three (3) opaque bond prints of all items requiring shop drawings. Submit three (3) paper copies of manufacturer's product submittals. Two (2) copies of submittals will be returned. Additional copies are the responsibility of the Contractor.

I. Electronic submittals where acceptable to the Architect will be submitted in PDF format through a project file sharing website.

J. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., UCSF-230923.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., UCSF-230923.01.A).
4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
5. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Architect, containing the following information:

    a. Project name.
    b. Date
    c. Name and address of Architect and Engineer
    d. Name of Owner
    e. Name of Contractor
    f. Name of firm or entity that prepared submittal
    g. Names of subcontractor, manufacturer, and supplier
    h. Category and type of submittal
    i. Specification Section number and title
    j. Drawing number and detail references, as appropriate
    k. Related physical samples submitted directly
    l. Indication of full or partial submittal
    m. Transmittal number [numbered consecutively]
    n. Submittal and transmittal distribution record
    o. Remarks

6. Metadata: Include the following information as keywords in the electronic submittal file metadata:

    a. Project name
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name
    d. Product name

K. Submissions (paper or electronic) will be stamped as follows:

Stamp	Interpretation
No Exceptions Noted	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.
Exceptions Noted: [ ] Resubmit for Record [ ] No Resubmission Required	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents and Engineer's notations are complied with. Within this category are two options. A resubmission for our records is required when corrections are necessary. A resubmission is not required if there are only minor comments.

Stamp	Interpretation
Revise and Resubmit	The submittal does not comply with the Contract Documents; do not proceed with fabrication, manufacture, or construction. The work and shop drawings are not permitted at the job site. Resubmit appropriate shop drawings.

L. Submit materials and equipment by manufacturer, trade name and model number. Include clear, legible copies of applicable brochure or catalog material. Provide statement of compliance with referenced standards, installation or application of testing agency labels and seals. Maintenance and operating manuals are not suitable substitutes for shop drawings.

M. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as voltages, motor efficiencies, special tank linings, pump seals, materials or paint finishes. Cross out all references to “options”. Cross out statements such as “subject to change without notice” or “not for construction”. Anything not specifically excluded is assumed to be included.

N. Include dimensional and required clearance data for roughing in and installation. Note on submittal required coordination with other elements of the work. Include technical data sufficient to verify that equipment meets requirements of the Contract Documents including performance curves at project site and operating conditions. Include wiring diagrams showing factory installed and field wiring requirements, piping and service connection data, motor sizes complete with voltage ratings, and schedules.

O. Maintain a complete set of the most current reviewed and stamped shop drawings and product data on site.

P. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project:

1. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Contract Documents.

Q. Prepare and submit detailed shop drawings for ductwork, piping work and other distribution services in minimum ¼-inch to 1-foot scale, including elevations and locations and sizes of openings in floor decks, walls and roofs.

R. The work described in shop drawing and product data submittals shall be carefully checked by all trades for clearances (including those required for code compliance, maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with other trades on the job. Each submitted shop drawing to include a certification that related field conditions and requirements have been checked by all Contractors and Subcontractors and that conflicts do not exist.

S. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions or for deviations from requirements in the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in

the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

T. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.

U. Indicate the following in the lower right hand corner of each shop drawing, and on the front cover of each product data brochure: the submittal identification number; title of the sheet or brochure; name and location of the Project; names of the Architect, Engineer, Contractor, Subcontractor, Manufacturer, Supplier, and Vendor; the date of submittal; and the date of each correction, version and revision. Number all pages and drawings in product data brochures, test reports or submittals consecutively from beginning to end. Unless the above information is included, the submittal will be returned for resubmission. Resubmittals of shop drawings or product data or brochures shall include a cover letter summarizing the corrections made in response to the review comments.

3.03 COORDINATION OF WORK

A. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.

B. The Contract Documents show the general arrangement of equipment, ductwork, piping and accessories. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.

C. Certain products will be provided by other trades. Examine the Contract Documents to ascertain the requirements for installation of these products.

D. Carefully check space requirements with other trades to ensure that material can be installed in the spaces allotted.

E. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (valves, dampers, coils, etc.) requiring access in order that the ceiling and partition contractors can install access doors and panels in the correct locations.

F. Consult with other trades regarding equipment so that, wherever possible, motors, motor controls, pumps and valves are of the same manufacturer.

G. Furnish and set sleeves for passage of pipes, ducts and conduits through structural masonry and concrete walls, roofs and floors and elsewhere as will be required for the proper protection of each pipe and duct passing through building surfaces.

H. Install firestopping around all pipes, conduits, etc., which pass through rated walls, partitions and floors in strict accordance with the manufacturer’s published approval listing and rating.

I. Provide detailed information on openings and holes required in structural elements and

pre-cast panels or components for mechanical work.

J. Provide required structural or architectural supports and hangers for ductwork, piping and equipment, designed so as not to exceed allowable loadings of structures.

K. Examine and compare the Contract Drawings and Specifications with the drawings and specifications of other trades, report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.

L. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Architect for review. At completion include a set of these drawings with each set of record drawings.

M. Before commencing work, examine adjoining work on which this work is in any way dependent and report conditions that prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

1. Adjust location of pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.
2. Right-of-Way: Lines which pitch have right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.

N. Provide offsets, transitions and changes in direction of pipes and ducts as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required to affect these offsets, transitions and changes in direction.

O. Install mechanical work to permit removal (without damage to other parts) of hydronic coils, heat exchanger, boiler or chiller tube bundles, heat exchanger plates, controls, fan shafts and wheels, smoke detectors, filters, belt guards, sheaves and drives, and any other parts requiring periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit access to valves, cocks, traps, starters, motors, and control components, and to clear the openings of swinging doors and access panels.

P. Changes in the cross-sectional dimensions of ductwork are permissible when required to meet job conditions. Maintain at least the same equivalent cross-sectional duct area in accordance with the latest edition of the ASHRAE Guide. Secure the approval of the Architect prior to fabrication of ductwork requiring these changes.

Q. Provide access panels in equipment, ducts, etc., as required for inspection and maintenance of concealed or internal equipment, dampers, plenums, smoke detectors, humidifiers, controls, etc.

R. In cases of doubt as to the work intended, or in the event of need for explanation thereof, request supplementary instructions from the Architect.

3.04 CONTRACTOR'S COORDINATION DRAWINGS

A. The Contractor shall coordinate efforts of all trades and shall furnish (in writing, with copies to the Architect) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. BIM File Incorporation: Develop and incorporate Coordination Drawing files into Building Information Model established for Project.

1. Prepare Coordination Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

C. The Contractor and all trade contractors shall prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased and the exact routing for all lines such as piping, conduit, ductwork, etc., including conduit embedded in concrete floors and walls. The Coordination Drawings shall be submitted complete to the Architect and the Engineer within three (3) months after notice to proceed is given and in compliance with the construction schedule for the project. The sheet metal drawings, at a scale of not less than ¼-inch to 1-foot, shall serve as the base drawings to which all other Contractors shall add their work. Each separate Trade Contractor shall draw their work on separate layers with different color assignments to facilitate coordination. Each Coordination Drawing shall be completed and signed off by the other Trade Contractors and the Contractor prior to the installation of the HVAC, plumbing, electrical and fire sprinkler work in the area covered by the specific drawing. The Contractor's work shall be installed according to the shop drawings and Coordination Drawings. If the Contractor allows one trade to install their work before coordination with the work of other trades, the Contractor shall make all necessary changes to correct the condition at no additional cost to the Owner.

D. The Contractor's Coordination Drawings shall indicate structural loads at support points for all piping 10-inch and larger, racked piping, racked conduit. Submit to Structural Engineer for review and approval. The elevation, location, support points, static, dynamic and expansion forces and loads imposed on the structure at support and anchor points shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. Work routed underground or embedded in concrete shall be indicated by dimension to column and building lines and shall be coordinated. Coordination Drawings shall document all required structural penetrations for initial construction. Penetrations shall be dimensioned for walls, floors and roofs. These structural coordination requirements require review and approval by the Structural Engineer prior to completion and submittal of the Drawings.

E. This requirement for Coordination Drawings shall not be construed as authorization for the Contractor or trade contractors to make any unauthorized changes to the Contract Documents. Contract document space allocations shall be maintained such as ceiling height, designated clearance for future construction and flexibility, chase walls, equipment room size, unless prior written authorization is received from the Architect to change them.

F. Prior to final acceptance of the work, the Contractor shall submit the Coordination Drawings as part of the Record Drawing submittal.

3.05 EXAMINATION OF SITE

A. The Contract Documents do not make representations regarding the character or extent of the subsoils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work.

B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.06 EXCAVATION AND BACKFILL

A. Provide excavation for the work of this Division. Excavate all material encountered, to the depths indicated on the Drawings or as required. Remove excavated materials not required or suitable for backfill from the site. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water that accumulates. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.

B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum overdepth of four inches below the trench depths indicated on the Drawings or as required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95 percent of standard proctor density or 75 percent relative density or as specified by the Architect. Whenever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

C. Excavate trenches for utilities that will provide the required minimum depths of cover from existing grade or from indicated finished grade, whichever is lower, unless otherwise specifically shown.

D. Trenches shall not be placed within ten (10) feet of foundation or soil surfaces that must resist horizontal forces.

E. Do not backfill trenches until all required tests have been performed and the installation observed by the Architect. Comply with the requirements of other sections of the specifications. Backfill shall consist of non-expansive material with limited porosity. Deposit backfill in 6-inch thick layers and tamp carefully until the mechanical work is covered by not less than 12 inches of material. Backfill and tamp remainder of trench at 1-foot intervals until complete. Uniformly grade the finished surface.

3.07 CUTTING AND PATCHING

A. Where cutting, channeling, or drilling of floors, walls, partitions, ceilings or other surfaces is necessary from the proper installation, support or anchorage of ductwork, piping or equipment, lay out the work carefully in advance. Repair any damage to the building,

piping, equipment or finishes using skilled tradesmen for all required work.

B. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect.

C. Where ductwork, piping or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.

D. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.

3.08 PROHIBITED LABELS AND IDENTIFICATION

A. Prohibited Markings: In all public areas, tenant areas, storage areas and similar locations within the project, the inclusion or installation of any equipment, fixture or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.

B. Exception: Required Underwriters Laboratories labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

3.09 EQUIPMENT PAD AND ANCHOR BOLTS

A. Provide concrete pads under all floor-mounted mechanical equipment. This includes electrical components, equipment mounted on legs and pipe support stands. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 2-inch margin around the equipment and supports. Pads shall be a minimum of 4 inches high and made of a minimum 28-day, 2,500-psi concrete reinforced with 6-inch by 6-inch 6/6-gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a ¾-inch radius. Use shop drawings stamped “NO EXCEPTIONS NOTED” or “EXCEPTIONS NOTED” for dimensional guidance in sizing pads.

B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Verify bolts size, number and embed depth recommended by the manufacturer of the equipment with seismic calculations as specified, and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation and seismic restraint manufacturer.

C. Where equipment is mounted on gypsum board partitions, the mounting screws will pass through the gypsum board and be securely attached to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6-inch square, 18-gauge galvanized metal backplates that are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

3.10 DELIVERY, DRAYAGE AND HAULING

A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and introduction of equipment to the project as required by the construction schedule. If any item of equipment is received prior to the time it is required, be responsible for its proper storage and protection until the time it is required. Pay for all costs of demurrage or storage.

B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc., at no additional cost to the Owner.

3.11 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.

B. The Contractor shall be responsible for all work, materials and equipment until finally inspected, tested and accepted. Protect work against theft, injury or damage; and carefully store material and equipment received on site that is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, moisture, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry heated spaces.

C. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

3.12 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. Do not install piping, equipment or ductwork for heating, ventilation, air conditioning, plumbing or any piping systems not included as part of the electrical work, in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

B. Do not install piping, equipment or ductwork above switchboards, disconnects, panelboards, dimmers, control panels, VFDs, motor control centers, individual motor controllers, electronics, etc. or the code-required service space for these electrical devices.

3.13 EQUIPMENT GUARDS

A. Provide easily (without tools) removable expanded metal guards for all hot surfaces, belts, couplings, exposed fan inlets and outlets, and other moving parts of machinery. Provide tachometer openings in the guards at least 2 inches in diameter, for all belt-driven, gear-driven or variable speed machinery. Comply with OSHA requirements for all equipment guards.

3.14 LUBRICATION

A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.

B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

3.15 DATE OF COMPLETION AND TESTING OF MECHANICAL SYSTEMS

A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing and commissioning prior to occupancy and the Contract closeout. Complete any adjustments and/or alterations that the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual sections for extent of testing required.

B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when tests will be performed. Update this schedule periodically as the project progresses.

3.16 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide the services of factory-trained specialists to supervise the operation of all equipment and systems specified and train the Owner's operating and maintenance personnel for a three (3) day operating/instruction period. Operating instruction time is defined as straight time working hours and not including nights, weekends or travel time to and from the project. Refer to individual sections for additional training and instruction by manufacturer's trained specialists.

B. In addition to the operating/instruction period, organize and conduct a training seminar to instruct the Owner's Representatives in the operation and general preventative maintenance of equipment and systems provided at the completion of the project. Training shall take place on-site using the installed equipment and systems.

C. Instruct Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, trouble-shooting, recommended spare parts, and regular maintenance procedures. Instruction for both normal and emergency operations procedures shall be provided.

D. Make arrangements to give instructions by system and not by building areas. Organize training session and the video recording to present segments for equipment types, and overall systems following the Table of Contents of the Operating and Maintenance manuals.

E. Provide services of qualified personnel, including each sub-trade, each major equipment supplier to attend seminar and instruct on respective equipment or systems. Seminar shall be conducted by the Contractor and shall be videotaped. Video recording shall be professional quality with sufficient lighting and narration. The seminars may be attended by the Architect or Architect's Representative.

F. Submit seminar agenda, schedule and list of representatives to the Owner for review thirty (30) days prior to seminar. Confirm attendance at seminar by written notification to participants.

G. At seminar, submit final copies of record drawings and operating and maintenance manuals to Owner.

H. Submit a written record of the seminar, complete with an attendance list to the Owner. I.H. Submit a written record of the seminar, complete with an attendance list to the Owner. Provide two copies of the training video recording on DVDs with minimum 640 x 480 resolution in .mp4 file format or other video file type acceptable to the Owner. Provide a transcript of the video narration in PDF format.

3.17 OPERATING AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance manuals for all equipment and materials furnished under this Division. Manuals shall be available at the operations training seminar.

B. Submit three (3) hard paper copies of operating and maintenance manuals for review at least four (4) before the completion date. Assemble data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item.

C. After the Architect's and Engineer's review, and any required Contractor revisions, the operating and maintenance manuals shall be delivered to the Owner as three (3) hard paper copies in a binder as described below and separately on electronic media in PDF format.

D. Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8½-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

1. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
2. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, **and** subject matter of contents. Indicate volume number for multiple-volume sets.
3. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
4. Supplementary Text: Prepared on 8½-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

E. Manual Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system.

F. Maintenance information shall include complete lubrication, cleaning, and servicing data compiled in clearly and easily understandable format. Show model and serial number of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.

G. Provide the following equipment operating and maintenance information where applicable:

1. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
2. Identifying equipment manufacturer, product name, model number and drawing number
3. Locations (where several similar items are used, provide a list)
4. Performance curves and data
5. Wiring diagrams
6. Lubrication charts
7. Manufacturers' recommended operating and maintenance instructions, with all non-applicable information deleted
8. Assembly and disassembly instructions with exploded view Drawings, where necessary
9. Startup procedures
10. Routine and normal operating instructions
11. Normal and emergency shutdown instructions
12. Trouble shooting diagnostic instructions, where applicable

3.18 RECORD DRAWINGS

A. The Contractor shall maintain on a daily basis at the project site a complete set of Record Drawings. The Record Drawings shall initially consist of a set of bond paper prints or AutoCAD files of the Contractor's Coordination Drawings. The prints shall be marked or AutoCAD files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded piping and valves, and all changes and deviations in the mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the Architect or Engineer. The updated Coordination Drawings shall be used to produce the final Record Drawings that shall be delivered to the Owner in AutoCAD electronic format media upon project completion.

B. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two (2) dimensions to permanent structures. Provide record drawings of the following items as a minimum:

1. Dimensional changes to Drawings.
2. Revisions to details shown on Drawings.
3. Locations and depths of underground utilities.
4. Revisions to routing of piping and conduits.
5. Actual equipment locations.
6. Duct size and routing.

7. Locations of concealed internal utilities.
8. Changes made by Change Order.
9. Field records for concealed conditions.
10. Record information on the Work that is shown only schematically in the contract documents.

C. The Contractor and subcontractor shall mark all in-progress Record Drawings on the front lower right hand corner with a rubber stamp impression or an AutoCAD image similar to the following:

RECORD DRAWING
(⅜-inch high letters)

To be used for recording Field Deviations and Dimensional Data Only
(5/16-inch high letters)

D. Upon completion of the work, the Contractor and subcontractors shall certify all Record Drawings on the front lower right hand corner adjacent to the above marking with a rubber stamp impression or an AutoCAD image similar to the following:

RECORD DRAWING
CERTIFIED CORRECT
(⅜-inch high letters)

(Printed Name of General Contractor)
(5/16-inch high letters)

Date:

(Printed Name of Subcontractor)
(5/16-inch high letters)

Date:

E. Prior to final acceptance of the work of this Division, the Contractor shall submit properly certified Record Drawings to the Architect and Engineer for review and shall make changes, corrections, or additions as the Architect and/or Engineer may require to the Record Drawings. After the Architect's and Engineer's review, and any required Contractor revisions, the Record Drawings shall be delivered to the Owner on electronic media in AutoCAD format and a complete set of hard copy plots of Record Drawings. The Architect and Engineer do not assume any responsibility for the accuracy or completeness of the Record Drawings.

F. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. After review, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as

the original Contract Drawings.

2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
4. Architect will provide data file layer information. Record markups in separate layers

3.19 CERTIFICATION

A. Any certifications required by the Specifications, in addition to those required for shop drawings, product data, equipment and other items, are to be so certified in writing by the Owner, a Partner, or a Corporate Officer of the firm required to provide the Certification, or by another person duly authorized to sign binding agreements for and on behalf of the Owner, Partner or Corporation.

3.20 FINAL REVIEW

A. At a time designated by the Owner, the entire system shall be reviewed for compliance with the Contract Drawings and Specifications. Be available at all times during this review.

B. Demonstrate to the Owner and/or the Architect's personnel prior to the Final Review that systems and equipment have been properly balanced and adjusted and are in compliance with the requirements of the Contract Documents. After these demonstration tests are satisfactorily completed, but prior to the Final Review, submit a written certification that attests to the Contract Document compliance for this project. Prior to the final review, the Contractor shall confirm the following items regarding the status of key elements of the work. Negative responses to any of the items indicate that the construction is not substantially complete, and the building is not ready for a final review. The Contractor shall confirm the following in writing:

1. Building air systems (fans, air handling units, etc.) are completely installed, commissioned and operating.
2. Building hydronic systems are completely installed, commissioned, operating and pressure tested.
3. Building management system is installed, commissioned and operating.
4. Building has normal electrical power.
5. Building systems have been cleaned.
6. Seismic restraints have been inspected as specified. Any required special inspections have been completed.
7. Building systems have been balanced and copy of balance report submitted to the Architect.
8. Building fire and life safety systems have been tested and accepted by the local authorities. Any required special inspections have been completed.
9. There are no deviations or non-compliance with the Contract Documents; otherwise, provide a detailed account of any and all deviations or non-compliance.
10. All items on field review reports have been responded to in writing and are resolved to the satisfaction of the Owner.
11. All outstanding items on submittals and shop drawings have been addressed in writing and are resolved to the satisfaction of the Owner.
12. Schedule the final review only after providing written confirmation of all items

above.

C. Operate the entire system properly with all systems balanced and all controls adjusted.

D. Certificates and Documents required by the Contract shall be presented to the Architect prior to the Final Review.

E. After the Final Review, any changes or corrections noted as necessary for the work to comply with the Contract Documents shall be accomplished without delay in order to secure final acceptance of the work.

3.21 EARLY OCCUPANCY

A. Be responsible for completing those systems, which are necessary to allow partial occupancy of the building even if systems in the unoccupied areas are incomplete.

B. Verify and comply with requirements for temporary occupancy with the local Building Department.

END OF SECTION 23 05 01