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## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. All of the Project "General Documents" apply to work specified in this Section; consult them in detail for applicable instructions. **Particular attention is called to Paragraph G5-K.8, therein.**
- B. Manufacturers referenced in the technical specifications are for the purpose of establishing a standard of quality. Alternate manufacturers providing the same quality materials or equipment will be given consideration by the Architect and/or Engineer if they are notified in writing per General Conditions Par. G5-K.6.
- C. This Section applies equally and specifically to all Contractors and Subcontractors supplying labor and/or equipment and/or materials as required under the Heating, Ventilating and Air Conditioning, Plumbing, Sprinkler and Electrical Sections of the Specifications.

## 1.02 DEFINITIONS

- A. "The Contractor" or "Each Contractor" means specifically, the Contractor or Subcontractor working under his respective Section (Heating, Ventilating and Air Conditioning, Plumbing, Sprinkler or Electrical) of this Specification.
- B. "Piping" includes, in addition to pipe, all fittings, valves, hangers and other accessories related to such piping.
- C. "Concealed" means hidden from sight as in chases, furred spaces, shafts, hung ceilings, or embedded in construction.
- D. "Exposed" means "not concealed" as defined above. Work in trenches, crawl spaces and tunnels shall be considered "exposed" unless otherwise specifically noted.
- E. "HVAC" means Heating, Ventilating and Air Conditioning.
- F. "Plumbing Contractor" means the Contractor doing Plumbing Work.
- G. "Sprinkler Contractor" means the Contractor doing all the Fire Protection including Sprinkler Work.

## 1.03 CODES AND STANDARDS

- A. New Jersey Uniform Construction Code.
- B. International Building Code 2015.
- C. National Electric Code 2015.
- D. International Mechanical Code 2015.

- E. International Fuel Gas Code 2015.
- F. ASME American Society of Mechanical Engineers.
- G. ANSI American National Standards Institute.
- H. ASTM American Society for Testing Materials.
- I. NEMA National Electrical Manufacturers Association.
- J. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers.
- K. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.
- L. ARI Air Conditioning and Refrigeration Institute.
- M. UL Underwriters' Laboratories.
- N. AMCA Air Moving and Conditioning Association.
- O. AABC Associated Air Balance Council.
- P. Local Water Company Rules and Regulations.
- Q. NFPA 13.
- R. National Standard Plumbing Code 2015.

1.04 INTENT

- A. It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation. All materials, equipment and apparatus shall be new and of first class quality.
- B. Any apparatus, appliance, material, or work not shown on Drawings, but mentioned in the Specifications, or vice versa, or any incidental accessories, or minor detail not shown but necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be provided without additional expense to the Owner.

1.05 DRAWINGS

- A. The Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangement of equipment; ducts, conduits, piping and fixtures.
- B. The locations of all items shown on the Drawings or called for in the Specifications that are not definitely fixed by dimensions are approximate only. The exact locations necessary to secure the best conditions and results must be determined at the project and shall have the approval of the Architect before being installed. Do not scale Drawings.

- C. Follow Drawings in laying out work and check Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom and space conditions appear inadequate, Architect shall be notified before proceeding with installation.
- D. If directed by the Architect, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.
- E. Piping or ductwork connected to the equipment may require different size connections than indicated on the Drawings. The Contractor shall provide transition pieces as required at the equipment.

#### 1.06 COORDINATION AND FIELD MEASUREMENTS

- A. Avoid space conflict with other trades.
- B. Submit the equipment and material required in accordance with field measurements taken at the proper time during the construction progress.

#### 1.07 EQUIPMENT AND MATERIALS

- A. All equipment and materials required for installation under these Specifications shall be new and without blemish or defect. All electrical equipment shall bear labels attesting to Underwriters' Laboratories approval. Where no specific indication as to the type of quality of the material or equipment is indicated, a first class standard article shall be furnished.
- B. All equipment of one type (such as fan, coils, etc.) shall be the product of the same manufacturer.

#### 1.08 SHOP DRAWINGS

- A. As and when required by the general conditions, submit electronically PDF shop drawings of all equipment, materials, piping, sleeves, conduit, ductwork and wiring diagrams and further obtain written comments "No Exception" or "Exception as Noted" for same from the Architect, before installing any of these items.
- B. For piping, sheet metal, sleeve layout and reflected ceiling plan shop drawings, utilize CAD drawings. After the PDF is noted and corrected by the Engineer, it will be returned. Then the required resubmittal shall be prepared.
- C. Shop drawings shall consist of manufacturer's certified scale drawings, cuts, or catalogs, including descriptive literature and complete certified characteristics of equipment, showing dimensions, capacity, code requirements, motor and drive testing, as indicated on the Drawings or Specifications.
- D. Certified performance curves for all pumping and fan equipment shall be submitted for

review.

- E. Samples of materials or equipment, when requested by the Architect, shall be submitted for review.
- F. Samples, drawings, specifications, catalogs, etc., submitted for review, shall be properly labeled indicating project name, specific service for which material or equipment is to be used, Section and Article number of Specifications.
- G. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested, shall be specific and identification in catalog, pamphlet, etc., of item submitted shall be clearly made in ink. Data of a general nature will not be accepted.
- H. The following is the meaning of the comments indicated on the Engineer's shop drawing review stamp. The review of a shop drawing shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, said review does not in any way relieve responsibility, or necessity, of furnishing material or performing work as required by the Contract Drawings and Specifications.
  - 1. "Reviewed" means that the shop drawing is correct as to performance, capacity, etc. and in substantial conformance with the contract documents.
  - 2. "Rejected" means that the shop drawing does not comply or conform to the contract documents. Fabrication or purchase may not commence.
  - 3. "Revise and Resubmit" means that the comments and/or correction are so extensive and important that the reviewer wants to see how the comments and/or corrections are resolved prior to release for fabrication and/or purchase. Fabrication and/or purchase may not commence.
  - 4. "Furnish as Corrected" means that comments and/or corrections are minimal and do not drastically impact on the performance, capacity, layout, etc. Fabrication and/or purchase may commence as long as all comments are addressed to the Engineer's satisfaction.
  - 5. Note that the comments "Reviewed" or "Furnish as Corrected" marked on the shop drawings or other information submitted in accordance with the requirements hereinbefore specified does not assure that the Engineer, Architect, or any other Owner's representative attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the mechanical performance of equipment. Comments on the shop drawings does not invalidate the Plans and Specifications if the shop drawings are in conflict with the Plans and Specifications.
- I. Failure to submit shop drawings in ample time for checking shall not entitle an extension of Contract time and no claim for extension by reason of such default will be allowed.
- J. Prior to submission of shop drawings, thoroughly check each shop drawing, reject those not conforming to the Specifications and indicate (by signature) that the shop drawings submitted meet Contract Requirements.

- K. All shop drawings showing routing of ductwork, piping and conduit, shall not be less than 1/4" = 1'-0" scale.
- L. Incorporate this numbering system to help keep track of shop drawing submittals:
  - M..... HVAC Shop Drawings
  - E.....Electrical Shop Drawings
  - P.....Plumbing Shop Drawings
  - SP.....Sprinkler Shop Drawings
- M. Concurrent numbers shall follow the prefix letter. Example: H-1, H-2, etc. In addition, shop drawings requiring resubmission should bear the number of the original submission and bear a suffix as follows: H-1A (second submission), H-1B (third submission), etc.
- N. Label resubmitted shop drawings with a stamp indicating the submittal number, for example: SECOND SUBMISSION; THIRD SUBMISSION, etc., and send separate transmittals for each item being submitted so that one transmittal does not cover more than one specific item or group of items from one manufacturer.
- O. Before request for acceptance and final payment for the work, write a letter to the Architect stating that all shop drawings have been brought to a condition "No Exception" or "No Exception as Noted." Any outstanding shop drawings must be brought to that condition before the project can be accepted.

#### 1.09 RECORD DRAWINGS

- A. Furnish record drawings as described in the General Conditions.
- B. During construction, keep an accurate record of all deviations between the work as shown on the Drawings and that which is actually installed.
- C. Secure from the Architect, a complete set of CAD drawings of the Drawings and note thereon all changes. Make a complete record of all changes and revisions in the original design which exist in the completed work.
- D. Furnishing above transparencies and preparing these Record Drawings shall be at no additional cost to the Owner. When all revisions showing the work as finally installed are made, the corrected Mylar transparencies shall be submitted for review by the Architect.
- E. After review of the "Record Drawings" transparencies by the Architect, provide the Owner with one set of blackline prints and Mylar transparencies, at no additional cost to the Owner.

#### 1.10 LAWS, ORDINANCES, PERMITS AND FEES

- A. Give all necessary notices, obtain all permits and pay governmental taxes, fees and other costs in connection with the work; file all necessary plans, prepare all documents and

obtain all necessary approvals of all governmental departments having jurisdiction for all combustion and refrigeration equipment such as boilers, furnaces, oil burners, refrigeration condensing units, chillers and air handling units. Obtain all required Certificates of Inspection for the work and deliver to the Architect before request for acceptance and final payment for the work.

- B. Include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings, (in addition to Contract Drawings and Documents) in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on Drawings and/or specified.
- C. All Materials furnished and all work installed shall comply with the rules and recommendations of the National Fire Protection Association, with all requirements of local utility companies, with the recommendations of the fire insurance rating organization having jurisdiction and with the requirements of all governmental agencies having jurisdiction.
- D. All equipment manufacturers are cautioned to provide internal factory restraints where necessary to comply with the seismic requirements of the New Jersey Uniform Construction Code.

#### 1.11 INDEMNIFICATION

- A. Pay all royalties and defend all suits or claims for infringement of any patent rights and save the Owner harmless from loss on account thereof.
- B. If process or article specified is an infringement of a patent, promptly notify the Architect in writing and any necessary changes shall be as provided in the Contract for changes in the work to avoid infringement. If the Contractor performs any work specified, knowing it to be an infringement of patent, he shall bear all costs arising there from.
- C. Take out all necessary insurance, free of extra charge and agree to indemnify and save harmless the Owner, Architect and Consulting Engineers against loss or expense, by reason of the liability imposed by law upon such party for damages because of bodily injuries, including death at any time resulting there from, accidentally sustained by any person or persons or on account of damage to property arising out of or in consequence of the performance of this Contract, whether such injuries to persons or damage to property are due or claimed to be due to any negligence in the performance of the Contract by the Owner, Architect or Consulting Engineers, or their employees or agents.

#### 1.12 ORGANIZATION OF WORK

- A. Coordinate and perform the work called for under this Contract simultaneously with the work of other trades such as not to delay the overall progress of the work. Furnish promptly to other trades involved at the project, all information and measurements relating to the work which they may require. Cooperate with them in order to secure the harmony necessary in the interest of the project as a whole.
- B. Furnish and install all work so as to meet all construction schedules.



- C. Keep a competent superintendent in charge of the work at all times. Such superintendent shall be replaced if unsatisfactory to the Owner.
- D. Maintain a complete file of shop drawings at all times available to the Owner's representative.
- E. Where items of equipment and/or materials are indicated in the Specifications as being furnished by other trades for installation, assume responsibility for the unloading of such equipment and/or materials from the delivery trucks and for providing safe storage for same as required pending installation.
- F. Where the work is to be installed in close proximity to work of other trades, or where there is evidence that the work will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. If installations are made before coordination with other trades, make all necessary changes in the work without extra charge to the Owner.
- G. Before submitting shop drawings for sleeves, piping and ductwork, the Heating, Ventilating and Air Conditioning Subcontractor shall prepare combined 1/4" = 1' - 0" scale shop drawings for piping and ductwork indicating location of piping and ductwork with dimensions for each floor and Mechanical Rooms. A CAD file of these shop drawings shall be given to the Electrical Contractor.
- H. The Electrical Contractor shall indicate the location of all lighting fixtures, conduit runs on these shop drawings. The Electrical Contractor shall then forward this shop drawing file to the Plumbing Contractor. The Plumbing Contractor shall indicate his work and forward to the Sprinkler Contractor, who shall indicate his work.
- I. The Heating, Ventilating and Air Conditioning Contractor shall arrange a Coordination Meeting with the other Contractors under the supervision of the General Contractor. After coordination, each Contractor shall sign the CAD file. The Heating, Ventilating and Air Conditioning Contractor shall submit these drawings to the Architect for review and he shall call any conflicts that could not be resolved in the coordination meetings and/or deviation from original design, to the Architect's attention. After receiving written review from the Architect, each Contractor shall prepare/revise their required shop drawings.

#### 1.13 TEMPORARY OPENINGS

- A. Ascertain, from examination of the Architectural Drawings, whether any special temporary openings in the building will be required for the admission of apparatus provided under the Contract and notify the Architect accordingly. In the event of failure to give sufficient notice to the Architect in time to arrange for these openings during construction, assume all costs of providing such openings thereafter.

#### 1.14 PIPE EXPANSION

- A. All pipe connections shall be installed to allow for freedom of movement of the piping during the expansion and contraction without springing. Swing joints, ball joints, expansion loops and expansion joints with proper anchors and guides shall be provided

where necessary and/or when shown on the Drawings. Anchors and guides shall be subject to the review of the Architect.

1.15 SCAFFOLDING, RIGGING, HOISTING

- A. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of all equipment and materials furnished under this Section of the Specifications and remove same from premises when no longer required.
- B. In the event that supplementary bracing of the basic building structure is required to assure a secure rigging procedure and a secure route for the equipment being handled, assume full responsibility for such supplementary bracing, including its engineering in accordance with applicable codes.

1.16 BASES AND SUPPORTS

- A. The standards for Concrete bases are specified under "Cast-In-Place Concrete". Each Contractor shall furnish dimensioned drawings of the concrete bases they are providing, to the Architect for approval. Steel dowels, sleeves and anchor bolts shall be furnished and set by the Contractor.

1.17 SLEEVES, PIPE AND CONDUIT INSERTS AND ANCHOR BOLTS

- A. Provide and assume responsibility for the location and maintenance in proper position of all sleeves, inserts and anchor bolts required for the work. In the event that failure to do so requires cutting and patching of finished work, it shall be done without additional cost to the Owner.
- B. All pipes and conduits passing through masonry walls or partitions shall be provided with sleeves having an internal diameter larger than the outside diameter of the pipe or insulation enclosing the pipe or conduit. Sleeves shall be Schedule 40 black steel pipe.
- C. Sleeves through foundation walls shall be James B. Clow & Sons No. F-1430 or F-1435 cast iron wall sleeve with intermediate integral flange. Sleeves shall be set with ends flush with each face of wall. The space between sleeve and pipe shall be packed with oakum to within 2" of each face of the wall. The remaining space shall be packed and made watertight with a waterproof compound.
- D. Sleeves through concrete floors or interior masonry walls shall be Schedule 40 black steel pipe, set flush with finished wall surfaces, but extending 1/2" above finished floors. The open sleeve space shall be packed with non- combustible materials.
- E. Sleeves through non-masonry partitions shall be 22 gauge galvanized sheet steel, set flush with finished surfaces of partitions.
- F. Inserts shall be individual type of malleable iron construction with accommodation for removable nuts and threaded rods up to 3/4" diameter, permitting lateral adjustment, except as otherwise noted. Individual inserts shall be Grinnell Fig. 279 up to 5" pipe and conduit, Fig. 282.6" and up to 8" pipe and conduit, Fig. 152 above 8" and up to 12" pipe and conduit. For Figures 282 and 152, they shall come with an opening at the tip to allow

reinforcing rods up to 1/2" diameter to be passed through the insert body. Rods shall extend a minimum of 4" on either side of the insert.

- G. In general, all piping and conduit shall be supported from structural steel building members only or approved malleable steel insets imbedded in concrete pours.
- H. Where revisions are required and are approved, piping and conduit 3" and smaller may be supported at intermediate points by Phillips' 3/4" expansion bolts with lead shields, provided main supports are welded to structural steel and are not more than twenty feet on center. Intermediate supports, for pipe 4" and larger shall be attached to concrete by means of 4" x 4" x 3/8" clip knee angles with 3/4" expansion bolt in shear and supporting rod at 90 degrees from another bolt.
- I. Piping and conduit 3" and smaller shall be supported from existing slab by "Phillips" 3/4 expansion bolts with lead shields. Piping 4" and larger shall be supported by means of 4" x 4" x 3/8" clip knee angle with 3/4" expansion bolt in shear and supporting rod at 90 degrees from another bolt.
- J. Provide sleeves for pipes passing through roofs. Sleeves passing thru roofs shall be as detailed on drawings, extending min. 12" above finished roof. All pipes passing through roofs shall be a minimum of 10" from walls or other construction to permit proper flashing. Provide counter flashing.
- K. Where sleeves pass through waterproofed floors, they shall be IPS brass pipe sleeves of the required diameter, brazed at the bottom to 18" x 18", 16-ounce copper flashing for bond with waterproofing. The tops of sleeves shall extend 1/2" above floors.
- L. No ductwork, piping, conduit or equipment shall be supported from corrugated decking construction. Provide supplementary steel to support ductwork, piping, conduit or equipment. Supplemental steel members shall be welded to building structural steel.
- M. All hangers, rods and supports shall be installed prior to any construction fireproofing.
- N. The required fire resistance rating of floor or floor/ ceiling assemblies and walls shall be maintained where a penetration is made for electrical, mechanical, plumbing pipes, conduits, ducts and systems. Firestopping shall be provided at openings around vents, pipes, ducts, conduits at floor levels and walls with non-combustible materials, such as rockwool or equal.
- O. For openings around pipes and conduits and/or sleeves, 3M Product Caulk CP 25 and Putty 303 is approved equal.

#### 1.18 ESCUTCHEONS

- A. Provide escutcheons on pipes wherever they pass through ceilings, walls or partitions.
- B. Escutcheons on pipes passing through outside walls shall be Ritter Pattern and Casting Co., No. 1, solid, cast brass, flat type secured to pipe with set screw.
- C. Escutcheons for pipes passing through floors shall be Ritter Pattern and Casting Co., No.

36A, split-hinged, cast brass type, designed to fit pipe on one end and cover sleeve projecting through floor on the other end.

- D. Escutcheons for pipes passing through interior walls, partitions and ceilings shall be Ritter pattern and Casting Co., No. 3A, split-hinged, cast brass chromium plated type.

#### 1.19 MANUFACTURER'S IDENTIFICATION

- A. Manufacturer's nameplate, name or trademark, shall be permanently affixed to all equipment and material furnished under this Specification. Where such equipment is in a finished occupied space, the nameplate shall be in a concealed but accessible location. The nameplate of a Subcontractor or Distributor will not be acceptable.

#### 1.20 EQUIPMENT NAMEPLATES

- A. Provide for each item of equipment, including panelboards, disconnects, breakers, starters, switches and all control devices, pumps, fans, compressors, boilers, etc., a permanently attached nameplate made of black surface, white core laminated bakelite with incised letters. Subcontractor furnishing equipment shall provide nameplate. Pneumatic, electric and mechanically actuated gauges shall have a brief, but complete description of their function. Stating the air pressure or voltage range alone is not acceptable. Nameplates shall be a minimum of 3" long by 1-1/2" wide and shall bear the equipment name and item number of 1/2" high white letters as designated in the equipment schedule. Mounting screws shall have chrome plated acorn headed screws.

#### 1.21 TAGS AND CHARTS

- A. Furnish and attach to each valve as hereinafter specified, a 1-1/2" diameter brass tag with 1/2" indented numerals filled with durable black compound. Tags shall be securely attached to stems of valves with copper wire and "S" hooks.
- B. Valve charts shall consist of schematic drawings of piping layouts, showing and identifying each valve and describing the function. Upon completion of the work, one (1) copy of each chart, sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung in a conspicuous location in the main equipment room, unless otherwise directed by the Architect. Two (2) additional unmounted copies in 8-1/2" x 11" leather ring binders shall be delivered to the Architect. Also furnish three (3) copies of schematic flow chart with corresponding valve numbers noted on chart.
- C. Provide tags for the following valves:
  - 1. Zone control, bypass, shut-off, check and balancing valves.
  - 2. Building and area shut-off and balancing valves.

- 3. Control, bypass, shutoff, balancing and drain valves for major pieces of equipment such as boilers, domestic hot water heaters, heat exchangers, refrigeration machines, pumps, heating, ventilating and air conditioning units, cooling towers, etc.
- 4. System drain valves, safety and relief valves. Vacuum breakers.

1.22 IDENTIFICATION

- A. Identification shall be in accordance with "Scheme for Identification of Piping System, ANSI A13.1 and OSHA safety color regulation.
- B. Markers shall be snap-on type as manufactured by Seton Nameplate Corp., New Haven, Conn. (Setmark System) or approved equal. Markers shall completely encircle the pipe with a substantial overlap. No adhesive shall be used. They shall be manufactured of U.L. approved, self- extinguishing plastic. When the pipe including insulation (if any) is larger than 6 inches diameter and larger, markers shall be strap-on type.
- C. Provide identification for new and altered piping, ductwork and conduit for electrical work.
- D. Pipe shall be lettered and valves tagged in accordance with the schedule below. Lettering shall be located near each valve and branch connection and at intervals of not over 40 feet (10 feet on fire lines) on straight runs of pipe. Provide flow arrows for all piping at each marker. Adjacent to the legend, stencil the size of the pipe, conduit or ductwork. Letter colors are as follows: yellow with black letters, green with white letters, blue with white letters and red with white letters.

STENCIL AND VALVE TAG SCHEDULE

<u>Service Stencil Designation</u>	<u>Tag Color</u>	<u>Designation</u>
Cold Water Cold Water	Green	C.W.
Hot Water (Plumbing) F.Hot Water Deg. F.	Yellow	H.W. Deg.
Sanitary Sewer San. Sewer	Green	----
Storm Sewer Storm Sewer	Green	----
Refrigerant Suction	Green	RS
Refrigerant Liquid	Green	RL
Refrigerant Hot Gas	Green	RHG
Vent Piping Vent	Green	----
Air Conditioning Drain	Green	----
Safety Valve		

SECTION 15000  
 REQUIREMENTS FOR  
 MECHANICAL AND ELECTRICAL WORK

OMDEX INC. SPECIAL

Discharge Safety V. Discharge	Yellow	S.V.D.
Heating Hot Water Supply Heat. Hot Water Sup.	Green	H.H.W.S.
Heating Hot Water Return Heat. Hot Water Ret.	Green	H.H.W.R.
Chilled Water Supply	Green	CHWS
Chilled Water Demand	Green	CHWS
Chemical Water Treatment Chemical W.T.	Green	C.W.T.
Air Conditioned Supply Air		
A.C. Supply Air	Green	----
Return Air R.A.	Green	----
Exhaust Air E.A.	Yellow	----
Outside Air O.A.	Green	----
Mixed Air M.A.	Green	----

- E. Pumps and other equipment shall have nameplates to show the number, if any and service.
- F. "HIGH VOLTAGE" in black letters two inches high, stenciled at 10-foot intervals over a continuous painted orange background.
- G. Except where other means of identification are specified, electric cabinets, switchboards, motor control centers, transformers, system control boards, disconnecting switches, remote control switches, individual motor starters and motor control pushbutton stations shall be stenciled to show the service and number, if any, of the equipment controlled, as appropriate. Panelboards and other electrical equipment located in finished areas, such as offices, shall have the identification placed on the inside of the cabinet doors.
- H. Cabinets housing 480V/277 volt panelboards shall have "480/277 volt" stenciled in 2-inch high yellow letters on the inside of the cabinet doors.
- I. Cabinet housing emergency lighting panelboards shall have the word "EMERGENCY" in 2-inch high red letters on the outside of the cabinet, in addition to other lettering required above.

- J. The bolted covers of housing for disconnecting switches or links in bus ducts between network transformers and switchboards shall be lettered to identify the equipment within.
- K. Serial numbers shall be stenciled on the tanks and covers of transformers having their nameplates attached to the high voltage switch chamber covers.

#### 1.23 DRIP PANS

- A. Examine the drawings and in cooperation with the Electrical Work confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than two feet from a vertical line to electric switchboards, panelboards, or similar equipment.
- B. Where the installation of piping does not comply with the requirements of foregoing paragraph, the piping shall be relocated to achieve compliance.
- C. Provide copper gutters as follows:
  - 1. Provide a gutter of 16 ounce cold roller copper under every pipe which is within 2'-0" (two feet) of being vertically over any motor, electrical controllers, switchboards, panelboards, or the like.
  - 2. Each gutter shall be soldered and made watertight, properly suspended; and carefully pitched to a convenient point for draining. Provide a 3/4 inch drain to nearest floor drain or slop sink.
  - 3. In lieu of such separate gutters, a continuous protecting sheet of similar construction, adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor and extending 2'-0" in all directions beyond the motor, over which such piping has to run.

#### 1.24 TOOLS

- A. All special tools for proper operation and maintenance of the equipment shall be delivered to the Owner's representative and a receipt requested for same at no additional cost to the Owner.

#### 1.25 QUIET OPERATION

- A. All equipment and material shall operate under all conditions of load without any sound or vibration which, in the opinion of the Architect, is objectionable. Where sound or vibration conditions arise which are considered objectionable by the Architect, eliminate same in a manner reviewed by the Architect, at no additional cost.

#### 1.26 CLEANING, PIPING, DUCTS AND EQUIPMENT

- A. Clean all piping, ducts and equipment of all foreign substances inside and out before being placed in operation.
- B. If any part of a system should be stopped by foreign matter after being placed in

operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and remove obstructions. Any work damaged in the course of removing obstructions shall be repaired when the system is reconnected at no additional cost to the Owner.

- C. During construction, properly cap all pipes and equipment nozzles so as to prevent the entrances of sand, dirt, etc.

#### 1.27 DELIVERY OF MATERIAL

- A. Deliver the material and store same in spaces indicated by the Architect and assume full responsibility for damage to structure caused by any overloading of the material.

#### 1.28 PAINTING

- A. Paint all exposed unpainted, non-insulated, non-galvanized, ferrous metal surfaces of pipes, conduits, ducts, equipment, fixtures, hangers, supports and accessories, including those portions of electrical panels and their doors that are exposed to view into the complete building with one prime coat and one finish coat of acrylic paint in a color selected by Architect.
- B. The inside of all ductwork where visible through openings shall be painted with two prime coats of dull black paint.
- C. Nameplates on all equipment shall be cleaned and left free of paint.

#### 1.29 LUBRICATION

- A. Assume responsibility that all rotating equipment is properly lubricated as soon as it is connected by the Electrical Contractor before operation of this equipment is started. Assume responsibility for any damage to any equipment that is turned on without previously having been oiled or greased when connected up.

#### 1.30 EXCAVATION AND BACKFILL

- A. All excavation and backfill, shall be done by the each Contractor in accordance with Division 2 Standards.

#### 1.31 TESTS

- A. All piping, wiring and equipment shall be tested as specified under the various sections of the work. Labor, materials, instruments and power required for testing shall be furnished under the respective sections of the Specification.
- B. Tests shall be performed to satisfaction of the Architect. The Architect will be present at such test, when he deems necessary and such other parties as may have legal jurisdiction.
- C. Pressure tests shall be applied to piping only before connection of equipment and installation of insulation. In no case shall piping, equipment, or accessories be subjected to pressure exceeding their rating.



- D. All defective work shall be promptly repaired or replaced and the test shall be replaced until the particular system and component parts thereof receive the review of the Architect.
- E. Any damages resulting from tests shall be repaired or replaced and the tests shall be repeated until the particular system and component parts thereof receive the approval of the Architect.
- F. The duration of tests shall be as determined by all authorities having jurisdiction, but in no case less than the time prescribed in each Section of the Specification.
- G. Equipment and systems which normally operate during certain seasons of the year shall be tested during the appropriate seasons. Tests shall be performed on individual equipment, systems and their controls. Whenever the equipment or system under test is interrelated with and depends upon the operation of other equipment, systems and controls for proper operation, functioning and performance, the latter shall be operated simultaneously with the equipment or system being tested.
- H. The electrical work shall include providing any assistance (such as removal of switchboard and panelboard trims and covers, pull and junction box covers, etc.) deemed necessary by the Architect to check compliance with the Drawings and Specifications.

#### 1.32 OPERATING INSTRUCTIONS

- A. Two months prior to the completion of all work and the final inspection of the installation by the Owner, five (5) copies of a complete Instruction Manual, bound in booklet form and suitably indexed, shall be submitted to the Architect for review. All written material contained in the manual shall be typewritten or printed.
- B. The manual shall contain the following items:
  - Table of Contents (HVAC and Electrical)
    - I. Introduction - Explanation of Manual and its use.
    - II. Description of Systems
      - 1. Complete schematic drawings of all systems
      - 2. Functional and sequential description of all systems.
      - 3. Relationship of system where applicable to the supervisory data system.
    - III. Systems Operation
      - 1. Start-up procedures.
      - 2. Shut-down procedures.
      - 3. Reset and adjustment and balancing procedures.
      - 4. Seasonal operation.
      - 5. All posted instruction charts.
    - IV. Maintenance
      - 1. Cleaning and replacement - lines, components, filters, strainers, etc.

2. Lubrication.
3. Charging and filling.
4. Purging and draining.
5. Systems trouble shooting charts.
6. Instruments checking and calibration.
7. Procedures for checking out functions with remote (Supervisory Data Console) indication and control.
8. Recommended list of spare parts.

V. Listing of Manufacturers

VI. Manufacturer's Data (Where multiple model, type and size listings are included, clearly and conspicuously indicate those that are pertinent to this installation.)

1. Description - Literature, drawings, illustrations, certified performance charts, technical data, etc.
2. Operation.
3. Maintenance - including complete trouble shooting charts.
4. Parts List.
5. Names, addresses and telephone numbers of local recommended repair and service companies.
6. Guarantee data.
7. Model No. and Serial No. of all equipment.

1.33 TRAINING OF OWNER'S PERSONNEL

- A. This article supplements any training called for in other Divisions or Sections.
- B. Testing and balancing, the Contractors will thoroughly train the Owner's personnel.
- C. Training will take the form of four (4) four-hour classroom sessions to introduce the operation, maintenance, and management personnel to the manuals, drawings, and other documents and aids available to operate and maintain the equipment and systems. All sessions shall be videotaped by the relevant sub-contractor. The tapes shall be turned over to the Owner with the O/M manual.
- D. Factory specialists in the area of major equipment and systems will present sessions on their specific equipment or system, or both.
- E. Extensive hands-on training will be conducted so that actual operation and maintenance of the equipment and systems can be the responsibility of these personnel at the completion of the project.
- F. TYPICAL TRAINING AGENDA
  1. Walk-through of building (Project)
  2. Start-up Procedures
    - a. Seasonal Considerations
    - b. Check List
    - c. Emergency Procedures

3. Operation Procedure
    - a. Occupancy Consideration
    - b. Seasonal Considerations (Changeover)
  
    - c. Manual/Automatic
    - d. Emergency
  4. Shut Down
    - a. Check List
    - b. Normal
    - c. Emergency
  5. Maintenance (list major equipment systems)
    - a. Routine
    - b. Periodic
    - c. Service
    - d. Lubrication
    - e. Overhaul
    - f. Factory
  6. Warranties
    - a. What they cover
    - b. How to use them
  7. Spare Parts
  8. Tools
    - a. Normal tools, supplies and equipment
    - b. Special tools
  9. Hands-on operation of equipment and systems
- G. After completion of all work and all tests and at such time as designated by the Architect, provide the necessary skilled personnel to operate the entire installation for a period of two (2) consecutive days, eight (8) hours each.
- H. During the operating period, verify the previous training of the Owner's representatives in the complete operation, adjustment and maintenance of the entire installation before turning over the operation of the installation to the Owner.

#### 1.34 GUARANTEE

- A. The Contractor guarantees by his acceptance of the Contract that all work installed will be free from any and all defects and that all apparatus will develop capacities and characteristics specified and that if during a period of two years from date of substantial completion of work any such defects in workmanship, material or performance appear, he shall immediately replace, repair, or otherwise correct the defect or deficiency without cost to the Owner within a reasonable time. Notify the Architect in writing of the time required to do work. For heating systems the guarantee period must include two continuous heating seasons from November 1st to April 1st. For cooling systems the

guarantee period must include two continuous cooling season from May 1st to October 1<sup>st</sup>.

- B. Replace or repair to the satisfaction of the Owner any and all damage done to the building or its contents or to the work of other trades in consequence of work performed in fulfilling guarantee.
- C. This Article is general in nature and will not waive stipulations of other claims which specify guarantee periods in excess of two (2) years.

#### 1.35 OPERATION PRIOR TO COMPLETION

- A. The Owner may require operation of parts or all of the installation for the beneficial occupancy prior to final completion and acceptance of the building.
- B. The operation shall not be construed to mean acceptance of the work by the Owner. The Owner will furnish supervisory personnel to direct operation of the entire system and the Contractor shall continue to assume this responsibility until final acceptance.

#### 1.36 ELECTRICAL WORK

- A. The Electrical Contractor shall install and do all power wiring for all electrical devices, motor starters and unmounted motors, furnished to him at the job site by other trades.
- B. The Heating, Ventilating and Air Conditioning Contractor shall provide all wiring for the Automatic Temperature Controls and condenser water treatment controls, except as otherwise specified herein.
- C. For single phase motors which are not interlocked with other motors and which have temperature control or motor control devices in the power circuit, all installation and wiring shall be done by the Electrical Contractor.
- D. For all other motors, temperature control wiring and motor control wiring, including wiring for interlocking shall be provided by the Section providing the motors, including the installation of all control devices.
- E. Electrically operated equipment supplied by other trades, which are required to be installed and power wired by the Electrical Contractor, shall be delivered with detailed instructions for their installation and wiring in sufficient time and proper sequence to meet the work schedule.
- F. Furnish all electrical motors, all starters and all other motor control devices for motor driven equipment required for the work. The Electrical Contractor shall provide all code required disconnects. The setting of all motors required for mechanical equipment shall be included as part of the mechanical work.

Equipment which includes a number of correlated electrical control devices mounted in a single enclosure or on a common base with equipment, shall be supplied for installation completely wired as a unit with terminal boxes and ample leads ready for external wiring.

- G. All electrical items called for as part of the mechanical work shall conform to NEMA Standards, to the requirements of the National Fire Protection Association and to requirements of any local electrical code authority having jurisdiction, any field modifications required to insure such conformance shall be included as part of the mechanical work.
- H. The purchase and delivery of floor mounted motor starter equipment shall include the purchase and delivery of channel sills for mounting the starter equipment.
- I. Whether or not shown on drawings, all fan motors shall have disconnect switches, provided by Electrical Contractor.
- J. The supplying of any and all "field instruction" diagrams deemed necessary by the Architect for the complete delineation of electrical wiring for mechanical equipment shall be included as part of the mechanical work. The above requirements shall be met regardless of any assignment between trades of the responsibility for the purchase of electric motors and associated starters and control devices.
- K. The drawings describing the electrical/or the mechanical work may include explanatory wiring diagrams indicating the function intended for the motor control circuits of certain specific motors. The "field instructions" wiring diagrams required as part of the mechanical work shall conform to these intended functions.

#### 1.37 ELECTRIC MOTORS

- A. Each Contractor shall provide all electric motors required for driving all motor driven equipment required to be furnished under this Section of the Specification.
- B. Except as otherwise indicated on the drawings all motors shall be designed for 3 phase, 60 cycle alternating current operation with 208 volts across the motor terminals, except that unless otherwise specified herein, all motors 1/3 HP and smaller shall be designed for single phase, 60 cycle alternating current at 120 volts across the terminals. Before ordering motors, ascertain the actual voltages and other current characteristics that will be available and permissible for each motor. Report the same in writing to the Architect and obtain approval before ordering motors. The designation of current characteristics in these Specifications does not relieve the responsibility for ascertaining the actual conditions of electric service available for each motor or for the proper operation of all motors under the actual conditions.
- C. The speed, horsepower, type and other essential data for each motor, if not given under paragraphs describing the various motor driven apparatus, or in the schedules on the drawings shall be obtained from the manufacturer of the respective apparatus and shall be submitted to the Architect for his review. All two speed motors shall be single winding type.
- D. Provide oversized motor junction box for 2 speed motors.
- E. All motors shall be built in accordance with the latest rules of the National Electrical Manufacturers Association and of the Institute of Electrical and Electronic Engineers and also as hereinafter specified.

- F. Motors 1/2 HP and larger shall have Class B insulation. All motors shall be rated for continuous duty and shall be designed for temperature rises not to exceed 55 Degrees C. for fully enclosed type, 55 Degrees C. for splashproof types and 40 Degrees C. for all other motors except as otherwise specified herein. Motors shall be capable of withstanding momentary overloads of fifty percent (50%) without injurious heating. They shall operate without excessive heating, flashing or sparking under any conditions within the specified capacity of load and speed. All motors shall operate quietly and shall be replaced if, in the Architect's opinion, they do not do so. All motors which are in the airstream of air conditioning units, shall be totally enclosed type.
- G. Motors 1/2 HP and larger shall have ball or roller bearings with pressure grease lubrication, except where otherwise noted.
- H. Direct connected motors shall be furnished without an adjustable base. All motors connected to driven equipment by belt shall be furnished with adjustable sliding bases, except fractional motors with slotted mounting holes.
- I. All motor leads shall be permanently identified and supplied with connectors.
- J. Motors shall have nameplates giving manufacturer's name, serial number, horsepower, speed, voltage, phase and current characteristics.
- K. The insulation resistance between static conductors and frames of motors at the time of final inspection shall be not less than one-half megohm.
- L. All motors shall be of the proper type for the duty and shall have sufficient torque to start and run the equipment to which they are connected and starting currents and running currents shall not exceed the limits imposed by the laws or rules and regulations of the public authorities having jurisdiction or of the electrical utility company. All motors shall have sufficient horsepower capacity and rated duty to operate the apparatus to which they are connected so as to give the speeds and performance specified, but the horsepower shall be in no case less than that stated herein or shown on the drawings. A schedule giving the characteristics of the motors proposed for each type of service shall be submitted to the Architect for approval.
- M. The maximum full load speed of each direct connected motor shall be suitable for the equipment it drives.
- N. Except where V-Belt drive is specified, the fan wheels for ventilating fans shall be mounted on the motor shafts, which shall be designed for this duty.
- O. All motors, except motors furnished as an integral part of equipment and factory installed on the equipment, shall be of same manufacture.
- P. Polyphase motors shall be squirrel cage induction high efficiency energy saver type, suitable for the starting torque and current requirements.
- Q. Single phase motors shall be of the capacitor start induction run or split phase type as required for proper operation of the driven equipment.

- R. All motors shall be premium efficiency motors to qualify for NJ Smart Start incentives. The efficiency of energy efficient motors shall be verified in accordance with NEMA Standard NGI-12.53a. Minimum acceptable efficiency shall be as follows:

**EFFICIENCY OF ENERGY MOTORS**

Rating	H.P.	Efficiency
460 Volts	1	85.53
3 Phase, 60 c/s	1.5 & 2	86.5
1.15 Service Factor	3	89.5
40 Degrees C Ambient	5	89.5
	7.5	91.
	10	91.7
	15 & 20	93
	25	93.6
	26	94.1
	30	94.5
	40 & above	94.5

1.38 INDIVIDUAL MOTOR STARTERS

- A. Each Contractor shall furnish and turn over to the Electrical Contractor, who shall erect and provide power wiring for same, motor starting equipment for motors provided as part of the work. If a motor is replaced (even same HP), provide new starter for that motor.
- B. For each motor 1/3 HP or smaller, starters shall be manual, with thermal overload protection, and pilot light, except that where interlocking or automatic control (other than for unit and cabinet heaters) is required, starters shall be 120 volts combination circuit breaker and magnetic starter with pilot light.
- C. For each motor 1/2 HP and over, starters shall be combination unfused switch and magnetic across-the line. All magnetic starters shall have 3 thermal overcurrent-units. Provide 460/120 volt transformers for control circuits with a fused secondary.
- D. For motors requiring electric interlock, or automatic control features, starters shall be equipped with the necessary auxiliary contacts, or terminals to provide the control features desired. Such starters shall be provided with "hand-off-auto" selection pushbuttons mounted in cover. For two speed motors, provide "high-low-off- auto" four position selector switch. In hand" position, all controls and safeties shall be operative.
- E. In addition to any auxiliary contacts required for interlocking purposes, each magnetic starter shall be equipped with one normally open auxiliary control circuit contact either for "sealing in" or as a spare for future use.
- F. Transformer type, pilot lights shall be provided for all magnetic starters and for all remote control stations. Pilot light shall be mounted on cover and shall have 6 volt bulb.

- G. For two speed motors, provide a pilot light for each speed. For starters for 10 HP and over, provide adjustable 20 second time delay between Hi and Low Speed.
- H. Each starter shall be clearly identified after installation by engraved nameplates. The nameplates shall be bakelite black plates with 1/2" high white letters and shall be securely fastened to starter or to wall immediately below same. Sections furnishing starter shall provide nameplates.
- I. The Electrical Contractor shall install all starting equipment except starters specified to the factory mounted and wired as part of the equipment, and shall do all wiring necessary to supply power to the starter, including connections from the starters to the motors. All selector switches and pilot lights required in accordance with the preceding information, shall be flush mounted in the cover of its respective starter.
- J. All enclosures shall be NEMA Type I sheet steel, with hinged cover, for general purpose indoor application, unless otherwise indicated. Enclosures shall be arranged for equipment or wall mounting. Weatherproof NEMA Type 4 enclosures shall be provided for all outdoor starters.
- K. Three phase motors under 40HP shall be furnished with full voltage, combination unfused/fused (refer to electrical drawings) switch and magnetic, across-the-line starters. Three phase motors 40HP and over shall be furnished with reduced voltage, combination unfused/fused (refer to electrical drawings) switch and magnetic starters of the auto transformer closed transition type.
- L. All starters, except those furnished as an integral part of equipment and factory installed on the equipment, shall be of the same manufacture.

#### 1.39 MOTOR CONTROLLERS

- A. Furnish motor controllers which are not under the starter cover, required for remote control of motors. Motor controllers shall be defined as devices for motor control, such as pushbuttons, switches, etc.
- B. Unless otherwise noted, motor controllers shall be housed in NEMA Type 1 general purpose enclosure. Outdoor controllers shall be provided with weatherproof NEMA Type 3 enclosures.
- C. The controllers to be installed in finished areas shall be flush mounted.
- D. The Electrical Contractor shall provide wiring for motor controllers.
- E. All motor controllers shall be minimum NEMA size, regardless of the actual duty they are required to perform.
- F. Pushbuttons shall be of the normal duty spring return momentary type.
- G. Selector switches shall be equipped with nameplates indicating the function of each of their positions as noted in the list of electric motors and motor controls.



- H. Pilot lights shall be transformer type with 6 volt bulbs and shall be equipped with nameplates indicating the operating conditions they annunciate as noted in the list of electric motors and motor controls.
- I. Pushbuttons shall be equipped with nameplates indicating their functions as noted in the list of electric motors and motor controls.
- J. Devices such as pushbuttons, pilot lights and selector switches, where mounted in enclosures other than the cover of the starter, shall be equipped with nameplates indicating the motor with which they are associated.

- END OF SECTION -

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