# GENERAL

## SECTION INCLUDES

### This section describes Basic Mechanical Requirements required to provide for a complete installation of all mechanical systems for this project. This section shall apply to all other Division 23 specification sections as well as all work shown on the drawings.

### Mechanical demolition requirements (if any).

### It is the intent of the Mechanical Division of the Specifications that all mechanical work specified herein be coordinated as required with the work of all other Divisions of the Specifications and Drawings so that all installations operate as designed.

### All systems shall be completely assembled, tested, adjusted and demonstrated to be ready for operation to the satisfaction of the Owner’s representative.

### The Contractor shall note that, in some cases, piping as shown on the Drawings provide general location and routing information only. The Contractor shall be responsible for providing interference-free systems with proper clearance to facilities and equipment.

### Where the word “provide” is used, it shall mean “furnish and install” unless otherwise noted or specified.

### Note that the words “mechanical” and “plumbing” are used interchangeably throughout the Division 22 and 23 specification sections.

## RELATED SECTIONS

### Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section and all other sections of Division 23.

## DESCRIPTION OF WORK

### The work included under this section consists of providing all labor, materials, supervision, and construction procedures necessary for the installation of the complete mechanical systems required by these specifications and/or shown on the drawings of the contract.

### The Contract Drawings are shown in part diagrammatic intended to convey the scope of work, indicating the intended general arrangement of equipment, piping fixtures, etc. The Contractor shall follow the drawings in laying out work and verify clearances for the installation of the materials and equipment based on the dimensions of actual equipment furnished. Whenever a question exists as to the exact intended location of outlets or equipment, obtain instructions from the Architect/Engineer before proceeding with the work.

## PERMITS

### All permits, fees, licenses, etc. required for this project shall be obtained by the Contractor.

## QUALITY ASSURANCE

### Installers shall have at least 2 years of successful installation experience on projects with mechanical installation work similar to that required by the project. All equipment and materials shall be installed in a neat and workmanlike manner and shall be aligned, leveled, and adjusted for satisfactory operation, unless noted otherwise in other mechanical sections.

### Manufacturer of equipment and materials must be regularly engaged in the manufacture of the specified equipment and material with similar construction and capacities and whose products have been in satisfactory use in similar service for not less than five (5) years, unless noted otherwise in other Mechanical Sections.

### Qualify welding processes and operators for structural steel according to AWS D1.1. "Structural Welding Code - Steel.

### Quality welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

### Comply with provisions of ASME B31 Series "Code for Pressure Piping”, including all addenda.

### Contractor signed welder certificate(s) shall be submitted. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current. A record shall be maintained on the job site showing the date and results of qualification tests for each welder employed on the job. One certified copy of the qualification test for each welder so employed shall be furnished to the Owner’s representative.

### For all the refrigerant work/service required by this project, all refrigerant technicians shall be EPA/ASHRAE 34 certified for corresponding classification type I, II, III and/or IV.

## REFERENCES

### The design, manufacture, testing, and method of installation of all equipment and materials furnished under the requirements of this specification shall conform to the following as applicable:

#### Safety and Health Regulations for Construction.

#### Occupational Safety and Health Standards, National Consensus Standards and Established Federal Standards.

#### ABMA - American Boiler Manufacturers Association.

#### ACCA - Air Conditioning Contractors of America.

#### ACGIH - American Conference of Governmental Industrial Hygienists.

#### ADC - Air Diffusion Council.

#### AGA - American Gas Association.

#### AIHA - American Industrial Hygiene Association.

#### AMCA - Air Movement and Control Association.

#### ANSI - American National Standards Institute.

#### ARI - Air-Conditioning and Refrigeration Institute.

#### ASA - Acoustical Society of American.

#### ASHRAE - American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

#### ASME - The American Society of Mechanical Engineers.

#### ASTM - American Society of Testing and Materials.

#### CAGI - Compressed Air and Gas Institute.

#### CTI - Cooling Tower Institute.

#### EJMA - Expansion Joint Manufacturers Association.

#### ETL - Engineering Tests Laboratory.

#### HEI - Heat Exchange Institute.

#### HI - Hydraulic Institute.

#### HYD I - Hydronics Institute.

#### ICBO - International Conference of Building Officials.

#### ICC – International Code Council.

#### NEBB - National Environmental Balancing Bureau.

#### NEC - National Electrical Code.

#### NEMA - National Electrical Manufacturers Association.

#### NFPA - National Fire Protection Association.

#### NSF - National Sanitation Foundation.

#### SAE - Society of Automatic Engineers.

#### SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.

#### TEMA - Tubular Exchanger Manufacturers Association.

#### UL - Underwriters Laboratories, Inc.

#### International Plumbing Code.

#### International Mechanical Code.

#### Other governing, state, and local codes that apply.

## SUBMITTALS

### General: Follow the procedures specified in Division 1 Sections "General Conditions" and “Special Conditions”.

### Shop drawings shall include the minimum following information as applies. Additional specific information required is outlined in other Mechanical Sections.

#### Certified performance and data with system operating conditions indicated (winter and summer performance as necessary). All coil, fan, and pump performance data shall be computer generated.

##### Submit sound power level data for all inlets, outlets, and casing radiation at rated capacities for all air handling equipment. Provide calculated sound power data based on AMCA 320 sound intensity test methods.

##### Where filters are included with equipment, provide data of filter media, filter performance data, filter assembly, and filter frames.

#### Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicating, weights (shipping, installed, and operating), furnished specialties and accessories; and installation and start-up instructions.

#### Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loading, required clearances, gages and finishes of materials, and methods of assembly of components.

#### Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to electrical equipment. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of electrical equipment and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

#### Maintenance Data: Submit maintenance data and parts list for each mechanical equipment, control and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.

### Provide separate shop drawing submittals for the following items.:

#### Section 23 05 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Mechanical permits |  |
| EPA/ASHRAE 34 refrigeration certification |  |
| Welding certificates |  |
| Warranties |  |
| As-built documents |  |
| Pipe pressure test logs |  |
| Operation and maintenance manuals (electronic copies integrated into EMCS) |  |
| Close-out / walk-through documentation |  |
| Training seminar documentation |  |

#### Section 23 05 19:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Flow meters |  |
| Calibrated balance valves |  |
| Pressure gauges |  |
| Thermometers |  |
| Pressure/temperature test plugs |  |
| Duct static pressure gauges |  |

#### Section 23 05 29:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Pipe supports, anchors, sleeves, and hangers |  |
| Equipment curbs, supports, and hangers |  |
| Mechanical seals |  |
| Roof curbs and supports |  |
| Fire sealants |  |

#### Section 23 05 48:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Vibrations controls |  |

#### Section 23 05 53:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Mechanical identification materials |  |
| Valve schedule |  |

#### Section 23 05 93:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Agency compliance documentation |  |
| Pre-balancing conference meeting documentation |  |
| Pre-balancing field deficiency report(s) |  |
| Draft TAB report |  |
| Final TAB report |  |

#### Section 23 07 13:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Ductwork insulation materials and insulation schedule |  |

#### Section 22 07 16:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Equipment insulation materials and insulation schedule |  |

#### Section 22 07 19:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Pipe insulation materials and insulation schedule |  |

#### Section 23 09 00, 23 09 01 & 23 09 93:

|  |  |
| --- | --- |
| **Submittal Requirement:** | **Date Submitted:** |
| Control drawings |  |
| Control materials and equipment |  |
| Sequences of operation |  |
| Points list |  |

#### Section 23 09 02:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Variable frequency drives |  |
| Factory start-up report(s) |  |

#### Section 23 11 13:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Fuel oil piping material and fitting schedule |  |
| Fuel oil valves |  |
| Fuel oil pipe accessories |  |
| Remote fuel fill station and alarm panel |  |
| Piping hydrostatic test report(s) |  |

#### Section 23 21 13:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| HVAC piping material and fitting schedule |  |
| HVAC valves |  |
| HVAC pipe accessories |  |
| HVAC hydrostatic test report(s) |  |

#### Section 23 21 16:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| HVAC specialty equipment and materials |  |
| Strainers |  |
| Air vents |  |
| Pump suction fittings |  |
| Combination pump discharge valves |  |
| Relief valves |  |
| Flexible connections |  |
| Glycol specialties |  |

#### Section 23 21 23:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| HVAC pumps |  |

#### Section 23 22 13:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Steam and condensate piping material and fitting schedule |  |
| Steam and condensate valves |  |
| Steam and condensate hydrostatic test report(s) |  |

#### Section 23 22 14:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Steam and condensate specialties |  |

#### Section 23 25 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Chemical feeder equipment |  |
| Chemical treatment materials |  |
| Chemical material safety data sheet (MSDS) information |  |
| Monthly field inspection reports |  |

#### Section 23 31 13:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Ductwork material and schedule |  |
| Flexible ductwork |  |
| High pressure manufactured ductwork fittings |  |
| Low pressure manufactured ductwork fittings |  |
| Ductwork hangers, sealants, tapes, etc. |  |
| Ductwork connection systems |  |
| Owner approval of ductwork cleaning |  |
| Fire, smoke, and fire/smoke damper resetting demonstration documentation |  |
| Ductwork coordination drawings |  |

#### Section 23 33 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Dampers |  |
| Flexible duct connections |  |
| Duct access doors |  |
| Duct test hole plugs |  |
| Volume control dampers |  |
| Damper quadrants |  |

#### Section 23 34 13:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Mixed flow fans |  |

#### Section 23 34 23:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Power ventilators |  |

#### Section 23 36 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Air terminal units and accessories |  |

#### Section 23 36 50:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Laboratory airflow control system air valves |  |
| LACS controls |  |
| LACS miscellaneous components |  |

#### Section 23 37 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Air outlets and inlets |  |

#### Section 23 51 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Generator exhaust system |  |
| Grease duct system |  |

#### Section 23 57 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Heat exchangers |  |

#### Section 23 72 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Energy recovery wheel units |  |
| Fixed-plate sensible heat exchangers |  |
| Fixed-plate total heat exchangers |  |
| Packaged energy recovery units |  |

#### Section 23 73 13:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Air handling units |  |

#### Section 23 81 23:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Computer room air-conditioners |  |

#### Section 23 81 25:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Computer room zone cooling distribution units |  |

#### Section 23 82 16:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Laboratory reheat coils |  |

#### Section 23 82 39:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Heat transfer units |  |

#### Section 23 95 00:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Mechanical commissioning documentation |  |

#### Section 23 99 50:

| **Submittal Requirement:** | **Date Submitted:** |
| --- | --- |
| Building automation system commissioning documentation |  |

## SUBSTITUTES

### All proposals shall be based on providing and installing the materials or items of equipment which are hereinafter specified.

### Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing. Associated mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are to be increased accordingly, but all recommended manufacturer clearances, etc., are to be maintained within the allotted mechanical spaces. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

### Where the terms "or equivalent" is used, the Contractor may substitute alternate equipment, materials, etc. subject to review by the Architect/Engineer and the Owner’s representative during the submittal phase of the project.

### Where the term "or approved equivalent" is used, the Contractor may not substitute alternate equipment, materials, etc. unless requesting approval at least ten (10) days before the bid date. Notifications of any such approvals by the Architect/Engineer shall only be made in writing by Addendum.

### Where the term "no equivalent" is used, the Contractor must provide the specified or scheduled equipment, materials, etc.

### Final determination regarding substitutions shall be by the Architect/Engineer.

## WARRANTY

### Refer to the General Conditions section of this Specification for general warranty requirements and information. Additional warranty requirements are specified in subsequent Mechanical Sections.

## CLOSE OUT AND OPERATION INSTRUCTIONS

### Operate each system and item of equipment in a test run of appropriate duration, but no less than 7 days, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance.

### Any system placed in temporary operation for testing or for the convenience of the Contractor during construction shall be properly maintained and operated by the Contractor.

### All systems shall be protected against freezing, flooding, corrosion or other forms of damage prior to acceptance by the Owner.

### Material or equipment damaged, shown to be defective or not in accordance with the Specifications shall be repaired or replaced to the satisfaction of the Owner’s representative.

### All tests shall be made after notification to and in the presence of the Owner’s representative.

### Before starting up any system, each piece of equipment comprising any part of the system shall be checked for proper lubrication and any other condition which may cause damage to the equipment or endanger personnel.

### After systems have been demonstrated to be satisfactory for 7 consecutive days and ready for permanent operation, all permanent pipe line strainers shall be cleaned, valve and packings properly adjusted, lubrication checked and replenished if required. Temporary piping, etc. shall be removed and openings restored in a permanent manner acceptable to the Owner’s representative.

### Conduct a walk-through instruction seminar for the Owner's personnel pertaining to the continued operation and maintenance of mechanical equipment and systems. Explain the identification system, maintenance requirements, operational diagrams, temperature control provisions, sequencing requirements, security, safety, efficiency and similar features of the systems. Walk through must be documented as to those attending and subjects covered. Walk through document(s) shall be signed and dated by the contractor's representative and the owner's representative.

#### [Note to A/E: List all HVAC systems that require walk through instructional seminar]

### At the time of substantial project completion, turn over the prime responsibility for operation of the mechanical equipment and systems to the Owner's operating personnel. Until the time of final acceptance, provide full time operating personnel, who are completely familiar with the work, to consult with and continue training the Owner's personnel. If any systems are operated prior to substantial completion, the contractor shall perform all necessary preventative maintenance according to all manufacturer recommendations.

## RECORD DOCUMENTS

### Prepare as-built documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in above, indicate the following installed conditions:

#### The Mechanical Contractor shall provide the Owner with as-built drawings for ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units and indicate all devices requiring periodic maintenance or repair, such as control power transformers, LACS panels/routers, field controllers, duct static pressure sensors, piping pressure sensors, etc.

#### All mechanical systems as described in the Specifications and/or shown on the drawings.

#### Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 23 Section "Mechanical Identification." Indicate actual inverts and horizontal locations of underground piping.

#### Equipment/material locations (exposed and concealed), dimensioned from prominent building lines.

## MAINTENANCE MANUALS

### Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:

#### Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

#### Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

#### Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

#### Servicing instructions and lubrication charts and schedules.

### Provide electronic copies, preferably in Adobe Acrobat Portable Document Format (pdf), of all maintenance manuals to Temperature Control Contractor for use in EMCS front-end system. Provide data in file types compatible with EMCS.

# PRODUCTS (NOT APPLICABLE).

# EXECUTION

## MECHANICAL DEMOLITION

## [Note to A/E: Revise this section as necessary to address actual project requirements]

Delete this Article if no mechanical demolition is required. Edit this Article as required for mechanical demolition. Show items for demolition on Drawings and supplement Drawings with descriptions in this Article.

* + - * 1. Refer to Division 01 Sections for general demolition requirements and procedures.
        2. Disconnect, demolish, and remove mechanical systems, equipment, and components specified under Division 23 and as indicated on the drawings.

Controls

Demolition related to others areas that must remain on line.

Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

Equipment to Be Removed: Disconnect and cap services and remove equipment.

Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

* + - * 1. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality. Refer to insulation specifications…..

## DELIVERY, STORAGE, AND HANDLING

### Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

### Store and handle material and equipment in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

### Use proper lifting equipment where size/weight requires handling by such means.

### Comply with manufacturer's rigging and moving instructions for unloading material and equipment, and moving them to final location.

### Equipment requiring disassembly for access purposes shall be disassembled and reassembled as required for movement into the final location following manufacturer's written instructions.

### Deliver material and equipment as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

### Mechanical Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

## ROUGH-IN

### Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

### Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

## COORDINATION

### Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

### Coordinate the mechanical work with work of the different trades so that:

#### Interferences between mechanical, electrical, architectural, and structural work, including existing services, will be avoided.

#### Within the limits indicated on the drawings, the maximum practicable space for operation, maintenance repair, removal and testing of mechanical and other equipment will be provided.

#### Pipes, ducts, and similar items, shall be kept as close as possible to ceiling, walls, and columns, to take up a minimum amount of space. Pipes, ducts, and similar items shall be located so that they will not interfere with the intended use of other equipment.

### Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.

### Furnish and install, without additional expense to the Owner, all offsets, fittings and similar items necessary in order to accomplish the requirements of coordination.

## MECHANICAL INSTALLATIONS

### All dimensions and clearances affecting the installation of work shall be verified in the field in relation to established datum, to building openings and to the work of other trades.

### The location of all equipment and systems shall be coordinated to preclude interferences with other construction.

### Should interferences occur which will necessitate deviations from layout or dimensions shown on the Drawings, the Architect/Engineer and the Owner’s representative shall be notified and any changes approved before proceeding with the work.

### Arrange for chases, slots, and openings in other building components during progress of construction to allow for mechanical installations.

### Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum possible headroom.

### Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

### Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.

### Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

### Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

### Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

### Welding, sweating, or brazing operations

#### All cutting, welding, brazing, or sweating operations carried on in the vicinity of, or accessible to, combustible material shall be adequately protected to make certain that a spark or hot slag does not reach the combustible material and start a fire.

#### When it is necessary to do cutting, welding, brazing, or sweating close to wood construction, in pipe shafts, or other locations where combustible materials can not be removed or adequately protected, employ fireproof blankets and proper fire extinguishers. Position another individual nearby to guard against sparks and fire.

#### Whenever combustible material has been exposed to molten metal or hot slag from welding or cutting operations, or spatter from electric arc operations, a guard shall be kept at the place of work for at least one hour after completion to verify that smoldering fires have not been started.

#### Whenever welding or cutting operations are carried on in a vertical shaft or where floor openings exist, a fire guard shall be employed to examine all floors below the point of the welding or cutting operation. The fire guard shall be kept on duty for at least one hour after completion to verify that smoldering fires have not been started.

#### Before any work involving cutting, welding, brazing, or sweating operations is started, consult with the Architect/Engineer as to particular safety precautions to be employed on the work.

## ACCESSIBILITY

### All work shall be installed so as to be accessible for operation, maintenance and repair with particular attention given to locating valves, controls and equipment requiring periodic lubrication, cleaning, adjusting or servicing of any kind.

## LUBRICATION AND TOOLS

### Provide a fresh charge of lubricant in accordance with manufacturer’s recommendations to all equipment requiring lubrication prior to start-up and maintain lubrication as required until acceptance by Owner.

### Provide for each piece of equipment any special tools and a list of such tools required for the operation or adjustment of the equipment and turn over to the Owner’s representative prior to final acceptance of the equipment.

## START-UP

## PIPING SYSTEMS PRESSURE TESTING

### The following personnel in the order listed shall be considered acceptable witnesses of all piping pressure testing:

#### UNL Project Inspector

### Removal of pressure charge and associated drain down shall also be witnessed.

### Mechanical contractor shall provide a minimum of 24-hour notice to at least one of the above listed parties before commencing any piping systems pressure test.

### Pressure gauge requirements: Provide recently calibrated gauge with 4” face and a range such that test pressure is between 50% and 100% of gauge range. For example, a gauge with a 15 psig range is acceptable for a 10 psig pressure test, whereas a gauge with a 30 psig range is unacceptable in this application. Gauge resolution shall be suitable for type of testing, system size and test media. Gauge shall have been recently calibrated.

### All piping pressurizing equipment (i.e., air compressor) shall be disconnected before test is commenced and shall remain disconnected for the entire duration of the test.

### Entire system shall be properly vented before test is commenced.

### For specific piping pressure testing requirements and procedures, see applicable piping systems specification sections.

### Submit completed pipe pressure test log for each pressure test before final project closeout. Test log shall also be included in operation and maintenance manuals.

## GENERAL CONTRACTOR - MECHANICAL EXTENT OF WORK

### Access Panels

#### Furnish and install panels for access to valves and dampers and similar items where no other means of access, such as readily removable, sectional ceiling is shown or specified.

#### The plans indicate the location of all anticipated access panels. The Division 23 Contractor shall make every effort to locate all material and equipment requiring service and maintenance above accessible ceilings or utilize the indicated access panels. Material and equipment requiring service and maintenance that is shown above inaccessible ceilings shall be relocated to accessible or exposed areas whenever possible. When these items are located in exposed areas, the Division 23 Contractor is to verify with the Architect/Engineer that the installation will not affect the aesthetics of the building. However, when it is not possible to locate these items in accessible or exposed areas due to the configuration of the actual installation of the mechanical and other trade systems or aesthetic reasons, additional access panels shall be provided. The contractor shall be equitably compensated for the additional access panels.

#### Refer to Section 08 31 13 – Access Doors and Panels for specific information on type and size of panels

### Cutting and Patching

#### General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

#### The Division 23 Contractor shall coordinate all cutting and patching of holes, in existing building and new construction which are required for the passage of mechanical work.

#### Division 23 Contractor is to notify the General Contractor prior to submitting his bid, the number, size and location of all cutting and patching requirements. The Division 23 Contractor shall be liable for all associated costs of cutting and patching for mechanical work upon failure to notify the General Contractor prior to bid submission.

#### Under no circumstances shall any structural members, load-bearing walls or footings be cut without first obtaining written permission from the Engineer.

#### Cut, channel, chase and core drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

#### Patching of concrete openings shall be filled with grout and finished smooth with the adjacent surface.

#### All below-grade openings for pipe shall be sealed with interlocking synthetic rubber line assembly, Link-Seal by Thunderline Corporation or equal.

#### All penetrations through the walls, floor, or structure of laboratory spaces, laboratory support spaces, lecture halls, classrooms, conference rooms, corridors or other areas in which relative pressurization relationships are important shall be sealed airtight. Refer to the drawings for additional information regarding rooms in which maintaining pressurization is important.

#### Repair cut surfaces to match adjacent surfaces.

#### Perform cutting, fitting, and patching of mechanical equipment and materials required to:

##### Uncover work to provide for installation of ill-timed work.

##### Remove and replace defective work.

##### Remove and replace work not conforming to requirements of the Contract Documents.

##### Remove samples of installed Work as specified for testing.

##### Install equipment and materials in existing structures.

##### Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

### Concrete Bases

#### Minimum 4" high concrete housekeeping pads shall be provided under floor mounted mechanical equipment. Concrete inertia pads shall be provided for all base-mounted pumps and air compressors installed in the penthouse area.

#### Division 23 Contractor is to notify the General Contractor prior to submitting his bid, the number, size and location of all mechanical equipment bases. The Division 23 Contractor shall be liable for all associated costs to install the mechanical equipment bases upon failure to notify the General Contractor prior to bid submission.

#### Construct concrete equipment bases a minimum 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000 psi, 28-day compressive strength concrete, reinforcement and forms as specified in Division 3 Section "Cast-In-Place Concrete." Coordinate final equipment base size with General Contractor.

### Roof curbs, roof support for mechanical equipment and roof penetrations.

#### Division 23 Contractor is to coordinate with the General Contractor all roof curb and roof supports supplied, number, size and location of all roof penetrations. All major roof penetrations are shown on the architectural roof plan. General Contractor shall be notified of all additional roof penetrations provided by the Division 23 Contractor not shown on this plan. The General Contractor shall provide all roof deck mounted equipment and pipe supports, pipe penetrations and cut roof deck for pipe and duct penetrations, unless noted otherwise. The Division 23 Contractor shall furnish all roof curbs and the General Contractor shall install, unless noted otherwise. The Division 23 Contractor shall provide all roof covering/membrane mounted equipment and pipe supports and roof drains, unless noted otherwise.

#### The Division 23 Contractor shall be liable for all associated costs to install the roof curbs, roof supports and roof penetrations not shown on the roof plan or added after the roof system has been installed. Coordinate with the General Contractor prior to construction the number size and location of all roof penetrations.

#### Division 23 Contractor is to coordinate with the General Contractor all roof curb and roof supports supplied, number, size and location of all roof penetrations. All major roof penetrations are shown on the architectural roof plan. General Contractor shall be notified of all additional roof penetrations provided by the Division 23 Contractor not shown on this plan.

### Painting

#### The General Contractor is to field paint mechanical equipment and materials in specified areas as noted on the mechanical plans, mechanical schedules and in the specifications. Division 23 Contractor is to coordinate the painting of these items with the General Contractor. The Mechanical Contractor is to provide materials in these areas that are suitable for accepting paint. The clean and preparation of the materials to reach paint is the responsibility of the General Contractor unless noted specifically to be responsibility of the Division 23 Contractor.

#### In concealed locations, field-fabricated bare iron or steel items required for installation of work under this Division shall have rough or sharp edges removed and shall be painted with one coat of zinc rich paint.

#### In exposed locations, field-fabricated bare iron or steel items required for installation of work under this Division shall have rough or sharp edges removed and shall be painted in accordance with Section 09 91 00.

## ELECTRICAL-MECHANICAL EXTENT OF WORK

### The responsibility of work specified under Division 23 and 26 is clarified under, Section 23 05 13, "Electrical Requirements for Mechanical Equipment. Division 23 Contractor is to coordinate all electrical requirements prior to ordering powered mechanical equipment.

END OF SECTION 23 05 00