

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. All work shall be subject to the General Conditions and shall comply with applicable requirements of the Contract.
- B. This Section, "230500", governs all requirements as applicable to the mechanical work specified in other Sections of Division 23.

1.02 DIVISION OF RESPONSIBILITY

- A. The requirements under Section 230500 are intended for the party or parties who have been duly awarded the applicable portion of work to be performed under the indexed sections of Division 23 also known as the Heating, Ventilating and Air Conditioning Work, and Division 21, Fire Protection and Sprinkler Work.

1.03 REFERENCE STANDARDS

- A. Compliance with the following codes and standards shall be required as applicable:

- 1. ADC Air Diffusion Council
- 2. AGA American Gas Association
- 3. AMCA Air Movement and Control Association
- 4. ANSI American National Standards Institute
- 5. ARI American Refrigeration Institute
- 6. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
- 7. ASME American Society of Mechanical Engineers
- 8. ASSE American Society of Sanitary Engineering
- 9. ASTM American Society for Testing Materials
- 10. AWWA American Water Works Association
- 11. DOE United States Department of Energy
- 12. EPA United States Environmental Protection Agency
- 13. FM Factory Mutual
- 14. MSS Manufacturer's Standardization Society of the Valve and Fitting Industry
- 15. NACE National Association of Corrosion Engineers
- 16. NEC National Electrical Code
- 17. NEMA National Electrical Manufacturers Association
- 18. NFPA National Fire Protection Association
- 19. IBC-NJ International Building Code – 2009, New Jersey Edition

20.	NJRSC	New Jersey Rehabilitation Sub-Code
21.	OSHA	Occupational Safety and Health Act
22.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
23.	TEMA	Tubular Exchanger Manufacturers Association
24.	UL	Underwriters' Laboratories, Inc.
25.	USAS	USA Standards Institute (Formerly ASA)

- B. Conform to materials and equipment rating standards, listings or classifications of the above organizations as well as ratings, listings or classifications accepted under local codes and laws.

1.04 ABBREVIATIONS

- A. In addition to those listed below, meanings of common abbreviations used in text of Division 23 of the Project Specifications are tabulated in ASHRAE Handbook, "Fundamentals", latest edition.

- B. Project Abbreviations:

AC	Air Conditioning
AHA	Authority Having Jurisdiction
ATC	Automatic Temperature Control
AWG	American Wire Gauge
B & S	Brown & Sharpe
BMS	Building Management System
BTU	British Thermal Units
BWG	Birmingham Wire Gauge
C	Degrees Celsius
CFM	Cubic Feet per Minute
CM	Construction Manager
F	Degrees Fahrenheit
GC	General Contractor
GPM	Gallons per Minute
H & V	Heating and Ventilating
HVAC	Heating, Ventilating and Air Conditioning
IBBM	Iron Body Brass Mounted
LB	Pound (Also shown as: #)
MBH	Thousand BTU per hour
MER	Mechanical Equipment Room
mm	Millimeter
#	Number
OS & Y	Outside Screw and Yoke
PRV	Pressure Reducing Valve
PSIG	Pounds per Square Inch Gauge
SP	Static Pressure
USS	United States Standard
WG	Water Gage

WSP Working Steam Pressure
See Drawings for additional abbreviations

1.05 DEFINITIONS

- A. "Provide" means furnish and install, complete, the specified material, equipment or other item and perform all required labor to make a finished installation.
- B. "Furnish and install" has the same meaning as given above for "Provide."
- C. "Furnish" means supply the specified material, equipment or other items.
- D. "Install" means provide all labor required to make a finished and complete installation.
- E. "Engineer" or "Architect" means the authorized representative of the Owner.
- F. Refer to General Conditions for other definitions.

1.06 REVIEW OF CONTRACT DOCUMENTS AND SITE

- A. With the submission of his Bid, Contractor shall give written notice to the Owner of any materials or apparatus believed in-adequate or unsuitable, in violation of laws, ordinances, rules or regulations of Authorities Having Jurisdiction, and any necessary items of work omitted. In the absence of such written notice it is mutually agreed that the Contractor has included the cost of all required items in his Proposal for a complete project.
- B. Contractor shall acknowledge that he has examined the Plans, Specifications and Site, and that from his own investigations he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials; availability of labor, water, electric power, roads and uncertainties of weather; the conformation and condition of the ground; the character, quality and quantity of surface and subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the work; all federal, state, city county, township and municipal laws, ordinances and regulations particularly those relating to employment of labor, rates of wages, and construction methods; and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.
- C. Owner assumes no responsibility for any understanding or representation made during or prior to the negotiation and execution of this Contract unless such understanding or representations are expressly stated in the Contract, and the Contract expressly provides that the responsibility, therefore, is assumed by the Owner.

1.07 MEASUREMENTS

- A. Contractor shall base all his measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. He shall verify all measurements at site; and check the correctness of same as related to the work.

1.08 LABOR AND MATERIALS

- A. All materials and apparatus required for the work shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces.
- B. Contractor shall remove all materials delivered, or work erected, which does not comply with Contract Drawings and Specifications, and replace with proper materials, or correct such work as directed, at no additional cost to the Owner.

1.09 COVERING OF WORK

- A. No pipe, fitting, or other work of any kind shall be covered up or hidden from view before it has been examined or approved by the Engineer, Architect, and/or other Authority Having Jurisdiction over same. Any unacceptable work, or unauthorized or disapproved materials discovered shall be removed and corrected immediately.
- B. Any type of equipment shown or specified to be installed outdoors, on grade, on roof or similar areas shall have appropriate protection against outdoor weather. Equipment such as motors, panels, etc. shall have rain hood or appropriate protection as provided under Division 23. Insulated pipes shall have aluminum covers or as specified. Insulated ducts shall be provided with aluminum jacket with overlapping, sealed joints. Uninsulated ducts shall be soldered joints and seams or as specified. Where no protection is feasible, such as in exposed vibration springs, hangers, pipe or steel members, such items shall be rated by the manufacturer for outdoor use or as approved by the Architect.

1.10 PROTECTION

- A. Contractor shall protect the work and material of all trades from damage by his work or workmen, and shall replace all damaged material with new.
- B. Contractor shall be responsible for work and equipment until his work is finally inspected, tested, and accepted; he shall protect his work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.
- C. Contractor shall be responsible for the preservation of all public and private property, along and adjacent to the work, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and shall carefully protect from disturbance or damage all property marks until an authorized

agent has witnessed or otherwise referenced their location, and shall not remove them until directed.

- D. All mechanical and electrical equipment delivered to the site shall have appropriate wrapping to protect them from rain, flood, wind, construction debris and all types of water damage normally encountered at the construction sites. Protection of equipment such as fans, coils, valves and similar equipment shall be the responsibility of the Contractor receiving such equipment at the jobsite for installation under Division 23 Contract.

1.11 CUTTING AND PATCHING

- A. Provide all cutting, rough and finish patching required for systems and equipment included in these specifications.
- B. Provide all sleeves and inserts required before the floors and walls are built; Contractor shall pay the cost of cutting and patching required for pipes where sleeves and inserts were not installed in time, or where incorrectly located. Provide all drilling required for the installation of hangers.
- C. All holes cut through concrete slabs or arches shall be punched or drilled from the underside. No structural members shall be cut without the written approval of the Architect and/or the Structural Engineer and all such cutting shall be done in a manner directed by him.
- D. Contractor shall not do any cutting that may impair strength of building construction. No holes, except for small screws, may be drilled in beams or other structural members without obtaining prior approval. All work shall be done in a neat manner by mechanics skilled in their trades and as approved.
- E. Provide sleeves and fire stopping at piping and ductwork floor, wall and roof penetrations in accordance with recognized standards.

1.12 SUBMITTALS

- A. Procedure:
 - 1. Prepare a schedule of specific submissions at the outset of the Project for the Owner's review and approval; make submissions listed below and in the other Sections of Division 23 of the Project Specifications.
 - a. If submissions listed in other Sections of Division 23 are more specific than those listed below, comply with the more specific requirements.
 - b. Failure of the Contractor to submit Shop Drawings in ample time for checking shall not entitle him to an extension of Contract time, and no claim for extension by reason of such default will be allowed.
 - c. Piecemeal submittals are unacceptable and will not be reviewed. No submittal shall be considered for review, the review of which is contingent upon acceptance of other features for which submittals have not been submitted.

- d. Submittals from Vendor without Contractor's review and approval stamp will not be reviewed.
- e. Submittals shall not be used by the Contractor as a means to secure approval of a substitution. Contractor must indicate all deviations, omissions and substitutions in his submittal; if there are none of these 3 exceptions, he shall then state on the submittal: "NO EXCEPTION TAKEN" and it will be assumed to fully comply with the contract documents. Any submittal without stated exceptions, or without statement that no exception is taken will not be reviewed and will be rejected and returned to Contractor for rectification.
- f. All products of a similar nature (i.e., diffusers, air handling units or variable speed drives) shall be provided by a single manufacturer.
- g. All products and material shall be submitted for approval regardless of whether products or materials are from the same manufacturer's model and type, as scheduled or specified. All items must be submitted for approval prior to procurement and installation.

B. Shop Drawings:

1. Manufacturer's Drawings:

- a. Submit equipment listed in all applicable Sections - include material specifications, operating characteristics and finishes, specified agency listings or approvals.
- b. Cuts, brochures or other literature submitted for expeditious approval but incomplete or missing items of hardware or software (performance data) shall be re-submitted until all system or equipment components have been reviewed and approved. Any item not included in the original or first submission shall be considered outstanding work until such item of equipment or work has been submitted or installed in place exactly conforming to the intent of the contract documents.
- c. Contractor shall provide preliminary layout drawings of all major pieces of equipment (i.e., boilers, chillers, cooling towers, air handling units), confirming that the submitted product physically fits within the architectural enclosures. This drawing is required along with the manufacturer's product data.
- d. Contractors shall be responsible for all costs related to substitutions as they affect other contractors.

2. Installation Drawings:

- a. Furnish coordinated drawings of equipment installation, including interconnecting piping and ductwork. Minimum scale for these drawings shall be 3/8 inch equals one foot.

- b. Coordinate space requirements for electrical, plumbing and other trades in the vicinity of work.
- c. Include connections, anchorages and fastenings for piping, conduit and ductwork.
- d. Make allowance for clearances for access to and maintenance of equipment.
- e. Do not install any piping conduits or ductwork, in any area, prior to obtaining approval of its layout by means of submitting shop drawings.
- f. Any missing items of equipment, material or labor, during initial submission of shop drawings, are to be completed and re-submitted for final approval. Shop drawing should not be used as a vehicle for obtaining variances, deviation or omission from the scope of contract documents. Approval of a submittal shall pertain to the portions that conform to the intent of the contract documents.
- g. Submission of any missing, incomplete or otherwise deviant layout is subject to re-submission until all contract requirements have been properly included or shown on the same layout.
- h. Submit drawings indicated on equipment, piping and ductwork loads to structural engineer for review.

C. Required Samples:

- 1. Color samples, for prefinished items.
- 2. Natural finish metals, for quality of finish.
- 3. As requested in other sections of Division 23.
- 4. Thermostats or space sensors.

D. Reports:

- 1. Compliance with listings and approvals for equipment and for fire ratings.
- 2. Acceptance certificates from inspecting agencies.
- 3. Complete printed and illustrated operating instructions where required in report format.
- 4. Manufacturer's pressure tests on vessels.
- 5. Manufacturer's performance tests on operating equipment.
- 6. Field pipe testing reports.

7. Welder's certificates and field test reports.
 8. Field operating test results for operating equipment.
 9. Performance report on the balancing of air and water systems.
 10. Performance reports for vibration isolation equipment.
 11. Manufacturer's reports on motorized equipment alignment and installation.
 12. Additional reports as noted in other sections.
- E. Specific references to any article, device, product or material, fixture or item of equipment by name, make or catalog number shall be interpreted as establishing a basis of cost and a standard quality. All devices shall be of the make and type listed by Special Agencies, such as the Underwriters' Laboratories, and where required, approved by the authority having jurisdiction.
- F. Contractor shall be responsible for any deviations in equipment size, motor horsepower and access requirement, from specified products, including coordination with and costs associated with the related work of other Trades.

1.13 COORDINATION

- A. Contractor shall prepare preliminary shop drawings suitable for use in coordinating his work with the work of other trades. The HVAC Section shall prepare and furnish background with ductwork at $\frac{3}{8}" = 1'-0"$ scale for all trades to indicate piping, cable tray and conduit in relation to all structural elements of the construction, including floor elevations; steel locations, size and elevations; partitions locations; door locations and direction of swing; and all other information required to assure coordination of the electrical, sheet metal and piping trades and fire protection in relation to the Architectural function of the project. Coordination meetings shall be held under the supervision of the Construction Manager (CM) or General Contractor (GC). Each trade shall have proper representation at all coordination meetings for the purpose of detailing, on the drawings mentioned above, the exact location and routing of their work. After the conclusion of the coordination at the working meetings, each trade shall sign the coordinated originals, copies of which shall be distributed by the CM or GC to all parties concerned including the Owner. Final shop drawings of all trades shall be in accordance with the coordinated drawing, after which final shop drawings shall be submitted for final approval.
- B. If the trade contractor installs work so as to cause interference with work of other trades, he shall make necessary changes in work to correct the condition immediately without delaying project and without extra charge. No work shall be fabricated or installed prior to coordination with all trades and resolution of any conflicts and approval by the architect.
- C. Dimensional layout plans of equipment rooms shall be made showing all bases, pads and inertia blocks required for mechanical equipment. Include dimensions of bases, bolt layouts, details, etc.

- D. Contractor shall furnish all necessary templates, patterns, etc., for installing work and for purpose of making adjoining work conform, furnish setting plans and shop details to other trades as required.

1.14 EXCAVATION AND BACKFILLING

- A. Excavation and backfilling of trenches required for the installation of all services underground piping and underground tanks inside and outside of the building are to be provided by each respective Section involved.
- B. Trenching: Excavate to required depth and grade, the bottom of trenches to secure required slope for pipe lines. Each trade will be responsible for the required slopes, inverts, bed material, and all other pertinent requirements.
- C. Bottom of trench shall be accurately excavated to provide firm, uniform bearing for bottom of the pipe. Pipe having bells, sleeves or other enlargement at joints to have recesses excavated to accommodate these joints.
- D. Backfilling: Trenches shall not be backfilled until piping has been tested. Backfill consisting of sand or selected excavated material shall be placed to a level equal to the final grade and hand compacted as required to produce the same density as the soil in the surrounding areas. Furnish and run constantly, if required or directed, sufficient pumping machinery to keep trenches free from water up to the time of inspection and acceptance of that part of this work.
- E. Refer to General Conditions for additional requirements governing excavation and backfilling. These requirements shall prevail unless superseded by specific requirements in Division 23.
- F. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be approved before work commences. Each Trade Contractor shall provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight.
- G. Provide sheet piling where required to properly support sides of trenches and excavations.

1.15 CONCRETE AND GROUTING

- A. Requirements for concrete and grouting are specified in other Sections.
 - 1. Concrete shall be 3,000 psi stone concrete with water reducing admixture, except where otherwise specified.
 - 2. Concrete shall have air entraining admixture where exposed to weather.
- B. Contractor shall provide housekeeping pads, roof curbs, thrust blocks, inertia blocks, etc.

- C. Concrete housekeeping pads: 4" minimum thickness, sized to cover the full area of each piece of equipment and access area.
- D. Concrete bases: Dimension and height to suit the equipment.
- E. Concrete inertia blocks for vibration isolation. Dimensions designed by the vibration isolation equipment manufacturer and inertia block provided by Division 23, under Mechanical work.
- F. Outside the building all concrete work related to mechanical equipment shall be provided by the Trade Contractor of Division 23, unless otherwise noted in the Contract Documents.

1.16 ACOUSTICAL PERFORMANCE OF EQUIPMENT AND SYSTEMS

- A. Noise levels from operation of motor driven equipment, whether airborne or structure-borne, and noise levels created by or within air handling equipment and air distribution and control media, are not to exceed sound pressure levels determined by the noise criteria curves in the ASHRAE Guide and as noted under Section 230548.
- B. Acoustical Tests:
 - 1. Owner may require contractor to conduct sound tests for those areas or equipment he deems too noisy.
 - 2. If NC level in any space exceeds that in the schedule or the specification due to improper installation or operation of mechanical systems, the respective Trade Contractor is required to make remedial changes or repairs.
 - 3. Respective Trade Contractor is required to retest until specified criteria has been met.

1.17 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Instructions and Demonstration for Owner's Personnel:
 - 1. After all equipment is functioning properly, each system is to be automatically operated for ten (10) working shifts, and not to be adjusted during this period, 80 hours in heating and 80 hours in cooling seasons, and 80 hours during "shoulder" or "swing" seasons scheduled at the convenience of the Owner. Any adjustments will void the test and start the time period all over again.
 - 2. The hours of operation are to include the Owner's designated personnel in each shift, for each season.
 - 3. During this period, instruct the Owner's personnel in the use, operation and maintenance of all equipment of each system. Training will include a lecture-type instruction given in a non-machine room environment. During the lesson, normal operation of the system installed and operating will be explained, along with troubleshooting procedures. This will be followed by a field inspection and demonstration of equipment.

4. The above instruction is exclusive of that required of specified equipment manufacturers. If more stringent or longer instruction is indicated for specific equipment or systems, these shall supersede the above requirements.

B. Operating and Maintenance Data:

1. Provide four (4) complete sets of manufacturer's catalogues, instructions, maintenance and repair information and parts lists for operating equipment and devices. Include one (1) CD with a PDF file with all required documentation.
 - a. Include performance curves for fans and pumps, factory furnished wiring diagrams and control diagrams, and applicable flow diagrams.
 - b. Submit seven sets of instructions for distribution.
2. Data for the equipment actually installed is to be submitted.
3. The data is to be carefully checked for accuracy by comparison with the installed equipment nameplates.
4. Provide a recommended list of spare parts for equipment and list of special, non-standard tools to service equipment.
5. Index and assemble the instructions in durable loose-leaf binders.
6. The completed binders are to be available at the time the equipment installation begins.
7. In addition, follow all requirements of Division 01 "Execution and Closeout Requirement".

1.18 RECORD DRAWINGS

- A. Provide and maintain a currently up-to-date record set of reproducible prints showing all changes, additions or omissions made during construction. Contractor shall, at his own expense, shall prepare accurate as-built drawings and produce the Record Drawings.
- B. Deliver four (4) sets of all as-built drawings and one (1) set of reproducibles of the record drawings to the Owner before submitting requisition for final payment.
- C. Shop Drawings shall be cross-referenced on the mylar copies for this requirement where applicable.
- D. CADD background, if desired to be obtained from Engineer, sign release and indemnification and pay fee.
- E. Submit AutoCADD, drawings as required by Owner, compatible as-built drawing files.

1.19 WARRANTY

- A. The following supplements the GENERAL CONDITIONS for Mechanical Work:
1. Non-durable, expendable items such as replaceable (not cleanable) air filter media are not subject to replacement after the date of acceptance.
 2. Warranty time limits for equipment exceeding those indicated in GENERAL CONDITIONS are specified in the applicable Sections of Division 23.
 3. In addition, follow all requirements of Division 01 "Execution and Closeout Requirement".

PART 2 - PRODUCTS

2.01 IDENTIFICATION MARKINGS

- A. Every equipment, valve, damper, control, panel, starter, VFD and apparatus installed under this Contract shall be tagged, labeled or stenciled as follows: Tags and labels securely fastened by brass chains, screws or mastic as applicable. Equipment controls numbered according to equipment schedules on Plans. Tags numbered to conform to a directory listing number, location and use. Directories to be mounted under glass in aluminum self-closing frames, 8-1/2" x 11" in size.
1. Apply identification after testing, insulation and field painting are completed.
- B. Valve Identification:
1. Provide an identification tag for each valve, including control valves.
 2. Differentiate between the different classes of service in the numbering systems; as an example: "CHW-II", "HW-II" or "CW-II".
 3. Use 2" brass tags stamped with designation numbers 1" high, filled in with black enamel.
 4. Attach tags securely to handles or spindles of valves with heavy brass "S" hooks or brass chains.
 5. Provide six copies of valve charts with one of each framed under glass and mounted where directed.
- C. Piping Identification:
1. Provide on bare and covered pipes for all services.
 2. Use a system of marking and colors conforming to ANSI A-13.1.
 3. Install to provide permanent adhesion.
 4. Install in readily visible location.

5. Apply legend and flow markers as required for maintenance purposes, with at least one marker in every 50'-0" of each line and at every change of direction.
6. Color Coding of Piping: After exposed and visible piping has been finish painted, the installer of the piping shall identify the type of service lines with applied color bands and stenciled letters. The direction of flow shall be indicated with stenciled arrows. Color bands shall be 1-inch wide, finished in gloss enamel; lettering and arrows shall be same color as the bands. Indicators shall be applied at connections to pumps, chillers and other equipment; at entrances to spaces; adjacent to valves; near access doors to pipe spaces; and at maximum intervals of 50 feet on long pipe runs and at each change of direction. Letters shall be positioned to be easily read from a normal standing position. If there is no owner's standard for color code and designation, the following colors and letter designations shall be used:

HVAC PIPING

<u>Service</u>	<u>Color</u>	<u>Designation</u>
Pumped Condensate	Yellow	PR
Chilled Water Supply	Blue	CHWS
Chilled Water Return	White with 2 blue vertical stripes 15'-0" o.c.	CHWR
Sec Chilled Water Supply	Magenta	CHWS
Sec Chilled Water Return	Magenta	CHWR
Hot Water Supply	Brown with Red Bands	HWS
Hot Water Return	Brown with Orange Bands	HWR
Compressed Air (Controls)	Green	CCA
Steam	Orange	HPS, LPS
Other	As directed	As directed

FIRE PROTECTION PIPING

<u>Service</u>	<u>Color</u>	<u>Designation</u>
Sprinkler	Red	Sprinkler
Standpipe	Red	Standpipe

D. Equipment Identification:

1. Provide stencil lettering on operating equipment and units:
 - a. Use black oil base paint, except where equipment finish is dark, use white paint.
 - b. Make all characters distinguishable from the floor, but not less than 2" high.
2. For each motor starter, controller and similar accessory provide a lamicore nameplate attached with screws or rivets to a fixed part of the equipment in a visible location.

- a. Make plates not less than 2" x 1" x 1/8" thick with 1/4" high characters.
 - b. Designations for equipment tags shall match contract schedules.
 - 3. Equipment such as fans, tanks, ducts, access doors to equipment such as filters, coils, fans, neatly stenciled with letters not less than 1 inch high. Any equipment too small to receive such stenciling shall be provided with brass name tags 2" x 1" in size.
 - a. Label ducts by function (supply air, return air, exhaust air and transfer).
 - 4. In areas where removable ceilings occur, install appropriate color coded tile markers to indicate location of valves and other equipment or fittings that may require maintenance service.
- E. Refer to Section 230553 for additional requirements.

2.02 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Keep piping 2'-0" outside the vertical line of unprotected electrical equipment or provide non-corrosive metal (soldered 20 gauge copper or welded stainless steel), watertight support, pans piped to an open drain.
 - 1. Construct and support pans to hold minimum depth of 3 inches of water and shall extend a minimum of 3 inches beyond pipe and insulation.

2.03 ACCESS DOORS

- A. General:
 - 1. Provide steel, flush four-sided frame and door assembly, chemically cleaned after fabrication and painted with rust inhibitive primer.
 - 2. Provide hardware and locking devices.
 - 3. Provide access doors required for access to mechanical work through finished wall construction and non-removable ceiling construction.
 - 4. Coordinate location information with appropriate trades.
- B. Provide flush type access door or panel no smaller than 18" x 18" and no larger than 30" x 30" for all dampers, valves, cleanouts, or apparatus located in chases, walls, non-accessible hung ceilings or floors; finish shall be prime coat, except floor panels which shall be polished brass or chrome plate. Doors and trim 14 gauge steel, frame 16 gauge steel, with flush concealed and standard flush locks, screwdriver operated cams, of Milcor manufacturer or approved equal.
 - 1. All panels and their exact location subject to approval of the Architect.

2. Where space conditions prevent door swinging open, provide removable door on lift-up hinges. This will only be accepted on a case-by-case basis. This condition must be submitted to the Owner and Engineer for approval prior to installation.
3. Furnish a complete list locating all access doors required in finished walls, ceilings, partitions, shafts and other inaccessible locations.
4. Access doors to be installed in rated construction shall match rating of construction.

2.04 PRIME PAINTING

- A. All piping, supports, auxiliary steel and miscellaneous iron within all MER's shall be prime painted as specified herein.
- B. All exposed uninsulated piping, fittings, equipment stands, supports, platforms, cradles, and hangers; except chrome finished materials, shall be painted. All ungalvanized surfaces shall be painted with zinc chromate, or approved equal, and all galvanized surfaces shall be prime coated with a phosphate pretreatment coating, dry film thickness of 0.35 with a 0.50 mil. one coat Glid-Guard galvanized steel primer Y5229, or approved equal. All ductwork on roof, uninsulated piping, uninsulated supports, hangers, inserts, accessories on roof shall be primed with rust resistant primer and painted of color and finish as selected by architect.
- C. All exposed ductwork inside building except in mechanical rooms shall be primed and painted of color and finish selected by the architect.
- D. Upon completion of the prime coat of all mechanical equipment specified above, all insulated and exposed piping shall be painted with finish coating, as specified under Division 09900 and/or other Sections. This Section shall complete stenciling and color identification, specified under Division 23, following the finish painting.
- E. Except where otherwise specified, steel piping in concrete and buried steel piping and steel tanks:
 1. Provide factory-applied anti-corrosive polyurethane coating, minimum 15 mils thickness which complies with UL 1746, Parts I and IV.
 2. In accordance with NFPA and other applicable codes.
- F. Provide factory finishes, except as noted, to match Architect's color samples, for items appearing in exposed finished work, and including:
 1. Equipment
 2. Registers and grilles
 3. Diffusers
 4. Enclosures on equipment
 5. Thermostat Covers

- G. All damaged factory painted surfaces shall be repaired to match original surface. If, in opinion of Owner, such repairs are unsatisfactory, item in question shall be completely refinished or replaced with new.

2.05 WELDING

A. General:

1. All welding procedures, welders, and welding operators shall be qualified in accordance with the requirements of ASME/ANSI B31.9 and Section IX of the ASME Code, latest editions.
2. Welding procedures shall be reported on ASME Section IX Forms "QW," or its equivalent. Joint preparation sketches (to be included with the welding procedures) shall show all dimensions including tolerances, for bevel angle, land size, offset and root gap.
3. Contractor shall be responsible for the welding performed by personnel of his organization and shall conduct the required qualification tests and submit results to the Owner for his review and approval.
4. All welding procedures shall meet requirements of New Jersey Fire Department Certified Requirements. The filing of MSDS form shall be held in the field office.
5. A copy of the welders and fire watch certificate shall be held in the field office of the sight.

B. Processes:

1. Employ the Manual Shielded Metal-Arc (SMAW) welding process.
2. Double butt welding shall be permitted on all joints accessible from both sides. Where double butt-welding is employed, the first root pass shall be back-chipped.
3. Welding of pressure parts shall be performed with low hydrogen type electrodes. Electrodes of Classifications E6012, E6013, E7014 and E7024 shall not be used.
4. Brazing and Soldering:
 - a. The Contractor shall prepare applicable "Brazing and Soldering Procedures" forms for approval of the Owner.
 - b. Brazing shall conform to ASME Section IX.
 - c. Soldering shall conform to the relevant procedures in the manuals of the Copper Development Association.
 - d. For all refrigeration piping, the mechanics shall be skilled and specially trained in this type of pipe joining.

- e. The Owner may reject any brazed or soldered joint for lack of penetration or for other applicable grounds. These defective joints shall be redone until satisfactory.
- C. Quality of Workmanship - In addition to conformance with the procedural and quality requirements set forth in the applicable Code or material specification, all welding shall meet the following requirements.
 - 1. Butt welds shall have full penetrations and shall be slightly convex with uniform height.
 - 2. Each weld shall be uniform in width and size throughout its full length.
 - 3. Each layer of welding shall be smooth, free of slag, cracks, pinholes, undercut in excess of 1/32" and completely fused to adjacent weld beads and base metal.
 - 4. Cover passes shall be free of coarse ripples, irregular surface, non-uniform bead patterns, high crown, and deep ridges or valleys between heads. The surface smoothness of the finished weld shall be suitable for the proper interpretation of non-destructive examination of the weld.
 - 5. Surfaces of parts to be joined by welding shall be cleaned of all oil, grease, paint, scale and rust with solvent and/or wire brushing.
 - 6. Fillet weld size shall be in accordance with the applicable code or as specified on the drawings with full throat and legs of equal length.
 - 7. Welding filler metal and welding flux shall be properly stored in such a manner as to insure that no damage to the coating or corrosion of weld rod will occur. Low hydrogen type electrodes shall be stored in enclosures which provide a regulated temperature as prescribed by the electrode manufacturer. All electrodes shall be properly identified.
 - 8. Socket welds shall have a gap of approximately 1/16" between the bottom of the socket and the end of the pipe prior to welding. Socket welds shall have a minimum of two weld layers.
 - 9. Welds for steam piping shall be X-rayed in accordance with IBC-NJ requirements. Submit results of X-ray analysis for approval.
- D. Repair and Weld Defects:
 - 1. A weld is defective and shall be repaired if it does not meet the acceptance standard of each applicable non-destructive examination as defined ASME/ANSI B31.9, latest edition.
 - 2. Repairs shall be made in accordance with ASME/ANSI B31.9, latest edition.
- E. Welding Identification and Weld Marking:
 - 1. All welds must be identified with the welder's identifying symbol. Welds, where more than one welder performs the work, shall be stamped by each welder.

2. Marking shall be done by a permanent method that will not result in sharp discontinuities.
3. Where stamping or marking on the base materials is not practical or feasible, permanently affixed metal bands of the same material may be applied. Stamping or any method of permanent marking on the bands is acceptable.

2.06 EQUIPMENT AND SYSTEMS CRITERIA

- A. The criteria of design and performance to produce the required operation is based on equipment shown or scheduled, and as specified.
- B. Equipment of other manufacturers will be considered, subject to its acceptability and the following:
 1. The equipment must conform to the structural design provisions for loads applied to the structure; to the dimensions established by drawings for spaces and other (service, etc.) clearances; and for inlet and outlet locations and relationships to associated equipment, piping and ducts.
 2. Changes to the building arrangement or structure, which are required to suit equipment offered must be by the Contractor at no extra expense to the Owner.
 3. Changes to the electrical requirements such as circuit breaker or starter size, conduit or wire size shall be coordinated by the Contractor and the expense borne by him with no additional cost to the Owner.
 4. Changes to other Contractor's scope of work shall be the responsibility of this Contractor, at no extra expense to the Owner.
- C. Operating equipment, operating systems and other products are specified by names and models and also by performance criteria standards:
 1. Where both specifying media are employed, the names and models establish a standard for manufacturing quality, while the performance criteria governs the capacity, rating or output.
 2. In any question regarding intent, the capacity, rating or output which is compatible with the other systems, is intended to be of prime concern and is to be provided.
 3. Contractor shall follow Owner's Standards for Turn-Over Acceptance, Commissioning and Testing. Where there is a conflict between these requirements and Building Department's requirements, the more stringent requirements shall apply.
- D. The descriptions of equipment and systems cover basic equipment and operation, but not all the details of design and construction.
 1. The use of singular in descriptions does not limit the quantities to be furnished to produce the complete system, together with the results specified.

2. Furnish equipment required to provide specified performance under installed conditions.
 3. Factory wiring and piping is to conform to specifications for field work, unless otherwise specified.
 4. Provide trim, enclosures, transition pieces and accessories required to make complete installation in each instance.
 5. Provide all seismic provisions as required to meet IBC-NJ requirements.
- E. All Mechanical Drawings of Division 23 are schematic and diagrammatic.
1. Symbols and diagrams are used to indicate the various items of work and the complete systems, but they do not necessarily have dimensional significance, neither do they necessarily include all related and subsidiary parts and equipment. Contractor shall provide all parts, elements, transition pieces, etc. as required for a complete and operational system.
 2. The work is to be installed complete and ready for operation in conformity with the intent expressed on the Drawings and in the Specifications.
 3. Coordinate work with the requirements of the Architectural and Structural drawings for dimensions, locations and clearances.
 4. Locations of mechanical and electrical items which are exposed to view shall be taken from the Architectural Drawings where available, or are to be located as directed by the Architect.
 5. Contractor shall provide all transition pieces and rises/drops for piping and ductwork.
 6. Minimum height of piping, ductwork, valves, etc. in mechanical rooms excluding drops to equipment, shall be 7'-0" unless otherwise noted.

2.07 EQUIPMENT INSTALLATION

- A. Locate and set equipment anchor bolts, dowels and aligning devices for equipment requiring them.
1. Level and shim the equipment; coordinate and oversee the grouting work.
 2. After one week of continuous operation, the technician will return to check and realign all shafts, bearings, seals, couplings and belt drives as needed. Provide report indicating completion of this work.
- B. Field assembly, installation and alignment of equipment is to be done under field supervision provided by the manufacturer or with inspection, adjustments and approval by the manufacturer, as a part of the Contract.
- C. Alignment and Lubrication Certification for Motor Driven Apparatus:
1. After permanent installation has been made and connections have been completed, but before the equipment is continuously operated, a qualified

representative of the manufacturer is to inspect the installation and shall report in writing on the manufacturer's letterhead as follows:

- a. That shafts, bearings, seals, couplings, and belt drives are perfectly aligned and doweled so the equipment will remain perfectly aligned in the normal service intended by the Documents and that no strain or distortion will occur in normal service. All dowels shall be aligned after equipment is running.
- b. That all parts of the apparatus are properly lubricated for operation.
- c. That the installation is in accordance with manufacturer's instructions.
- d. That suitable maintenance and operating instructions have been provided for the Owner's use.

D. Belt Drives:

1. V-belt drives shall include a driving and driven sheave grooved for belts of trapezoidal cross-section. Belts shall be constructed of fabric and rubber so designed as not to touch the bottom of the grooves, the power being transmitted by the contact between the belts and V-shape groove sides. Drives shall be designed for a minimum of 150 percent of motor horsepower. Drive sheaves shall be of the companion type.
2. All motors shall be provided with fixed sheaves, once the correct speed is determined during testing/balancing period.
3. All fans shall be installed with fixed pitch sheaves on their drive motors. Sheaves shall be selected to provide air quantities under specified conditions. Air systems shall be put into operation, and Contractor shall determine actual size of sheaves required to produce specified air quantities on installed systems via the use of adjustable sheaves. Adjustable pitch sheaves shall then be replaced with the proper size fixed sheave. Adjustable pitch sheaves shall be property of Contractor and removed from premises.

E. Machinery Guards:

1. Motor drives shall be protected by belt guards furnished by the equipment manufacturer or in accordance with the Sheet Metal and Air Conditioning Contractors National Association's Duct Manual. In all cases, guards of all types must be as approved as acceptable under OSHA Standards.

F. Equipment Startup:

1. Each equipment manufacturer is to provide qualified personnel to inspect and approve equipment and installation and to supervise the startup of the equipment and to supervise the operating tests of the equipment.
2. If a minimum number of hours for startup and instruction are not stated with the equipment specifications, these shall be 2 full 8-hour working days as a minimum.
3. Advise Owner of startup at least 72 hours in advance.

G. Equipment Turn-Over:

1. Contractor shall follow Owner's Standards for Turn-Over Acceptance, Commissioning and Testing. Where there is a conflict between these requirements and the regulations by commissioning agent, the more stringent requirements shall apply.

2.08 CLEANING AND ADJUSTING

A. Notification:

1. Inform owner and architect's field representatives of all cleaning, blowing out and fill-up schedules one week prior to starting.
2. Notify owner and architect again, 48-hours prior to each event. If neither attends the procedures, notify in writing, the specific task performed 24-hours after each event.
3. Leaks appearing during the various pressure tests shall be corrected by replacing all defective materials or welds and subsequent tests shall not be made until the piping is found in perfect condition. Caulking of screwed joints or peening of welds is prohibited. Wherever it is necessary to cut out a weld and the ends of the pipe cannot be conveniently brought together, then a short piece shall be fitted in and welded.
4. Damage to the building and equipment resulting from tests shall be repaired at no additional cost to the Owner.
5. Tests claimed to have been performed without following above procedures shall be deemed as not performed.

B. Cleaning:

1. Blow out, clean and flush each piping system and equipment, to clean thoroughly. MSDS forms for clean agent and procedure shall be presented to the field office. After cleaning, the systems shall be tested by an independent organization, approved by Owner's representative prior to testing.
2. Clean all materials and equipment; leave in condition ready to operate and ready to receive succeeding finishes where required.
3. Clean the operating equipment and systems to be dust free inside and out. Keep and maintain mechanical spaces and premises clean of dust, dirt and debris every day.
4. Clean concealed and unoccupied areas such as plenums, pipe and duct spaces and equipment rooms to be free of rubbish and dust.
5. After completion of all pressure tests, properly clean every piece of apparatus furnished and remove caps and other provisions made for testing purposes only.

6. Cutting oil, excess pipe joint compound, finely divided solids and other similar foreign material shall be removed from all circulating water systems before they go into operation. Before chemical cleaning of water systems flush with clean water. Each system shall be cleaned chemically with circulating solution as specified in section 232500. Fill, vent and circulate the system with this solution at maximum operating temperature for required duration. During cleaning procedure, circulation shall be stopped periodically followed by blow off at all low points. Immediately following chemical cleaning, system to be drained and then refilled with clean water to which treatment shall then be added. After systems have been drained, flushed and refilled, a chemical test shall be made to determine that the cleaning solution remaining in the system does not impart alkalinity to the water in excess of 300 ppm.
7. After the water piping system has been properly cleaned as indicated above, each water system shall be operated for a minimum of 3 days with 1/2" surgical felt, bonded to baskets on each pump strainer. Felt filters shall be run for as long a time as necessary to thoroughly clean all piping until approved by Owner's representative. During the cleaning period, heat exchangers and coil valves shall be kept closed for the entire cleaning period. Provide one (1) inch manual bypass at equipment to permit flushing of branch piping. For flushing and blow-off for main risers, provide drain valves at the bottom in the horizontal runout to the riser. Also provide an additional valve in the cyclo-clean separator piping for pumps with mechanical seals so that separator discharge water may be wasted during the cleaning procedure.
8. All pipe strainers shall be removed and cleaned upon completion of blow-down period.
9. After this period of operation, all systems shall be drained and refilled with fresh water and new chemicals as specified.
10. All equipment installed shall be thoroughly cleaned in preparation of the finished painting.
11. All dowels shall be aligned after system is running.

C. Adjusting:

1. Adjust and align equipment interconnected with couplings or belts. After one week of continuous operation, the technician will return to check and realign all shafts, bearings, seals, couplings and belt drives as needed. Provide report indicating completion of this work.
2. Adjust valves of all types and calibrate equipment of all types to provide proper operation.
3. Clean all strainers after system cleaning and flushing and again before final system startup.
4. Motors, fans, pumps, compressors, etc. shall be properly oiled and left ready for operation.

5. Verify that each and every supply and return and exhaust fan, each fan coil unit fan, motor and automatic control valve is in running condition. All equipment shall be cleaned, including coils, motors, housing, pans, etc. and inspected by the Owner's representative.
6. Submission of certified tests shall, in no way, relieve the Contractor of fulfillment of guarantee.
7. Gauges, instruments, thermometers and meters shall be checked and tested to specified accuracy.
8. Alarms shall be tested to fulfill satisfactory operating conditions.
9. Allow sufficient time to perform all tests, adjustments, etc., necessary to place the various systems in final operating condition, verify performance requirements and check all safety devices. Labor, instruments, etc., required for various tests shall be furnished by Contractor. The Contractor shall see that all his Sub-Contractors, manufacturer's representatives or Field Engineers necessary to check and adjust various systems are present, with sufficient forms, and that all test results are recorded properly and turned over to Owner for approval.
10. The Owner's representative will make final check for all systems only after Contractor has completed and returned to the Owner all recorded test data together with letter that his work is 100% complete. Additional tests may be required to meet the requirements of Owner's documents for demonstration of various systems, whether or not specified, to verify performance, workmanship or for adjustments.
11. Unless otherwise specified, equipment shall be installed and adjusted in accordance with manufacturer's recommendations to function properly with capacities required or specified.
12. Provide adjustments during summer, winter and shoulder/swing seasons.

D. Running Test of Piping Systems:

1. Any section of the work, after it has been completed and otherwise satisfactorily tested, shall be put in actual operation by Contractor and operated by him for a period of 2 days of 24 hours each, during which time any defects which may appear shall be remedied and any necessary adjustments shall be made. Test shall be performed in the presence of the Owner or his authorized representative, and serve as part of the Instructions Program.
2. During the time of the tests, repack all valves, make all adjustments and otherwise put the apparatus in perfect condition for operation, and shall instruct the Owner's authorized personnel in the use of management of the apparatus. All joints shall be made absolutely tight under tests. Caulking of pipe joints or makeshift methods of repairing leaks shall not be allowed. Piping which is not tight under tests shall be taken down and reassembled. Contractor is responsible to provide all valves, flanges, temporary work, accessories, material, labor, fill, drain, retest system and piping to perform tests.

3. All gauges, thermometers, alarms, instruments, etc. shall be tested to demonstrate that they are functioning properly and within the range of these devices, and to show their degree of accuracy.
 4. If during the first test run, the system cannot be completely vented within 24 hours, install additional air vents at high points of system to facilitate quick venting of all water systems.
- E. Permanent Equipment Operating During Construction:
1. Use only in same service as the permanent applications, provided that written approval is granted by Owner's representative.
 2. Use disposable filters during temporary operation.
 3. Expendable media, including belts used for temporary operation and similar materials are to be replaced just prior to acceptance.
 4. Packings in equipment operated during construction must be repacked just prior to system acceptance, using materials and methods specified by the supplying manufacturer.
- F. Retouch or repaint equipment furnished with factory finish as required to provide same appearance as new.
- G. Tools:
1. Provide one set of specialized or non-standard maintenance tools and devices required for servicing the installed equipment.
- H. Fan and Pump Characteristic Charts:
1. Fan Characteristic Charts: Furnish 4 characteristics curve charts for each fan, including those embodied in factory assembled units. Characteristic curve charts shall not be less than 8-1/2" x 11" and shall show the static pressure, capacity, horsepower and overall efficiency for operating conditions from no load to 130% specified load.
 2. Pump Characteristic Charts: Furnish 4 characteristic charts for each pump. Charts shall be not less than 8-1/2" x 11" showing head developed, efficiency and power required for varying capacities at the operating speed of the equipment.

PART 3 – EXECUTION

3.01 GENERAL

- A. Temporary Protection:
1. Provide and maintain protection for the work whether completed or in progress.

2. Provide suitable coverings and enclosures.
- B. Scaffolding, Rigging and Hoisting:
1. Provide all scaffolding, rigging and hoisting services necessary for erection, and/or delivery into the premises, of any equipment and apparatus furnished. Remove from the premises when no longer required.
- C. Waterproofing:
1. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect before work is done. This Contractor shall provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

3.02 EQUIPMENT BASES, PLATFORMS AND SUPPORTS

- A. Provide supporting platforms, steel supports, anchor bolts, inserts, etc., for all equipment and apparatus requiring access for service and maintenance.
- B. Obtain prior approval for installation method of structural steel required to frame into building structural members for the proper support of equipment, conduit, etc. Welding will be permitted only when approved by the Architect or the Structural Engineer.
- C. Submit shop drawings of supports for approval to the Architect before fabricating or constructing.
- D. Provide leveling channels, anchor bolts, complete with nuts and washers, for all apparatus and equipment secured to concrete pads and further supply exact information and dimensions for the location of these leveling channels, anchor bolts, inserts, concrete bases and pads.
- E. Where supports are on concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing.

3.03 ACCESSIBILITY

- A. The installation of valves, dampers and other items shall be conveniently and accessibly located with reference to the finished building floors, walls, roof and penthouses as applicable.
- B. In-line pumps shall not be installed higher than 7 ft. above floor and shall be fully accessible for servicing its motor, valves, controls and instruments.
- C. Equipment removal, tube-pull access door swing spaces shall be identified on shop drawings and maintained during installation.

3.04 PROTECTION

- A. Contractor shall protect the work and material of all trades from damage by his work or workmen, and shall replace all damaged material with new material. The plan shall outline corrective action to repair and/or replace the object(s) including all materials to be utilized. Implementation of corrective plan shall be subject to final approval from the Architect.

The Building systems are to remain active during the project as the construction will be phased. Refer to Scope of Work document prepared by the Construction Manager.

Contractor shall be responsible for protecting and maintaining the systems for the duration of the project. Contractor shall note that the building shall remain in operation throughout the duration of construction.

- B. Contractor shall be responsible for work and equipment until his work is finally inspected, tested and accepted; he shall protect his work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.
- C. Contractor shall be responsible for the preservation of all public and private property, along and adjacent to the work, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and shall carefully protect from disturbance or damage all property marks until an authorized agent has witnessed or otherwise referenced their location, and shall not remove them until directed.
- D. Where pipe, ductwork, insulation or equipment to remain is inadvertently damaged or disturbed, cut out and remove damaged section and provide new pipe, ductwork, insulation or equipment of equal capacity and quality.
- E. Where conduit and wiring to remain are inadvertently damaged or disturbed, cut out and remove damaged portion and all damaged wiring from the source switchboard, panelboard or pullbox to the destination connection point. Provide new wiring of equal capacity.
- F. Vibration: Contractor shall reduce the construction dust not to adversely affect operation of the building. Contractor shall keep vibration to a minimum and not have adverse effect to the operation of the building.
- G. Dust Control: Provide adequate filters and dust collectors as required for building operation. Provide duct end caps for all open-ended ducts.

3.05 DEMOLITION WORK RELATED TO EXISTING WORK

- A. Contractor shall disconnect and remove all abandoned, unused or discarded equipment (piping, conduits, wires, ductwork, tubing, supports, etc.) from the areas of work as indicated on Drawings.

- B. Contractor shall mark out all items to be removed and all items to remain in the field and review with the Construction Manager and Owner prior to demolition.
- C. Provide firestopping at all conduit/pipe penetrations at rated construction, where ducts, piping/conduit, etc. have been removed.
- D. Whenever existing equipment is disconnected from its services, remove all pipe, conduit or duct branches or runnouts to the point of connection to the existing pipe riser or electrical panel or duct shaft as the case may be. Cap off pipes or ducts near the risers, valved outlets or at mains. Remove all ductwork as indicated on plans and provide sheet metal cap (minimum 24 gage) at all connections to existing ductwork that is to remain. Provide temporary ducts with dampers and valved pipes as required to keep system in operation and occupancy of building.
- E. Remove all piping as indicated on plans and provide capped outlets at the point of connection to the existing risers or as indicated on plans. For steel piping to be removed, provide Steel Schedule 40 welded cap. For brass and copper piping, provide 95/5 (tin-antimony) soldered copper Type 'L' Cap. All waste and vent lines shall be capped with a no hub coupling.
- F. All welding and soldering shall conform to the following:
 - 1. General:
 - a. All welding procedures, welders, and welding operators shall be qualified in accordance with the requirements of ASME/ANSI B31.9 and Section IX of the ASME Code, latest editions.
 - b. Welding procedures shall be reported on ASME Section IX Forms "QW," or its equivalent. Joint preparation sketches (to be included with the welding procedures) shall show all dimensions including tolerances, for bevel angle, land size, offset and root gap.
 - c. Contractor shall be responsible for the welding performed by personnel of his organization and shall conduct the required qualification tests and submit results to the Owner for his review and approval.
 - 2. Processes:
 - a. Employ the Manual Shielded Metal-Arc (SMAW) welding process.
 - b. Use backing rings for welds above 6" diameter pipe.
 - c. Double butt welding shall be permitted on all joints accessible from both sides. Where double butt-welding is employed, the first root pass shall be back-chipped.
 - d. Welding of pressure parts shall be performed with low hydrogen type electrodes. Electrodes of Classifications E6012, E6013, E7014 and E7024 shall not be used.

- e. Provide ventilation and exhaust.
3. Brazing and Soldering:
- a. The Contractor shall prepare applicable "Brazing and Soldering Procedures" forms for approval of the Owner.
 - b. Brazing shall conform to ASME Section IX.
 - c. Soldering shall conform to the relevant procedures in the manuals of the Copper Development Association.
 - d. The Owner may reject any brazed or soldered joint for lack of penetration or for other applicable grounds. These defective joints shall be redone until satisfactory.
4. Quality of Workmanship - In addition to conformance with the procedural and quality requirements set forth in the applicable Code or material specification, all welding shall meet the following requirements.
- a. Butt welds shall have full penetrations and shall be slightly convex with uniform height.
 - b. Each weld shall be uniform in width and size throughout its full length.
 - c. Each layer of welding shall be smooth, free of slag, cracks, pinholes, undercut in excess of 1/32" and completely fused to adjacent weld beads and base metal.
 - d. Cover passes shall be free of coarse ripples, irregular surface, non-uniform bead patterns, high crown, and deep ridges or valleys between heads. The surface smoothness of the finished weld shall be suitable for the proper interpretation of non-destructive examination of the weld.
 - e. Surfaces of parts to be joined by welding shall be cleaned of all oil, grease, paint, scale and rust with solvent and/or wire brushing.
 - f. Fillet weld size shall be in accordance with the applicable code or as specified on the drawings with full throat and legs of equal length.
 - g. Welding filler metal and welding flux shall be properly stored in such a manner as to insure that no damage to the coating or corrosion of weld rod will occur. Low hydrogen type electrodes shall be stored in enclosures which provide a regulated temperature as prescribed by the electrode manufacturer. All electrodes shall be properly identified.

- h. Socket welds shall have a gap of approximately 1/16" between the bottom of the socket and the end of the pipe prior to welding. Socket welds shall have a minimum of two weld layers.
- 5. Repair and Weld Defects:
 - a. A weld is defective and shall be repaired if it does not meet the acceptance standard of each applicable non-destructive examination as defined ASME/ANSI B31.9, latest edition.
 - b. Repairs shall be made in accordance with ASME/ANSI B31.9, latest edition.
- G. Cutting shall be done carefully in order not to disturb systems or services in areas where demolition is not required.
- H. Fully charged fire extinguisher and/or active hoses are to be on sight for fire watch during all burning conditions that require Oxygen/Accel gas for cutting or welding, soldering and the creation of dust, that may activate the fire alarm system, requires that the system be put on bypass for the affected zones. Coordinate shutdown with Owner.
- I. Equipment specified or indicated to be demolished shall be removed from the project site. All ballasts shall be tested for PCBs and mercury before removal. Test results shall be submitted to the Owner, and ballasts shall be disposed of properly.
- J. Provide additional support for all existing conditions, cabling and devices to remain which are affected by demolition of existing ceilings and partitions.
- K. Protect existing systems, pipes, conduits and communications wiring to remain with flame retardant plywood.
- L. Drawings are general in nature and do not indicate full extent of removal required, including all hangers, supports, ancillary devices, etc.

3.06 MODIFICATIONS TO EXISTING WORK

- A. Contractor shall perform all work as shown or as specified, within the existing site and structures as part of this Contract without detriment to the existing systems or equipment to be kept in operation or maintained in their places.
- B. For full extent of modifications to be done to existing systems, Contractor shall inspect existing systems and site conditions to familiarize himself with the complexity of his work related to removals and relocations required, and the existing finishes to be preserved without any damage resulting from possible careless installation procedures. Upon written request by the bidders, Owner shall make the existing schematic plans available for inspection (at his own address) without any responsibility for their completeness or accuracy.

- C. As-Built drawings are not available on the existing installations. Any drawings that may be available to the Contractor are for information only. All field criteria must be field verified by Contractor.
- D. Contractor shall provide all temporary work, valved pipe connections, ductwork, remove, relocate existing work and reconnect with new material, supports, accessories to keep existing system, building in operation and for installation of new work as part of the project cost.
- E. All cutting shall be done only by mechanics skilled in the particular trade which is affected. No cutting shall be done without proper protections against damage, dirt and dust resulting therefrom or without proper safeguards to workmen, the public, and occupants of buildings.
- F. Before cutting is started in any location, Contractor shall carefully investigate conditions influencing human and structural safety. Existing piping, wiring and items concealed in walls and slabs, wherever these walls and slabs are removed, shall be properly relocated, rerouted or removed as the case may require.
- G. General Construction trades shall perform all finish masonry, repairing, restoring and finishing of all cut openings, closing up of existing openings, and removing and restoring the affected sections of the suspended ceilings.
- H. If, during partial occupancy of the building, circumstances necessitate temporary shutdown of any facilities or otherwise interfere with access to building, owner shall be given a minimum of 48 hours notice before doing such work.
- I. In all areas where interface, relocation or alternation work is to be done, Contractor shall disconnect and remove from the premises all existing ductwork, piping, etc., that will not be required to remain in service after the alterations are completed. All such equipment (except as requested as salvage by the Owner) shall become the property of this Contractor, and he shall remove same from the premises immediately upon disconnection. Existing ductwork, piping, etc., being removed shall not be reused.
- J. Contractor shall move or relocate any existing mechanical equipment, piping, ductwork, etc., which may temporarily interfere with the construction, (to a temporary location) if the existing equipment is to be kept in operation during construction. He shall also install temporary piping, ductwork or equipment that might be required (during demolition or excavation and during the construction of tunnels, retaining walls, footings or columns) for offsetting all piping around the construction area in order to maintain services to the existing systems. Provide temporary piers, supports and hangers as required for excavation.
- K. Provide all cuts and openings through structural slabs and walls. Contractor shall coordinate his work with concrete contractor and provide necessary dimensions for all openings.
- L. Upon completion, remove all temporary piping and equipment, shoring, scaffolds, etc., and leave all areas clean and free from material and debris resulting from work performed under this Section. Provide rough patching in areas shown.
- M. Test all piping to be retained or shown to be re-used together with the new extensions connected to them. Install isolation valves as required.

- N. Where a fan or any of its connected ductwork is to be modified, relocated or ductwork extended to a new discharge location, test fan prior to starting work and submit test data to Architect for record purposes. Test same fan following completion of work to verify its final capacity in terms of CFM, Static Pressure and Amperes drawn while in operation, showing compliance to data previously established.

3.07 USE OF EQUIPMENT

- A. The use of any equipment, or any part thereof, for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor shall it be construed to obligate the Owner in any way to accept improper work or defective materials.
- B. Use of permanent equipment for temporary services must be approved in writing by Owner.

3.08 CODES, RULES, PERMITS & FEES

- A. The Contractor shall give all necessary notices, obtain all permits and filings including, but not limited to, New Jersey DEP, New Jersey DCA, IBC-NJ Code requirements, and pay all government sales taxes, fees, and other costs, in connection with his work. However, all utility connections, extensions, and tap fees for water, storm, sewer, gas, telephone, and electricity shall be paid directly to utility companies and/or agencies by the Owner, unless otherwise indicated. The Contractor shall file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Owner's Representative before request for acceptance and final payment for the work.
- B. The complete design and construction shall conform to the requirements of the IBC-NJ, NFPA, NEC, FM, UL and any other local or state code which may govern.
- C. Provide all New Jersey State permits for boilers, stacks, chillers, fuel oil equipment, fuel oil tanks, equipment, systems, etc. as required.

3.09 FINAL INSPECTION

- A. Contractor shall arrange and schedule final inspection of work and shall notify the Architect in writing that the Contractor has thoroughly checked his work and, in the opinion of the Contractor, is ready for final inspection.
- B. During the entire period schedule for these inspections, the Contractor and representatives of each manufacturer of equipment involved shall be present. All of these organizations shall have sufficient and competent personnel present so that adjustments can be made to all systems without delay.
- C. Contractor shall recheck equipment after seasonal use to ensure proper operation for summer, winter and shoulder/swing seasons.

3.10 ACCEPTANCE

- A. The operation or the temporary use of the equipment and the mechanical and electrical installation, by the Owner does not constitute an acceptance of the work. The final acceptance is to be made after the Contractor has adjusted his equipment, demonstrated that it fulfills the requirements of the Contract Documents, and has furnished all the required Certificates. Warranties and guaranties are effective after the final acceptance.

END OF SECTION