

SECTION 15010 - MECHANICAL - GENERAL CONDITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The General Conditions of these Specifications, along with Special Provisions, Information to Bidders, and any other pertinent information and documents shall apply the same as if repeated herein.

1.02 DIVISION 15 SECTIONS

- A. Division 15 is divided into Sections for convenience purposes.

- 15010 - General Provisions
- 15100 - Plumbing
- 15200 - Air Conditioning, Heating, and Ventilation
- 15210 - Mechanical HVAC FVR
- 15220 - Mechanical HVAC VFR DOAS
- 15300 - Fire Protection

1.03 DRAWINGS

- A. Plans and detailed sketches are submitted to limit, explain and define conditions, specified requirements, pipe sizes, and manner of erecting Work. Structural or other conditions may require certain Modifications from the manner of installation shown, and such deviations are permissible and shall be made as required, but specified sizes and requirements necessary for satisfactory operations shall remain unchanged. It may be necessary to shift ducts or pipes or to change the shape of the ducts, and these changes shall be made as required. All other changes must be referred to the Architect for approval before proceeding. Extra charges will not be allowed for these changes.
- B. The Contractor should realize that the Drawings could delve into every step, sequence of operation necessary for the completion of the Project without drawing on the Contractors experience or ingenuity. However, only typical Details are shown on the Drawings. In cases where the Contractor is not certain about the method of installation of his Work, he shall ask for Details. Lack of Details will not be an excuse for improper installation.

1.04 QUALITY ASSURANCE

- A. All materials, equipment, and accessories installed under this Contract shall conform to all rules, codes, etc. as recommended by National Associations governing the manufacturer, rating and testing of such materials, equipment, and

accessories. All materials must be new, of the best quality and first class in every respect. Whenever directed by the Architect, the Contractor shall submit a sample for approval before proceeding.

- B. This Contractor shall protect the entire system and all parts thereof from injury, throughout the progress and up to the acceptance of the Work. Failure to do so shall be sufficient cause for the Architect to reject any piece of equipment.
- C. Where local laws or regulations provide that certain accessories such as gauges, thermometers, relief valves, and parts to be installed on equipment, it shall be understood that such equipment shall be furnished complete with the necessary accessories whether or not called for in these Specifications.

1.05 MANUFACTURER, TRADE NAMES, AND EQUIVALENCY REVIEW

- A. Whenever manufacturers or trade names are mentioned in these Specifications or Plans, the words "or equivalent" shall be assumed to follow whether or not so stated. Manufacturers or trade names are used to establish a standard of quality only and should not in any way be construed to infer a preference.
- B. The name of a certain brand, make, manufacturer, or product is to denote the quality standard desired, but does not restrict bidders to that brand, make, manufacturer or product. The purpose is to convey to bidders the general style, type, character, and quality of product desired, and it shall therefore be regarded merely as a standard.
- C. See Architectural Section of Specifications for Time Limit Requirements and Equivalency Requirements for Equivalency Review.

1.06 A.S.M.E.

- A. All unfired pressure vessels shall be built in accordance with A.S.M.E. Code and so stamped. Furnish shop certificates for each vessel.

1.07 PAINTING

- A. All painting shall be by the General Contractor's Painting Subcontractor. All pipe, pipe covering, ducts, equipment, supports, hangers, etc. exposed in building or in mechanical equipment room shall be painted.

1.08 FILL AND CHARGES FOR EQUIPMENT

- A. Fill and charge the materials or chemicals all devices or equipment required to comply with manufacturer's guarantee or required for proper operation of the equipment.

1.09 LAWS AND CODES

- A. The entire Mechanical Work shall comply with the rules and regulations of the City, Parish, and State in which this Project is being constructed, including the State Fire Marshal and State Board of Health. All Modifications required by these authorities shall be made without additional charge to the Owner. The Mechanical Contractor shall report these changes to the Architect and secure his approval before Work is started.
- B. In addition to the codes heretofore mentioned, all Mechanical Work and Equipment shall conform to the applicable portions of the following specifications, codes, and regulations:
 - 1. American Society of Heating, Refrigeration and Air Conditioning Engineers
 - 2. National Electrical Code
 - 3. National Fire Protection Association
 - 4. American Society of Mechanical Engineers
 - 5. International Building Code
 - 6. International Plumbing Code
 - 7. International Mechanical Code

1.10 UTILITIES

- A. The location and elevations of all utilities are based on available surveys and utility maps and are reasonably accurate. However, they shall serve as a general guide only, and the Contractor shall visit the site and verify the location and elevation of all services to his own satisfaction, in order to determine the amount of Work required for the execution of the Contract.
- B. In case major changes are required, this fact, together with the reasons therefore, shall be submitted to the Architect in writing, not less than seven (7) days before the date of bidding. Failure to comply with this requirement will make the Contractor liable for any changes, additions, and expense necessary for the successful completion of the Project.
- C. Cutting and patching of all streets, walks, and other paved areas necessary for the successful completion of this Contract shall be included in this Contract.
- D. The Contractor shall contact the various utility companies, determine the extent of their requirements, and he shall include in his bid all lawful fees and payments required by these companies for service connections, extensions from mains to meters, street patching, etc. Meter Deposits, Costs, etc. by this Contractor, to be placed in Owner's Name at Project completion.

1.11 PERMITS AND INSPECTIONS

- A. Secure all permits and inspections and pay fees for permits and inspections necessary for completion and acceptance of Work. Notify Architect and proper authorities in ample time when any Work is ready for inspection. Obtain certificates of inspection and approval from inspection agencies having jurisdiction.
- B. The Owner is responsible for sewage assessments and/or property taxes as may be applicable.

1.12 VISIT TO JOB SITE

- A. Visit and examine Project Site prior to bid opening to determine all conditions which may affect the Work. Notify Architect, in writing, seven (7) days prior to opening of bids of any discrepancies. No additional compensation will be allowed for failure to visit Project Site.

1.13 SHOP DRAWINGS/SUBMITTALS

- A. Before proceeding with Work and/or within thirty (30) days after award of the General Contract for this Work, the Mechanical Contractor shall furnish to the Architect complete Shop Drawings of such apparatus, equipment, controls, insulation, etc. to be provided in this Project. These Drawings shall give dimensions, weights, mounting data, performance curves and other pertinent information.
- B. Architect's approval of Shop Drawings shall not relieve the Contractor from the responsibility of incorrectly figure dimensions, or any other errors that may be contained in these Drawings. The omission from the Shop Drawings of any materials shown on the Contract Drawings or specified, even though reviewed by the Engineer, shall not relieve this Contractor from furnishing and erecting same.
- C. Seven (7) sets of blueline prints of Shop Drawings or Submittals shall be submitted to the Architect for approval. Any Drawings disapproved shall be resubmitted. Submit all Shop Drawings at the same time. No separate items will be accepted.

1.14 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Provide Owner with three (3) copies of printed instructions, and one copy in PDF format, indicating various pieces of equipment by name and model number, complete with parts list and maintenance and repair instructions. This information shall be bound in canvas covered notebooks. Substantial Completion of the Project will not be recommended without compliance with this paragraph.

1.15 RECORD DRAWINGS

- A. Contractor shall be furnished a complete set of Blueline Drawings which shall be marked up by the Contractor as Work progresses to reflect all items of installation which differ from Work shown on Contract Documents. Record Drawings shall be neatly done, not sketchy or free-hand. Final payment will be withheld until Drawings are furnished.

1.16 GUARANTEE

- A. The Contractor shall guarantee all materials, equipment and workmanship for a period of one (1) year from the date of final acceptance of the Project. This guarantee shall include the furnishing of all labor and materials necessary to make any repairs, adjustments, or replacements of any equipment, parts, etc., necessary to restore the Project to first class condition. This guarantee shall not include replacement of filters. Air Conditioning Compressors shall be warranted for an additional four (4) years beyond the one (1) year overall warranty. Additional four (4) year warranty shall include compressor replacement, not including labor, refrigerant, freight, etc. NOTE: The additional four (4) year warranty shall be for new replacement compressor, not re-built compressors or field repaired compressors.
- B. Should the Contractor's office be in excess of a 50 mile radius of this Project, he shall appoint a local, qualified Contractor to perform any emergency repairs and adjustments required during the guaranteed period. The Contractor appointed to provide emergency services shall be submitted to the Architect for his approval.

PART 2 PRODUCTS

2.01 MACHINERY GUARDS

- A. This Contractor shall provide V-belt guards for each V-belt drive or other hazardous drive. Guard shall enclose drive entirely and shall have holes for taking tachometer readings.

2.02 ACCESS PANELS

- A. Furnish and install access panels where valves, dampers, etc. are concealed in walls, ceilings, or floors, or otherwise inaccessible. Panels shall be Milcor, Karp, Williams, or equivalent, sized as required and furnished with prime coat finish.

2.03 HANGERS AND MISCELLANEOUS

- A. This Contractor shall furnish and install all escutcheons, inserts, thimbles, hangers, etc. required for the proper support and installation of his equipment and piping. Cooperate with other Trades in locating and placing these items.
- B. Provide sleeves for all pipes passing through walls, floors, beams, etc. Sleeves passing through structural members shall be of cast iron or Schedule 40 steel pipe. Sleeves passing through non-structural walls or floors shall be 22 gauge galvanized iron. Joints between sleeves and pipes passing through floors shall be made watertight with plastic materials. Where pipes pass through waterproofing members, flashing and sleeves shall be installed.
- C. Provide Grinnell, PHD or equivalent malleable iron split ring hangers with rod supports throughout. Strap hangers or wire will not be accepted. Maximum spacing of hangers shall be as follows:
 - 1. Copper - 1/2" & 3/4" - 4'-0" o.c. max.
- 1" thru 1 1/2" - 5'-0" o.c. max.
- 2" and above - 6'-0" o.c. max.
 - 2. Iron - 1/2" thru 1" - 4'-0" o.c. max.
- 1 1/4" thru 2 1/2" - 5'-0" o.c. max.
- 3" and above - 6'-0" o.c. max.
 - 3. PVC and other plastic - 4'-0" o.c. max., all sizes.
- D. Provide galvanized iron shields between hangers and pipe covering.
- E. Provide Grinnell, PHD or equivalent heavy steel riser clamps on vertical risers at floors to support pipes.
- F. Provide Crane 10B or C chrome plated brass escutcheons wherever pipes pass through floors, walls, or ceilings, in exposed or finished areas.
- G. All piping projected from chases shall be rigidly supported by walls of chase. Loosely supporting fixtures or accessories will not be accepted.

2.04 VALVES AND UNIONS

- A. Furnish and install all valves, unions, stops, connections, etc. shown on Plans and necessary to make complete system in working order. Provide valves on inlet and outlet of all equipment and fixtures and on branch lines to fixtures or groups of fixtures. Provide valve in main water line.

B. Valves and unions shall be as follows:

<u>Copper Pipe</u>	<u>2" and less</u>	<u>Over 2"</u>
gate valve	Hammond 607	Hammond IR-1138
globe valve	Hammond 424	Hammond IR-126
check valve	Hammond 915	Hammond IR-1124
ball valve	Apollo 70	Apollo 70
<u>Iron Pipe</u>	<u>2" and less</u>	<u>Over 2"</u>
gate valve	Hammond 606	Hammond IR-1138
globe valve	Hammond 404	Hammond IR-126
check valve	Hammond 903	Hammond IR-1124
ball valve	Apollo 70	Apollo 70

- C. All valves, cocks, unions, etc. where pipe is chrome plated shall have similar finish. All exposed supplies to plumbing fixtures shall be chrome plated.
- D. Valves - all ball valves shall have extended stems to allow for insulation thickness.

2.05 MOTORS, STARTERS, AND ELECTRICAL WORK

- A. The Mechanical Contractor shall furnish all motors for each piece of motor-driven equipment, unless shown otherwise. The Mechanical Contractor shall furnish these pieces of equipment to the Electrical Contractor, complete with all required diagrams, etc. for his installation.
- B. The Electrical Subcontractor shall do all line voltage wiring required for the installation of the mechanical equipment, including interlocking, power wiring, etc. All Work shall be in accordance with the National Electrical Code requirements wiring workmanship, etc. as called for in the Electrical Specifications. The Mechanical Contractor shall provide approved wiring diagrams of all equipment, controls, etc. to the Electrical Contractor for coordination. Coordinate all Work to provide a complete system in working order. Controls, associated wiring, and installation is the responsibility of the Mechanical Subcontractor.
- C. All motors for the mechanical equipment shall be of the 40°C rise type and shall be furnished and installed by the Mechanical Contractor. All motors shall be wound for plus or minus 10% of specified voltage.
- D. Motors 1/2 HP and smaller shall be 120 volt, single phase, 60 cycle, and motors above 1/2 HP shall be 208 volt, three phase, 60 cycle, unless noted otherwise on Plans or hereinafter.
- E. All electrical equipment shall have Underwriters' Label and shall meet the standards of the National Electrical Code and N.E.M.A.

- F. Combination Starters/Disconnects shall be furnished by the Electrical Contractor.

PART 3. EXECUTION

3.01 SUPERVISION

- A. The Contractor shall provide competent supervision of the Work from beginning to completion and final acceptance. To the best of his ability, he shall keep the same foreman and workmen through the Project duration.
- B. During the progress of the Work, it shall be subject to observation by the representative of the Architect and/or Engineer, and at these specified times, the Contractor shall furnish required information.

3.02 PROTECTION OF WORK

- A. Contractor shall protect all equipment, fixtures, and Work from damage. Damaged Work will be rejected and replaced at the expense of the Contractor.
- B. Where possible, all rooms containing new fixtures shall be kept locked until the building is turned over to the Owner. Immediately after installation of each fixture it shall be covered with a fixture protector.
- C. Piping shall be racked and handled in a manner to prevent entrance of dirt and foreign matter. Open pipe ends shall be plugged or capped during erection.

3.03 FOUNDATION AND SUPPORT

- A. This Contractor shall furnish and install all foundations and supports required for all his equipment, unless indicated otherwise on Drawings.

3.04 GROUNDS AND CHASES

- A. This Contractor shall see that all required chases, grounds, holes and accessories necessary for the installation of this Work are properly built in as the Work progresses; otherwise, he shall bear the cost of providing same.

3.05 CUTTING AND BORING

- A. Wall, roof, and floor penetrations, if not pre-sleeved by the Mechanical Contractor, shall be by the Mechanical Contractor. Use only Boring apparatus for penetrations. No jack-hammering allowed. Roto-hammers may only be utilized for pilot holes and no larger than 1/2"

3.06 EXCAVATION AND BACKFILL

- A. This Contractor shall do all excavating necessary to lay the specified services. After services have been tested, inspected and approved by the authorized inspectors, the trenches shall be backfilled with approved materials in 6" layers and tamped thoroughly to the satisfaction of all parties concerned. All underground lines shall be bedded in 6" thickness river sand.
- B. Where specified compaction methods and requirements are called for elsewhere in these Specifications, this Contractor shall meet these requirements, and all Work shall be performed as specified herein.
- C. Cart away from the premises all unnecessary dirt, rubbish, etc. as indicated.

3.07 REPAIRING ROADWAYS AND WALKS

- A. Where this Contractor cuts or breaks roadways or walks to lay the piping, he shall repair or replace these sections.

3.08 INTERFERENCES

- A. In general, the Drawings are diagrammatic, and the Contractor shall install his Work in a manner interferences between the various Trades is avoided.

3.09 CLOSING IN UNINSPECTED WORK

- A. Do not cover up or enclose Work until it has been properly completely inspected and approved. Should any of the Work be covered up or enclosed prior to all required inspections and approvals, uncover Work as required and, after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect and at no additional cost to the Owner.

3.10 CLEANING AND ADJUSTING

- A. Upon completion of his Work, the Contractor shall clean and adjust all equipment, plumbing fixtures, piping, ductwork, control valves, filters (provide new filters if throwaway style is specified) and leave the entire installation(s) in proper working order.
- B. On plumbing fixtures, thoroughly flush hot and cold systems and clean strainers. Use only a cleaning solution approved by manufacturer of the plumbing item.
- C. Contractor shall adjust all equipment and system to operate at capacities and quantities scheduled or shown on Plans and shall furnish all thermometers, velometers, gauges, etc. required to adjust and balance the system properly.

- D. Prior to requesting final inspection by the Architect, the Contractor shall have a complete coordination and adjusting meeting of all of his sub-contractors directly responsible for the control, operation or balance of any portion of the system.
- E. At the time of this meeting, each and every sequence of operation shall be checked to assure proper operation. Notify the Architect in writing ten (10) days prior to this meeting instructing him of the time, date, and whom you are requesting be present. This Project will not be accepted until the above provisions are met to the satisfaction of the Architect.

END OF SECTION

SECTION 15100 - MECHANICAL - PLUMBING

PART 1 GENERAL

1.01 SPECIAL NOTICE

- A. The General Conditions of the Contract for Construction, Supplementary Conditions, all Division 1 Sections of Specifications, and Section 15010 - General Provisions-Mechanical and all other relevant Documents are part of this Work. The references to certain paragraphs are intended to point out specific items to the Contractor but in no way relieve him of the responsibility of complying with all relevant parts of the entire Specifications.

1.02 SCOPE

- A. The Work intended under this Contract comprises the furnishing of all labor and materials necessary for the complete installation of the Plumbing Work, including equipment, piping, valves, accessories, services, etc. as indicated or reasonably implied by the Drawings and as herein specified for the following systems:
 - Cold Water System
 - Hot Water System
 - Sanitary Drainage System
 - Fire Entry
 - Roof Drain System
- B. The Contractor shall take care in providing accurate costs for the renovation portion of the Project.
- C. All systems shall be provided complete as shown on Plans to meet existing conditions. All equipment and materials used shall be new and of the best quality specified in every respect.
- D. The accompanying Drawings show the general arrangement of all pipes and the location of all apparatus; however, where local conditions necessitate change, these changes shall be made upon approval of the Architect at no additional cost to the Owner. The various Contractors must cooperate in installing their Work to the end that there will be no conflict of space required. Provide pipe sleeves as herein specified.

1.03 QUALITY ASSURANCE

- A. Use only thoroughly trained and experienced workmen, completely familiar with the items required and the manufacturer's correct recommended methods of installation. In acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of the installers.

1.04 PRODUCT HANDLING

- A. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed Work and materials of all other Trades. In the event of damage, immediately make all repairs and replacements necessary for the approval of the Architect and at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 PIPE, PIPING, AND FITTINGS

- A. All Sanitary Sewer Lines and Vents within building, below slabs, and below grade are to be constructed of PVC DWV plastic pipe and fittings fabricated with PVC solvent. All pipe, fittings, and solvent shall have NSF approval as a system. Plastic pipe and fittings shall be as manufactured by Cresline, Yardley, Tyler, or equal and be in conformance with Commercial Standards CS 270-65.
- B. All Domestic Hot and Cold Water Lines shall be Government Type "L" hard drawn copper pipe and fittings. Soft drawn may only be used in sizes 1-1/4" and smaller and only below grade. The copper pipe/tubing shall be standard weight and thickness as made by Mueller, Chase, Anaconda, or equal. Use 95-5 solder on piping above grade. Use Silfos 1000°F low temperature brazing on piping underground. NOTE: Do not use lead bearing solder.
- C. Relief lines shall be government Type "L" rigid copper, Bridgit 500°F solder.
- D. Fire Service Water Mains shall be PVC-C-900, cast iron pipe dimensions, UL rated plastic pipe and fittings. See Plans for location of Fire Hydrants and Thrust Blocks.
- E. Roof Drain Piping shall be standard weight Cast Iron Pipe.

2.02 CLEANOUTS (CO, WCO)

- A. Cleanouts shall be provided where shown on Plans, at each change of direction of the building drain greater than 45°, and at or near the foot of each vertical waste or soil stack. Location of all cleanouts shall be checked with Architect. All cleanouts shall be same size as piping up to 4". Larger pipes shall have 4"

cleanouts, unless noted otherwise. Every cleanout shall be installed so that the cleanout opens in the direction of flow of the drainage line or at right angle thereto. Floor cleanouts shall be cast iron body with brass plug, J.R. Smith Speedi-set, model 4032. Top of access cover shall be level with finished floor. Wall cleanouts shall be nickel-bronze access frame and cover J.R. Smith model 4720. Outside cleanouts shall be as detailed on Plans.

- B. Cleanout access door for cleanouts terminating in outside walls shall be J.R. Smith 4940-10X10.

2.03 THERMAL INSULATION

- A. After all Work has been tested and found to be tight, insulate as follows:
 - 1. Insulate all above grade cold, hot, and hot return water lines with 1" thickness fiberglass pipe insulation with universal jacket. All flanges, valves, and fittings shall be insulated with fiberglass molded fittings insulation, fabricated mitred segments of pipe insulation, or fiberglass Aerowrap Insulation equal in thickness to insulation of adjoining pipe. All covering and pipes shall be banded using aluminum bands, three (3) to a section, and one (1) band on each side of each fitting. NOTE: "Zeston" fittings covering shall be utilized.
- B. In water heater room and AC mechanical room, encapsulate insulation with 0.02" PVC, white. Identify cold, hot, and hot return with Seton "Opti-Code" pipe markers and flow arrows..
- C. P-traps and horizontal runs of sanitary sewers that are draining HVAC units shall be insulated. Insulation may be ½" Armaflex, Rubatex, Imcolock, or 1" commercial ductwrap.
- D. Insulate Roof Drains down to horizontal and all Roof Drain Piping with 2", 3/4lb density, minimum R6.0 Ductwrap with foil face. Tape all joints and seal to maintain a Vapor Barrier.

2.04 WATER HEATERS

- A. Water Heater is existing – connect with new circulation pump as indicated on Plans.

2.05 HOT WATER RETURN PUMPS

- A. RE: Plans

2.06 PLUMBING FIXTURES

- A. Plumbing Contractor shall furnish and install all plumbing fixtures shown on accompanying Drawings. Refer to both Plumbing and Architectural and provide all fixtures shown on either. Fixtures shall be complete with all necessary brass and accessories required for a complete installation including traps, escutcheons, angle supplies, basin cocks, etc. All fixtures shall be new and must be delivered to building properly crated in perfect condition.
- B. All brass must be of the best quality, lightweight goods will not be accepted. All brass pipe shall be seamless brass tubing and nipples shall be extra heavy. All fittings and trim shall be chrome plated heavy cast brass, unless otherwise specified. "P" traps shall be cast brass with cleanouts. All exposed piping shall be chrome plated. Provide cutoff valves at each fixture in both hot and cold water piping.
- C. Manufacturers and model numbers shown below are minimum standards. Substitutions will be allowed, based on Equivalency Review:
- * WATER CLOSET (Marked "WC-2")
American Standard 3451.128, 15" high, 12" rough-in, vitreous china, siphon jet, 1.6 GPF. Church 255C, open front seat, solid plastic, Sloan 111 water closet flushometer, ADA handle, 1.6 GPF.
 - * WATER CLOSET (Marked "WC-1")
American Standard 3461.128, 16 1/2" high, 12" rough-in, vitreous china, siphon jet, 1.6 GPF. Church 255C, open front seat solid plastic, white. Sloan 111 water closet flushometer, 1.6 GPF, ADA handle. Install per Adult ADA.
 - * LAVATORY (Marked "L-1")
American Standard 0356.421, vitreous china, single faucet hole. American Standard 2000.100X Lavatory Faucet, single handle, ceramic disc valving, all brass and copper waterways. 2411.015 grid drain, Dearborn tailpiece. Brasscraft CR1912C, angle supplies w/stops. Truebro #102W insulation kit. Mount rim of lavatory 30" A.F.F. (ADA).
 - * SINK (Marked "SK-1")
Elkay LR-1720, 18 ga. 302 S.S., self-rimming, one (1) 1 1/2" faucet hole. American Standard 2385.479 single handle faucet less pop-up drain, 18" supply tubes. Elkay LK-35 duo-strainer. Brasscraft CR1912C angle supply w/stop. PVC "P"-trap, 1 1/2".

- * SINK (Marked "SK-2")
Elkay LRAD 2922, double bowl, 5.5" depth, 18 gauge type 304 s.s. self-rimming, LK-35, duo strainers, 1 3/4" radius coved corners, one hole, LK7620CR single handle faucet. PVC p-trap. Brasscraft CR1912C angle supplies with stops. ADA Installation.
- * HOSE BIBB (Marked "HB")
Watts Hy-330, 3/4", Nickel Bronze Box, vacuum breaker, loose key stop.
- * FLOOR DRAINS (Marked "FD-1")
J.R. Smith 2005Y03-A-06PB-P050, 3" outlet, cast iron body, no-hub, 6" round nickel bronze strainer, and trap primer, 1/2". Use Proset Trap Guard or equal in floor drain-verify proper Trap Guard for Floor Drain..
- * ELECTRIC WATER COOLERS (Marked "EWC")
Elkay EZSTL8C, 8.0 G.P.H., 325 watts, 120 volt, stainless steel cabinet, ADA compliant. LKA PREZL Apron, PVC drain trap.
- * ICE MAKER (Marked "IM")
Ice Maker Wall Box with valve and connect to owner provided "REF".

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Prior to all Work of this Section, carefully inspect the installed Work of all other Trades and verify that all such Work is complete to the point where this installation may properly commence.
- B. Verify that Plumbing may be installed in strict accordance with all pertinent codes and regulations and the approved Shop Drawings.
- C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 SEWAGE AND DRAINAGE

- A. The system of sewage and drainage shall be of materials hereinbefore specified. All Work shall be in strict conformity with the International Plumbing Code and in accordance with all local codes. Piping shall be routed as shown on Plans and in an acceptable manner to meet building conditions. Venting shall be as shown on plumbing riser diagram.

- B. Connections between traps and cast iron pipes are to be made with heavy brass ferrules. Provide reducers, increasers, special flanges, and fittings where required between piping work and fixtures, in order to connect and complete work and render it ready for use. Make any offsets required to avoid construction.
- C. All lines 2 ½" and smaller shall be sloped ¼" per foot and lines 4" and above shall be sloped as shown on plans. Piping shall be laid so slope is continuous.

3.03 PLUMBING SYSTEM LAYOUT

- A. Layout the Plumbing System in careful coordination with the approved Shop Drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactory, functioning system. Follow the general layout shown on the approved Shop Drawings in all cases, except where other Work may interfere. Except where specifically permitted by the Architect, layout all pipes to fall within partitions, ceilings, or roof cavities and do not require furring, other than that shown on approved Shop Drawings.

3.04 TESTING

- A. All pressure lines, unless elsewhere specified, shall be tested at 100 PSI hydrostatic pressure for a minimum of five (5) hours.
- B. Test all plumbing vertical lines, waste vents, etc. with a minimum of 10' water head for 24 hours or in accordance with the International Plumbing Code, whichever is stricter.
- C. Contractor shall make all other tests required by the Architect and/or Engineer, or other governing authorities, at no additional cost to the Owner.
- D. Contractor shall notify the Architect and Parish Plumbing Inspector before any test are made, and test are not to be drawn off a line, covered, or insulated until examined and approved by the authorities. If in the event defects are found, these shall be corrected, and the Work shall be retested.

3.05 WATER SERVICE

- A. Modify water service(s) as shown on plans, domestic.
- B. Provide New Fire Service as shown on Plans with new mains. Coordinate all costs and requirements with the local water district and Fire Department.

3.06 SANITARY SEWER SERVICE

- A. Connect to existing as shown on Plans. Coordinate all costs and requirements with the local sewer district.

3.07 WATER PIPING

- A. All water supply piping shall be of materials hereinbefore specified. Make provisions for expansion and contraction of hot water lines by means of expansion bends or loops as required.
- B. All water lines shall be disinfected in accordance with the International Plumbing Code.
- C. Water lines that run underground shall have a minimum of 18" cover to finished grade and hot water and cold water lines running parallel shall be run a minimum of 18" apart.
- D. Make up a complete water supply system. Connect to all fixtures and outlets requiring water.
- E. At each fixture or group of fixtures, furnish and install a 12" high air chamber of same size as branch feed line.
- G. All non-metallic pipe (C-900) outside of building shall have a #12 copper tracer wire run with the pipe.

3.08 SANITARY SEWER LINES AND STORM DRAINAGE LINES

- A. Lines shall be bedded in river sand installed no less than 4" thick at the bottom of trenches. Under buildings, lines shall be hung with s.s. rods, see Plans for details, 1/4" or 3/16" diameter rods.

END OF SECTION

Section 15200 -MECHANICAL - HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. The General Conditions of the Contract for Construction, Supplementary Conditions, all Division 1 Sections of Specifications, and Section 15010-General Provisions-Mechanical and all other relevant Documents are part of this Work. The references to certain paragraphs are intended to point out specific items to the Contractor but in no way relieve him of the responsibility of complying with all relevant parts of the entire Specifications.
- B. 15010-General Provisions-Mechanical
- C. 15210-Mechanical-HVAC VRF
- D. 15220-Mechanical-HVAC VRF DOAS

1.02 SCOPE

- A. This Section calls for furnishing of all labor and materials necessary to provide and install the complete Air Conditioning, Heating, and Ventilation Systems. It is the intention of these Specifications that the System(s) shall be furnished complete with all the necessary valves, controls, insulation, piping, devices, equipment, etc. as necessary to provide a satisfactory installation in working order.
- B. The Cooling/Heating Systems shall be VRF, direct expansion heat pump with multiple indoor air units, simultaneous heat/cool as shown, detailed, and scheduled on Plans. The temperature control systems shall be electric.
- C. All systems shall be provided complete as shown on Plans and to meet existing conditions. All equipment and materials used shall be new and of the quality specified in every respect.
- D. The accompanying Drawings show the general arrangement of all pipes and the location of all apparatus, however, where local conditions necessitate change, these changes shall be made upon the approval of the Architect at no additional cost to the Owner. The various Contractors must cooperate in installing their

Work to the end that there will be no conflict of space required.

1.03 QUALITY ASSURANCE

- A. Use only thoroughly trained and experienced workmen, completely familiar with the items required and the manufacturer's correct recommended methods of installation. In acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of the installer.

1.04 LAWS, PERMITS, AND FEES

- A. The entire Mechanical Work shall comply with the rules and regulations of the City, Parish, and State in which this Project is being constructed, including the State Fire Marshal and State Board of Health. All modifications required by these authorities shall be made without additional charge to the Owner. The Mechanical Contractor shall report these changes to the Architect and secure his approval before Work is started.
- B. In addition to the codes heretofore mentioned, all Mechanical Work and equipment shall conform to the applicable portions of the following specifications, codes, and regulations:
 - 1. American Society of Heating, Refrigeration & Air Conditioning Engineers
 - 2. National Electric Code
 - 3. National Fire Protection Association
 - 4. American Society of Mechanical Engineers
 - 5. International Mechanical Code
- C. The Contractor shall pay all fees for permits, inspections, etc. and arrange with the proper authorities and utility companies for all the service connections, verifying locations and arrangements and paying all charges pertaining thereto.

1.05 PRODUCT HANDLING

- A. Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed Work and Materials of all other Trades. In the event of damage, immediately make all repairs and replacements necessary for the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 VRF EQUIPMENT

- A. Furnish and install VRF Equipment where shown and as detailed on Plans.
- B. All Model Numbers indicate the selection and type of equipment and shall be updated by Supplier to the latest Model and Version.
- C. Refer to Specifications Section 15210 and 15220 for VRF Equipment and other Requirements.

2.02 EXHAUST FANS/SUPPLY FANS

- A. Provide and install supply/exhaust fans where shown, as detailed, and as scheduled on Plans.
- B. Fans shall be supplied with backdraft dampers. All motors shall be 40°C rise type, voltage/HP as scheduled.

2.03 PIPING, PIPE, FITTINGS

- A. Condensate Drains shall be Type "M" copper pipe and fittings. Utilize "Bridgit" Solder.
- B. Refrigerant Piping shall be type "L" ACR tubing or type "L" dead soft sealed and dehydrated refrigerant tubing. Use rigid in all exposed areas.

2.04 INSULATION

- A. After all Work has been tested and found to be tight and accepted as such by the Engineer, insulate as follows:
- B. Refrigeration Suction Lines shall be insulated with 3/4" "IMCOLOCK" closed cell polyolefin foam insulation, K factor = 0.24 at 75°F, flame spread 25, smoke density 50. Refrigerant liquid lines that run through attics shall be insulated with 1/2" "IMCOLOCK". Condensate Drains shall be insulated with 3/8" "IMCOLOCK". All field cut joints and seams shall be sealed by troweling a bedding coat of mastic, applying Glassfab or Foster "MAST-A-FAB" and thoroughly sealing with mastic. Mastic shall be Foster "SAFETEE C.I. MASTIC" No. 65-07 or approved equal. Insulation subject to weather shall have two (2) coats of mastic. NOTE: Armaflex or Rubatex insulation is acceptable.

2.05 FILTERS

- A. Outside air prefilter shall be Permatron Lifetime Electrostatic, 2", model IN-2 or equal. Filters shall be shrinkproof up to 250°F, UL approved label, washable two (2) units each with four (4) layers of fabric in galvanized frames, separated by accumulator chamber when mounted in sheet metal frame with baked enamel finish. Frame to have drain holes in each side for washing out dust and pollen. Filters are distributed by Taylor-Siedenback, Inc. - New Orleans, LA.
- B. All other filters besides outside air shall be pleated 2". Filters shall be mounted in filter back grilles. Verify proper sizes prior to ordering.
- C. Any unit run during construction shall be minimum double filtered to prevent construction dust from entering unit. Contractor shall be responsible for having to clean all units if units are found to contain construction dust.

2.06 GRILLES, DAMPERS, LOUVERS, ETC.

- A. This Contractor shall furnish and install in ductwork all dampers, vanes, splitters, etc. as shown on the Drawings or that may be necessary to make the system complete.
- B. Provide vanes behind every supply grille or diffuser. Splitter shall be provided where shown on Plans, and where located in concealed non-accessible space, provide young regulator to operate splitter. Vanes shall be Tuttle & Bailey "ducturn", Barber-Colman "Uniflo", or equivalent. Shop fabricated vanes will be acceptable.
- C. All dampers shall be constructed of 14 gauge steel.
- D. For the purpose of establishing type and class of diffusers and registers required, the scheduled model numbers were taken from the Metalaire Catalog. Diffusers and registers of equivalent quality will be accepted. See Plans for Schedule. Titus, Reliable, Enviro-air, and Krueger are acceptable.
- E. Exhaust, intake, and door grilles shall be as manufactured by Metalaire or equivalent and shall be of style called for on Plans. Grilles as manufactured by Titus, Reliable, and Enviro-Air are acceptable.
- F. All supply outlets and registers shall have sponge rubber gasket.
- G. All grilles, diffusers and registers shall be of sizes as indicated on Plans or

scheduled Drawings.

- H. Unless otherwise shown on Drawings, all diffusers, grilles, or registers installed in ceilings shall be furnished with white baked on enamel finish. All door grilles and registers installed in doors or walls shall have aluminum finish suitable for painting by Painting Subcontractor.

2.07 LOW VELOCITY DUCTWORK

- A. Furnish and install all ducts for all air conditioning, heating, and ventilation systems as shown on Plans and as may be required to provide a complete system. Ductwork shall be complete with all vanes, grilles, flashings, louvers, reinforcing angles, etc.
- B. All ductwork shall be galvanized steel and shall be of construction as recommended by the Sheet Metal and Air Conditioning Contractor's National Association's Application Standards. Gauges shall be as follows with longest side governing:

<u>Dimension of longest side</u>	<u>Sheet Metal Gauge</u>
0" - 24"	24 ga.
25" - 40"	22 ga.
41" - 72"	20 ga.
73" - 84"	18 ga.

- C. Submittals are required on duct liner, adhesives, duct wraps, flexduct, turning vanes, fire dampers, flexible connections, spin-taps, etc.
- D. Joints and reinforcing shall be as per SMACNA Application Standards and all slips shall be installed with edge of internal part of slip facing downstream.
- E. All edges shall be straight and true and all bends shall be made with vaned turns. Where long radius turns cannot be used, the Contractor shall use square turns with turning vanes spaced not more than 4" center-to-center and of a length so air will be properly distributed over ducts.
- F. All ductwork shall be properly braced to prevent rattling, breathing, or other unnecessary noise. No sharp edge of obstructions shall project into air stream.
- G. Duct dimensions shown are interior clear dimensions and need not be increased for insulation. All duct connections to low pressure equipment shall be made with flexible connections (neoprene coated flexible fabric), UL listed/approved.

- H. Provide and install extractors, adjustable splitters, etc., where shown on Plans. Where round duct taps are made to rectangular duct, they shall be performed with the use of "spin-taps" with damper and air scoop, Air Control Products model S-SM-D. Provide and install with extensions on all damper shafts to exterior of insulation.
- I. Damper of the fusible link operated type shall be provided in all ductwork passing through floors or firewalls. See Plans for locations of fire dampers and smoke dampers. Fire dampers for rectangular duct through firewalls shall be RUSKIN or equal, model 1BD2, style C, dynamic. Fire dampers for round duct shall be RUSKIN or equal, Model FDR25, dynamic only. Provide and install with access doors as required in NFPA.
- J. All ductwork to be externally wrapped unless other wise specifically noted on the Plans as lined. Only if noted specifically on the Drawings as "Lined", supply and return air plenums utilized for air conditioning and heating shall be internally lined with 1" thickness, 2# density duct liner, CSG "Ultralite Duct Liner" or equal for conditioned spaces and 1 ½" for unconditioned. Insulation shall have a flame spread classification of 25 or less, a smoke developed rating of 50 or less and a fuel contribution rating of 50 or less and conform to NFPA 90-A, 90-B and all applicable State of Louisiana Fire Codes. Insulation shall have a "K" factor of 0.23 BTU in/hr-sq.ft. °F at 50°F mean temperature. All portions of duct to receive duct liner shall be completely covered with liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. Duct liner shall be adhered to the metal with 100% coverage of adhesive 3M #4230 to form tight seals. The liner shall be additionally secured to metal with mechanical fasteners, (stick pin, welded pin, or grip pin), maximum 18" o.c. in the longitudinal direction and 12" o.c. in the transverse direction. Joints of ducts shall be sealed on exterior utilizing "Hard Cast" DT5300, 3" tape secured with "Hard Cast" FTA20 adhesive. Further insulate rectangular ductwork in attic by externally wrapping with 2" thickness commercial ductwrap.
- K. Round ductwork that is indicated as flexduct shall be ATCO UPC #031-R-8 or Hart & Cooley F218: R-8.0 flexible duct, Class I, UL 181. Inner core shall be two (2) ply polyester core encapsulating a galvanized steel helix wire. Insulation shall be 2" thickness fiberglass covered with a metalized polkyester vapor barrier. Duct shall be capable of withstanding 6" w.c. positive pressure (12" diameter and smaller) and 4" w.c. (14" and larger) and velocity to 4,000 fpm. Duct shall have a maximum flame spread of 25 and maximum smoke developed rating of 50. Flexible duct shall be hung from sheet metal saddles 6" wide minimum. Utilized metal elbows where required to prevent dimensional contortion. Install/seal in accordance with manufacturers recommendations.

- L. When not specifically indicated as internally lined duct all rectangular and round duct shall be insulated with external ductwrap. Round ductwork shall be rigid or flexible metal, "Joval", "Metalaire", "Clevaflex", or equal. All joints of round metal duct shall be wrapped with 2" wide cloth/polyethylene tape, National Tape Corp. No. 182 or No. 184 (transverse and longitudinal joints). All duct shall be externally wrapped with 2", 0.75# density faced ductwrap in conditioned spaces and 2 3/16" in unconditioned spaces; the facing shall be foil kraft laminate, Commercial Grade type 75 as manufactured by Owens/Corning Fiberglass Corp. The insulation shall have a flame spread rating of 25 or less, fuel contributed rating of 50 or less, and a smoke developed rating of 50 or less. The "K" factor shall be 0.27 BTU-in/hr.-F°-sq.ft. at 50° mean temperature and a vapor permeability of 0.02 perms, maximum. Ductwrap shall be applied over clean, dry ductwork, after all duct has been made air tight. Insulation shall be butted tightly at joints, and vapor barrier facing shall be overlapped at a minimum of 2" (remove insulation from overlap). All vapor barrier seams shall be stapled 6" o.c. with outward clenching staples, then sealed with a vapor barrier mastic, "Hard Cast" or equal.
- M. Maximum length of flexible ductwork allowed per diffuser drop shall be 6'.

2.08 TEMPERATURE CONTROLS

- A. Furnish and install a completely automatic electric temperature control system to be provided with ac equipment. System shall be from one manufacturer and not a put together system. The control system shall be designed specifically by the equipment manufacturer for all the new equipment installed.
- B. The Mechanical Subcontractor shall provide and install all conduit, raceways, conductors, etc. required for the installation of control wiring. Wiring between air units and condensing units and fresh air fans is by Mechanical Sub-contractor. Electrical Subcontractor is responsible for line voltage connections.
- C. Thermostats shall be Electronic, as indicated on the control drawings.
- D. Outside Air Damper system and controls shall be provided and installed by Mechanical Contractor.
- E. Provide all Software for local computer control and remote access and control of all New HVAC Equipment.
- F. Interlock New Dedicated Outside Air System (DOAS) with all the exhaust fans in the building.

2.09 OTHER EQUIPMENT

- A. All other ac equipment indicated or schedule shall meet the type, form, function, performance, and look of the scheduled equipment. If not scheduled it shall meet function of equipment indicated on the plans. Prior approvals are still required for substitutions.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Prior to all Work of this Section, carefully inspect the installed Work of other Trades and verify that all such Work is complete to the point where this installation may properly commence.
- B. Verify that the Work of this Section may be installed in accordance with all pertinent codes and regulations and the approved Shop Drawings.
- C. In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
- D. Refer to Specifications Section 15210 and 15220 for additional items and work.

3.02 INSTALLATION OF EQUIPMENT

- A. Avoid interferences with structure and the Work of other Trades; do not cut into load carrying members without the specific approval of the Architect.
- B. Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, that all items function properly and that all adjustments have been made.

3.03 REFRIGERANT PIPING INSTALLATION, LEAK TESTING, EVACUATION & CHARGING

- A. Contractor shall provide a completed operational system. Refer to Specifications Section 15210 and 15220 for requirements and additional work.
- B. Charging - System shall be charged following the manufacturer's recommendation after system has been properly evacuated. NOTE: The system is multiple evaporator with single condensing unit and various accumulator accessories. The proper refrigerant charge is most important and the manufacturer's

instructions shall be strictly adhered to.

3.04 BALANCING

- A. Procure the services of a qualified firm which specializes in the balancing and testing of heating, ventilating, and air conditioning systems to balance, adjust and test air moving equipment herein specified. All Work by this agency shall be done under direct supervision of a registered heating and ventilation engineer employed by them. All instruments used by this agency shall be accurately calibrated and maintained in good working order. If requested, the test shall be conducted in the presence of the Mechanical Engineer responsible for the Project and/or his representative.
- B. Air balance and system test shall not begin until system has been completed and is in full working order. The HVAC Contractor shall put all heating, ventilation, and air conditioning systems and equipment into full operation.
- C. Test and balance agency shall include an extended warranty of 90 days, after completion of test and balance work, during which time the Engineer at his discretion may request a recheck or resetting of any outlet, supply air fan or exhaust fan as listed in test report. The agency shall provide technicians to assist the Engineer in making any test he may require during this period of time. The balancing agency shall submit four (4) copies of compiled test data typed neatly and inserted in a loose leaf binder.
- D. Mechanical Contractor shall award the Test and Balancing Subcontractor to the approved agency within 30 days after initial Construction Contract, to allow the balancing agency to schedule this Work in cooperation with other Trades, review Drawings and note balancing devices required in addition to those shown on Drawings.
- E. Upon completion of the air conditioning system, the HVAC Contractor, as part of his Contract, shall prepare the air systems for balancing by starting up the system as specified, including the following:
 - 1. Check fan for proper clearances and keys, keyways, lock tight all set screws, including drive.
 - 2. Set drive at designed rpm.
 - 3. Correct size heater in motor starters.
 - 4. Open all dampers.
 - 5. Set and calibrate automatic controls.
 - 6. Access doors at smoke, fire and large balancing dampers.
 - 7. Close all access doors and plates.

8. Fusible links installed and fire dampers open.
9. Filters installed.
10. All outlets, returns, intake and louvers installed and connections made air tight.
11. Installation of volume dampers downstream of pressure switches and reheat coils.
12. Mixing box linkages, motors, and thermostats are properly installed and operative.

F. The balancing agency shall perform the following, and balance the air systems in accordance with the following requirements:

1. Test and adjust lowest rpm to obtain design requirements.
2. Test and record motor full load amperes.
3. Make pitot tube transverse of main supply ducts and obtain design cfm at fans.
4. Test and record system static pressure, suction and discharge.
5. Test and adjust system for design cfm outside air.
6. Test and adjust system for design recirculated air, cfm.
7. Test and record entering air temperature, (D.B. heating and cooling) before coils.
8. Test and record entering air temperature, (D.O. after heating and cooling coils).
9. Test and record leaving air temperature, (D.O. after heating and cooling coils).
10. Test and record leaving air temperature, (W.B. cooling).
11. Adjust all main supply and return air ducts to proper design cfm.
12. Adjust all zones to proper design cfm, supply and return.
13. Test and adjust each diffuser, grille and register to within 10% of design requirements.
14. Each grille, diffuser, and register shall be identified as to location and area.
15. Size, type and manufacturer of diffuser, grille, register and all tested equipment shall be identified and listed.
16. Readings and test of diffusers, grilles, and registers shall include required rpm velocity and test resultant cfm after adjustments.
17. In cooperation with the control manufacturer's representative setting adjustments of automatically operated dampers to operate as specified, indicated and/or noted. Testing agency shall check all controls for proper calibration and list all controls, requiring adjustment by control installers.
18. All diffusers, grilles, and registers shall be adjusted to minimize drafts in all areas.
19. As a part of the Work of this Contract, the Mechanical Contractor shall

make any changes in the pulleys, belts and dampers of the addition of dampers required for correct balance as recommended by Balancing and Testing Agency, at no expense to the Owner.

- G. Upon completion, all information shall be inserted on a sheet listing all items required by Specifications and be included in complete test and balance report. All sheets shall be neatly typed.

END OF SECTION 15200

SECTION 15210 – MECHANICAL HVAC VRF

Part 1 – General

1.01 SYSTEM DESCRIPTION

The variable capacity, heat pump heat recovery air conditioning system shall be a VRF (Variable Refrigerant Flow) zoning system.

The system shall consist of a outdoor unit, BC (Branch Circuit) Controller, multiple indoor units, and DDC (Direct Digital Controls) system. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.

1.02 QUALITY ASSURANCE

- A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.
- E. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendation.

1.04 CONTROLS

- A. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network.

Operators shall be able to perform all normal operator functions through the web browser interface.

- B. System controls and control components shall be installed in accordance with the manufacturer's written installation instructions.
- C. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.
- D. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.
- E. Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.
- F. System shall be capable of email generation for remote alarm annunciation.
- G. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in the equipment manufacturer's dedicated controls system configuration and operation. The representative shall provide proof of certification from the manufacturer's training facility indicating successful completion of the current controls systems provided by the equipment manufacturer. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

Part 2 – Warranty

- 2.01 The units shall be fully covered by the manufacturer's limited warranty for a period of one (1) year from date of installation.

then the units shall be covered by an extended manufacturer's limited warranty for a period of five (5) years from date of installation.

In addition the compressor shall have a manufacturer's limited warranty for a period of seven (7) years from date of installation.

If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

This warranty shall not include labor.

- 2.02 Manufacturer shall have a extensive experience with VRF HVAC systems in the U.S. market.
- 2.03 All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

2.04 The VRF system shall be installed by a contractor approved and certified by the Manufacturer of the VRF systems as having extensive VRF install and service training with the Manufacturers systems. The mandatory contractor service and install training should be performed by the manufacturer.

Part 3 – Products

3.01 OUTDOOR UNIT – VRF HEAT PUMP

A. General:

The outdoor unit shall be used specifically with VRF components. The outdoor units shall be equipped with multiple circuit boards that interface to the direct digital controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.

1. The model nomenclature and unit requirements are shown below. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected from that indicated in the schedules and schematics on the plans, any additional material, cost, and labor to install additional lines shall be incurred by the contractor. The following table indicates the twinning kit required for the scheduled units (not all units are utilized):

Outdoor Unit Model Nomenclature		
460 Volt		Twinning Kit
Model Number	Units	
PURY-P72YKMU	(1) PURY-P72YKMU	None
PURY-P96YKMU	(1) PURY-P96YKMU	None
PURY-P120YKMU	(1) PURY-P120YKMU	None
PURY-P144YKMU	(1) PURY-P144YKMU	None
PURY-P144YSKMU	(2) PURY-P72YKMU	CMY-R100CBK2

Outdoor Unit Model Nomenclature		
PURY- P168YSKMU	(1) PURY- P96YKMU	CMY- R100CBK2
	(1) PURY- P72YKMU	
PURY- P192YSKMU	(2) PURY- P96YKMU	CMY- R100CBK2
PURY- P216YSKMU	(1) PURY- P96YKMU	CMY- R100CBKXL
	(1) PURY- P120YKMU	
PURY- P240YSKMU	(2) PURY- P120YKMU	CMY- R100CBKXL
PURY- P264YSKMU	(1) PURY- P120YKMU	CMY- R100CBKXL
	(1) PURY- P144YKMU	
PURY- P288YSKMU	(2) PURY- P144YKMU	CMY- R100CBKXL

2. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation. If the unit selected by the contractor does not meet the required sound level then any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor. Modification of the unit to lower the sound level of the unit to the maximum dB(A)'s indicated shall be done at the Manufacturers factory with their approval and shall not impede performance, longevity, and ease of maintenance of the unit. System shall not be field modified or modified at the supplier's (sales representative) facility. Final sound levels attained by the Manufacturer of the modified unit shall be provided in writing on their letterhead from the Manufacturer to the Engineer before acceptance of the equipment.
3. Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller (Single or Main) shall be insulated in accordance with the installation manual.
4. There shall be no more than 3 branch circuit controllers connected to any one outdoor unit.

5. Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.
6. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
7. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
8. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet and have total refrigerant tubing length of 1804-2625 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.
9. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperatures or cooling mode down to 23°F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.
10. The outdoor unit shall be capable of operating in cooling mode down to -10°F with optional manufacturer supplied low ambient kit.
11. Manufacturer supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
12. Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
13. Manufacturer supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
14. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
15. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.
16. Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend “no or reduced heating” periods shall not be allowed.

B. Unit Cabinet:

1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (-BS models)

C. Fan:

1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.
2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
3. All fan motors shall be mounted for quiet operation.
4. All fans shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have vertical discharge airflow.

D. Refrigerant

1. R410A refrigerant shall be required for VRF dedicated outdoor unit systems.
2. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

E. Coil:

1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

F. Compressor:

1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.
2. A crankcase heater(s) shall be factory mounted on the compressor(s).

3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.
4. The compressor will be equipped with an internal thermal overload.
5. The compressor shall be mounted to avoid the transmission of vibration.
6. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

G. Controls:

1. The outdoor unit shall have the capability of up to 8 levels of demand control for each refrigerant system

H. Electrical:

1. The outdoor unit electrical power shall be 460 volts, 3-phase, 60 hertz (verify all electrical requirements).
2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 414-506 volts.
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

I. Corrosion Protective Coating:

1. The outdoor unit shall be coated with a factory applied coating on the coil system to prevent corrosion and any other components as indicated in this section. The scheduled unit is indicated with this coating by the “-BS” designation in the model number and is considered a seacoast protection model.
2. The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.
3. The outdoor unit shall be installed in such a way as to achieve optimal drainage.
4. The outdoor unit shall be washed periodically to remove any corrosive residue.
5. The panels on the outdoor unit should be scratch free. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately.

6. The outdoor unit shall be inspected regularly and parts shall be painted or replaced as necessary.
7. The salt spray coating shall adhere to the following specifications:

Component	Base Material	Standard Models	Seacoast Protection Models (-BS)	Surface Treatment	Coating Thickness	
					External Surface	Internal Surface
External Panel Base	Alloyed Galvanized Steel Sheet	●	●	Thermoset Polyester-resin Powder Coating	≥70µm	≥70µm
External Front Panel	Alloyed Galvanized Steel Sheet	●		Polyester-resin Coating	≥15µm	≥5µm
			●	Thermoset Polyester-resin Powder Coating	≥85µm	≥75µm
Pillar	Alloyed Galvanized Steel Sheet	●		Polyester-resin Coating	≥30µm	
			●	Thermoset Polyester-resin Powder Coating	≥70µm	≥70µm
Compressor Cover	Galvanized Steel Sheet	●		No Treatment		
	Galvanized Aluminum Sheet		●	Thermoset Polyester-resin Powder Coating	≥70µm	≥70µm
Fin Guard	Steel Wires	●	●	Weather-resistant Polypropylene-resin Coating	≥300µm	≥300µm
Fan Guard and Drum	Weather-resistant Polypropylene Plastic	●	●	No Treatment		
Fan	Weather-resistant Acrylic Nitrile Styrene Plastic	●	●	No Treatment		
Fan Motor Frame	Galvanized Steel Sheet	●	●	No Treatment		
Fan Motor Shaft	High-carbon S35C Steel	●	●	Rust-prevention Coating		
Fan Motor Support	Galvanized Steel Sheet	●		No Treatment		
			●	Thermoset Polyester-resin Powder Coating	≥70µm	≥70µm
Heat Exchanger (Fin Only)	Aluminum Plate	●		Cellulose- and Polyurethane-resin Coating (<i>Blue Fin</i>) (no unusual rust development to 480 hours)	≥1µm	
			●	Cellulose- and Polyurethane-resin Coating (<i>Blue Fin</i>) (no unusual rust development to 960 hours)	≥1 - 1.5µm	
Electrical Parts Box	Galvanized Steel Sheet	●		No Treatment		
	Galvanized Aluminum Sheet		●	Thermoset Polyester-resin Powder Coating	≥70µm	
Printed Circuit Board	Epoxy Resin	●		No Treatment		
			●	Polyurethane Coating	≥10µm	
Screws	Steel	●	●	Zinc-nickel Alloy Plating with a Chromate Film	≥5µm	

3.02 BRANCH CIRCUIT (BC) CONTROLLERS FOR THE VRF SYSTEMS

A. General

The BC (Branch Circuit) Controllers shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance;

alternate branch devices with no subcooling risk bubbles in liquid supplied to LEV and are not allowed.

The BC (Branch Circuit) Controllers shall be specifically used with R410A systems. These units shall be equipped with a circuit board that interfaces to the DDC system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

B. BC Unit Cabinet:

1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant

1. R410A refrigerant shall be required.

D. Refrigerant valves:

1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and up to three indoor units. Branches may be twinned to allow more than 54,000 BTUH.
2. Each branch shall have multiple two-position valves to control refrigerant flow.
3. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.
4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

E. Integral Drain Pan:

1. An Integral drain pan and drain shall be provided

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz) – contractor to verify voltage.
3. The BC Controller shall be controlled by integral microprocessors

4. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

3.03 4-WAY CEILING-RECESSED CASSETTE WITH GRILLE INDOOR UNIT

A. General

1. The unit that is scheduled (RE: Plans) as a PLFY-P**NBMU-ER2 shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns for different ceiling heights. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:

1. The cabinet shall be space-saving ceiling-recessed cassette.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
3. Branch ducting shall be allowed from cabinet.
4. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.
5. The grille vane angles shall be individually adjustable from the wired remote controller to customize the airflow pattern for the conditioned space

C. Fan:

1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of five (5) speed settings, Low, Mid1, Mid2, High and Auto.
4. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
5. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.

6. The indoor unit shall have switches that can be set to provide optimum airflow based on ceiling height and number of outlets used.
 7. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution.
- D. The vanes shall have an Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space. Filter:
1. Return air shall be filtered by means of a long-life washable filter
- E. Coil:
1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
 2. The tubing shall have inner grooves for high efficiency heat exchange.
 3. All tube joints shall be brazed with phos-copper or silver alloy.
 4. The coils shall be pressure tested at the factory.
 5. A condensate pan and drain shall be provided under the coil.
 6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.
 7. Both refrigerant lines to the PLFY indoor units shall be insulated in accordance with the installation manual.
- F. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
 2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz) – contractor to verify voltage.
- G. Controls:
1. This unit shall use controls provided by the equipment manufacturer to perform functions necessary to operate the system.
 2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

3.04 4-WAY CEILING-RECESSED CASSETTE WITH GRILLE - INDOOR UNIT

A. General:

1. The air unit that is scheduled (RE: Plans) as a PLFY-P**NCMU-ER4 shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:

1. The cabinet shall be a compact 22-7/16" wide x 22-7/16" deep so it will fit within a standard 24" square suspended ceiling grid.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
3. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.

C. Fan:

1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
4. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
5. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

D. Filter:

1. Return air shall be filtered by means of a long-life washable filter.

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4" inches above the condensate pan.
7. Both refrigerant lines to the PLFY indoor units shall be insulated in accordance with the installation manual.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

G. Controls:

1. This unit shall use controls provided by equipment manufacturer to perform functions necessary to operate the system.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

3.05 1-WAY CEILING-RECESSED CASSETTE WITH GRILLE- INDOOR UNIT

A. General:

The air unit that is scheduled (RE: Plans) as a PMFY shall be a one-way cassette indoor unit that recesses into the ceiling with a ceiling grille and shall have a modulating linear expansion device. The unit shall be used with the VRF outdoor unit and BC Controller. The air unit shall support individual control using the DDC controllers.

B. Indoor Unit.

The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:

1. The cabinet shall be space-saving ceiling recessed.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
3. Branch ducting shall be allowed from cabinet.
4. The one-way grille shall be fixed to bottom of cabinet allowing for one-way airflow.

D. Fan:

1. The indoor fan shall be an assembly with one line-flow fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of four (4) speeds, Low, Mid1, Mid2, and High.

E. Filter:

1. Return air shall be filtered by means of a long-life washable permanent filter.

F. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.

3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism able to raise drain water 23 inches above the condensate pan.
7. Both refrigerant lines to the indoor units shall be insulated in accordance with the installation manual.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

H. Controls:

1. This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system. Please refer to Part 5 of this guide specification for details on controllers and other control options.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

3.06 CEILING-CONCEALED DUCTED INDOOR UNIT

A. General:

The air unit that is scheduled (RE: Plans) as a PEFY shall be a ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device. The air unit shall be used with the VRF outdoor unit and BC Controller. The air unit shall support individual control using DC controllers.

B. Indoor Unit.

The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:

1. The unit shall be, ceiling-concealed, ducted.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

D. Fan:

1. The schedule air unit shall feature external static pressure settings from 0.14 to 0.60 in. WG.
2. The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
3. The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
4. The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function
5. The indoor unit shall have a ducted air outlet system and ducted return air system.

E. Filter:

1. Return air shall be filtered by means of a standard factory installed return air filter.

F. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The condensate shall be gravity drained from the fan coil.

7. Both refrigerant lines to the indoor air units shall be insulated in accordance with the installation manual.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

H. Controls:

1. This unit shall use controls provided by Mitsubishi Electric Cooling & Heating to perform functions necessary to operate the system. Please refer to Part 5 of this guide specification for details on controllers and other control options.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

Part 4 – Controls

4.01 Overview

A. General:

The equipment manufacturer shall provide a DDC system that is designed for the equipment to be installed and shall be capable of supporting remote controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet[®] and LonWorks[®]. This control system shall also include the equipment indicated in Section 15220 – Mechanical HVAC VRF DOAS.

4.02 Electrical Characteristics

A. General:

The DDC controls shall operate at 30VDC. Controller power and communications shall be via a common non-polar communications bus.

B. Wiring:

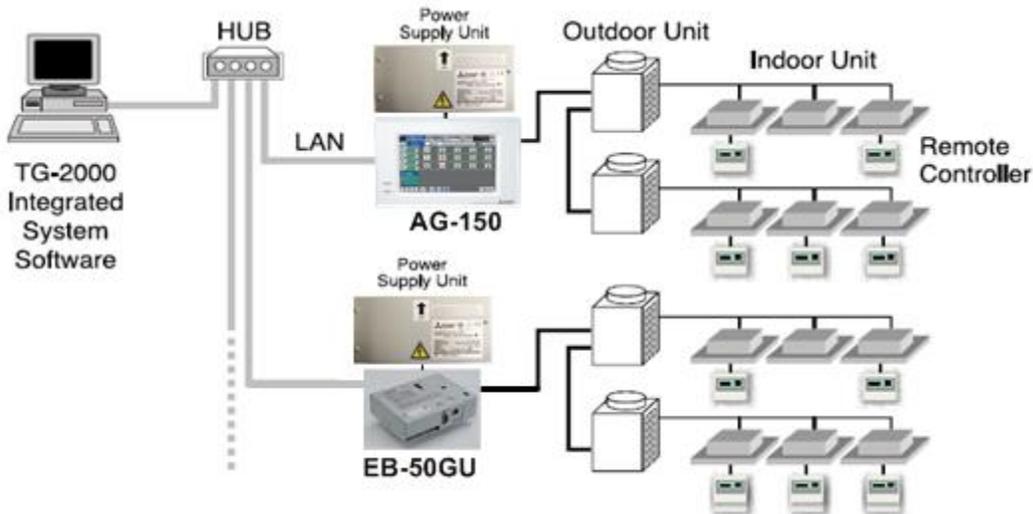
1. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
2. Control wiring for the remote controller shall be from the remote controller to the first associated indoor unit with a TB-5 DDC connection. The remote controller panel shall be assigned an M-NET address.
3. Control wiring for the remote controller panels shall be from the remote controller (receiver) to the first associated indoor unit then to the remaining associated indoor units in a daisy chain configuration.
4. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.
5. The main panel centralized controller shall be capable of being networked with other sub and main panel centralized controllers for centralized control of all systems.

C. Wiring type:

1. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.
2. Network wiring shall be CAT-5 with RJ-45 connection.

4.03 Controls Network

The controls network consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks[®] or BACnet[®] interfaces. The below figure illustrates a sample CMCN System Configuration for the manufacturer of the scheduled system (RE: Plans).



CMCN System Configuration

A. Remote Controllers - Backlit Simple Remote Controller

The Backlit Simple MA Remote Controller (scheduled as a PAC-YT53CRAU) shall be capable of controlling up to 16 indoor units (defined as 1 group). The Backlit Simple MA Remote Controller shall be compact in size, approximately 3” x 5” and have limited user functionality. The Backlit supports temperature display selection of Fahrenheit or Celsius. The Backlit Remote Controller shall allow the user to change on/off, mode (cool, heat, auto, dry, setback, and fan, temperature setting, and fan speed setting and airflow direction. The Backlit Remote Controller shall be able to limit the set temperature range from the Backlit Simple MA. The Backlit Simple MA Remote controller shall be capable of night setback control with upper and lower set temperature settings. The room temperature shall be sensed at either the Backlit Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Backlit Remote Controller shall display a four-digit error code in the event of system abnormality/error.

The Backlit Remote Controller shall only be used in same group with other Backlit Remote Controllers, with up to two remote controllers per group.

The Backlit Remote Controller shall require no addressing. The Backlit Simple MA Remote Controller shall connect using two-wire, stranded, non-polar control wire to type TB15 connection terminal on the indoor unit. The Simple MA Remote Controller shall require cross-over wiring for grouping across indoor units.

Backlit Remote Controller			
Item	Description	Operation	Display
ON/OFF	Run and stop operation for a single group	Each Group	Each Group

Backlit Remote Controller			
Item	Description	Operation	Display
Operation Mode	Switches between Cool/Drying/Auto/Fan/Heat/Setback. Operation modes vary depending on the air conditioner unit. Auto and Setback mode are available for the R2/WR2-Series only.	Each Group	Each Group
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit. Separate COOL and HEAT mode set points available depending on central controller and connected mechanical equipment.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Group	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions.	N/A	Each Group *1
Display Indoor Unit Intake Temp	Measures and displays the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Display Backlight	Pressing the button lights up a backlight. The light automatically turns off after a certain period of time. (The brightness settings can be selected from Bright, Dark, and Light off.)	N/A	Each Unit
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed	N/A	Each Unit
Test Run	Operates air conditioner units in test run mode. *2 The display for test run mode will be the same as for normal start/stop (does not display “test run”).	Each Group	Each Group *2
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit.	Each Group	N/A
Set Temperature Range Limit	Set temperature range limit for cooling, heating, or auto mode.	Each Group	Each Group

4.04 Centralized Controller (Web-enabled)

A. Centralized Controller

The Centralized Controller (scheduled as an AE-200A) shall be capable of controlling a maximum of two hundred (200) indoor units across multiple outdoor units with the use of three (3) expansion controllers. The AE-200A Centralized Controller shall be approximately 11-5/32" x 7-55/64" x 2-17/32" in size and shall be powered with an integrated 100-240 VAC power supply. The Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. When being used alone without the expansion controllers, the Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the Centralized Controller shall include on/off, operation mode selection cool, heat, auto, dry, setback and fan, temperature setting, fan speed setting, and airflow direction setting. The centralized control shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the AE-200A Centralized Controller shall allow the user to define both daily and weekly schedules for up to 24 scheduled events per day with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

Centralized Controller			
Item	Description	Operation	Display
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collective
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat. (Group of Lossnay unit: automatic ventilation/vent-heat/interchange/normal ventilation) Operation modes vary depending on the air conditioner unit.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature from 57°F – 87°F depending on operation mode and indoor unit.	Each Block, Group or Collective	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group

Centralized Controller			
Item	Description	Operation	Display
Schedule Operation	<p>Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available.</p> <p>*1. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority.</p> <p>Twenty-four events can be scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition.</p> <p>Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.</p>	*2 Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Night Setback Setting	The function helps keep the indoor temperature in the temperature range while the units are stopped and during the time this function is effective.	Each Group	Each Group
Permit / Prohibit Local Operation	<p>Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter).</p> <p>*3. Centrally Controlled is displayed on the remote controller for prohibited functions.</p>	Each Block, Group or Collective	*3 Each Group
Room Temp	Displays the room temperature of the group. Space temperature displayed on the indoor unit icon on the touch screen interface.	N/A	Each Group
Error	<p>When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed</p> <p>*4. When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection</p>	N/A	*4 Each Unit or Collective
Outdoor Unit Status	Compressor capacity percentage and system pressure (high and low) pressure (excludes S-Series)	Each ODU	Each ODU
Connected Unit Information	MNET addresses of all connected systems	Each IDU, ODU and BC	Each IDU, ODU and BC

Centralized Controller			
Item	Description	Operation	Display
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between “Hi”, “Low” and “Stop”. When setting a group of only free plan LOSSNAY units, you can switch between “Normal ventilation”, “Interchange ventilation” and “Automatic ventilation”.	Each Group	Each Group
Multiple Language	Other than English, the following language can be chosen. Spanish, French, Japanese, Dutch, Italian, Russian, Chinese, and Portuguese are available.	N/A	Collective
External Input / Output	By using accessory cables you can set and monitor the following. Input By level: “Batch start/stop”, “Batch emergency stop” By pulse: “batch start/stop”, “Enable/disable remote controller” Output: “start/stop”, “error/Normal” *5. Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective

All Centralized Controllers shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to a network switch for IP communication to up to three expansion controllers for display of up to two hundred (200) indoor units on the main centralized controller interface.

The Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.

Standard software functions shall be available and provided so that the building manager can securely log into each centralized controller via the PC’s web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Software functions shall be included for personal browsers for PCs and MACs. Tenant Billing shall be available but are not required to be included in the software. The system shall be capable of adding the tenant billing function with integrated system software in conjunction with the Centralized Controllers.

B. Expansion Controller

The Expansion Controller (scheduled as AE-50A) shall serve as a standalone centralized controller or as an expansion module to the Centralized Controller for the purpose of adding up to 50 indoor units to either the main touch screen interface of the centralized controller.

Up to three (3) expansion controllers can be connected to the centralized controller via a local IP network (and their IP addresses assigned on the centralized controller) to the centralized controller to allow for up to two hundred (200) indoor units to be monitored and controlled from the centralized controller interface.

The expansion controllers have all of the same capabilities to monitor and control their associated indoor units as the features specified above. Even when connected to the centralized controller and configured to display their units on the main controller, the individual indoor units connected to the expansion controller can still be monitored and controlled from the interface of the expansion controller. The last command entered will take precedence, whether at the wall controller, the expansion controller or the Centralized Controller.

4.05 Central Controller (Non-Web)

A. Touch Controller

The Touch Controller (scheduled as a TC-24 on plans) features a 5 inch wide color LCD touch panel. The settings for air conditioning units can be changed by touching the corresponding icons on the display. There are 3 buttons on the panel of the touch controller; ON/OFF, SET BACK and HOLD enabling simple and quick batch operation. One touch controller can control up to 24 groups/units of air conditioners. Operation status is displayed on easy-to-read LCD. The group currently operating can be seen at a glance with the operation status display. The touch controller can perform functions such as ON/OFF, Operation mode changeover, temperature setting and prohibit operation by local remote controller. Up to 12 patterns of weekly schedule can be set. "ON/OFF", "Operation mode", "Set Temperature", "Fan speed", "Air flow direction" and "Permit / Prohibit local operation" can be scheduled with up to 16 settings in one pattern. Up to 5 patterns of today's schedule can be set. Independent LOSSNAY operation is possible. Automatic ventilation, Normal ventilation and Ventilation with heat exchanger can be switched from the system controller. The touch controller is equipped with a system changeover function which an operation mode can be switched to an optimal mode depending on indoor temperature setting and target temperature of each group or a representative indoor unit.

Touch Controller			
Item	Description	Operation	Display
ON/OFF	ON and OFF operation for the air conditioner units. Even when only a single indoor unit connected to the group remote controller will operate and collective ON/OFF lamp will light up.	Group or Collective	Group or Collective
Operation Mode Switching	Switches between Cool / Dry / Auto / Fan / Heat / Setback. Operation modes vary depending on the air conditioner unit.	Group or Collective	Group or Collective

Touch Controller			
Item	Description	Operation	Display
Temperature Setting	Set temperature from 57° F - 87° F depending on operation mode and indoor unit. Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.	Group or Collective	Group or Collective
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Group or Collective	Group or Collective
Air Flow Direction Setting	Air flow direction angles 4-angle or 5-angle, Swing, Auto Louver ON/OFF * Air flow direction settings vary depending on the indoor unit model.	Group or Collective	Group or Collective
Hold	Hold Prohibits the scheduled operation from being executed. a. ON/OFF timer b. Auto-OFF timer c. Weekly timer d. Automatic return to the preset temperature * While an operation is prohibited by Hold function, the operation icon lights up.	Group or Collective	Group or Collective
Permit / Prohibit	When set as the master, the ON/OFF, operation mode, setting temperature and filter sign reset operations using the local remote controllers can be prohibited. Only ON/OFF and filter reset can be prohibited for the LOSSNAY group.	Group or Collective	Group or Collective
Operation Lock	(ON/OFF, operation mode, setting temperature, fan speed, Air flow direction)	Group or Collective	Group or Collective
Room Temp Display	The room temperature can be displayed.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed. * When an error occurs, the "ON/OFF" LED flashes. The operation monitor screen show abnormal icon over the unit. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection.	N/A	Each Unit, Group, or Collective
Schedule Operation	Weekly schedule setting up to 12 patterns is available. In one pattern, up to 16 setting of "ON/OFF", "Operation mode", "Set Temperature", "Fan speed", "Air flow direction" and "Permit / Prohibit local operation" can be scheduled. Today's schedule setting up to 5 pattern in available. *Time setting unit: 5 minute /unit	Each Group	Each Group

Touch Controller			
Item	Description	Operation	Display
Ventilation Operation (Independent)	Group operation of only the free plan LOSSNAY is possible. The operation mode of these groups is automatic ventilation, ventilation with heat exchanger and normal ventilation.	Group or Collective	Group or Collective
Ventilation Operation (Interlocked)	The LOSSNAY will run in interlock with the operation of indoor unit. The mode cannot be changed. The LED will turn ON during operation after interlocking.	Group or Collective	Group or Collective
Set Temperature Range Limit	The range of room temperature setting can be limited by the initial setting. The lowest limit temperature can be made higher than the usual (67°F) in cool/dry mode, while the upper limit temperature lower than the usual (83°F) in heat mode.	Group or Collective	Group or Collective
External Input / Output	By using accessory cables you can set and monitor the following. Input By level: "Batch start/stop", "Batch emergency stop" By pulse: "batch start/stop", "Enable/disable remote controller" Output: "start/stop", "error/Normal" Provide system with the external I/O cables (PAC-YG10HA-E).	Collective	Collective

4.06 Graphical User Workstation Software

The Graphical User Workstation Software shall be provided and installed on multiple owner provided workstations or servers.

A. Software

The Integrated System Software (scheduled Mitsubishi system to provide current TG-2000 for their system) shall enable the user to control multiple central and expansion controllers and shall provide additional functions such as tenant billing if required from a single, dedicated network PC configured with control software. The control software configured computer shall be capable of controlling up to forty Centralized Controllers with a maximum of 2,000 indoor units across outdoor units. The graphical user control software shall be required to be provided with the equipment and shall be dedicated software for the equipment provided by the manufacturer. Licensing of the software shall be included with the systems. Optional software features shall be available through the software including tenant billing.

Integrated System Software	
Item	Details
ON/OFF	The units can turn ON and OFF for all floors or in a block, floor, or group of units.
Operation	The operation mode can be switched between COOL, DRY, FAN,

Integrated System Software	
Item	Details
Modes	AUTO, and HEAT for all floors or in a block, floor, or group of units
Temperature Setting	Sets the temperature for a single group. Range of Temperature setting from 57°F – 87°F depending on operation mode and indoor unit model. Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.
Fan Speed	The fan speed can be set to four stages for all floors or in a block, floor, or group of units
Air Direction	The air direction can be set in four vertical directions or to swing for all floors or in block, floor, or group of units. (The selectable air direction differs according to the model.)
Interlocked Unit ON/OFF LOSSNAY	If there is an interlocked unit (LOSSNAY), then the unit can be turned ON (strong/weak) or OFF for all floors or in a block, floor, or group of units. (Note that the ventilation mode cannot be selected for interlocked units.)
Local Operation Prohibit	The items for which operation with the local remote controller are to be prohibited can be selected for all floors or in a block, floor, or group of units. (The items that can be prohibited are ON/OFF, operation mode, set temperature and filter sign reset.)
Annual / Weekly Schedule	The annual/weekly schedule function can be used by registering the license. Two settings, such as seasonal settings for summer and winter, can be saved.
Power Rate Apportionment Charging	A RS-485 watt-hour meter (WHM) is connected to calculate the air conditioning charges based on the amount each tenant's air-conditioner has operated. Two charging rates can be applied per day. This function will not be utilized at this time.
History	Up to 3,000 items for the error history and up to 10,000 items for operation history can be saved. Each history file can be output as a daily report or monthly report in CSV format. (The operation history consists only of the operations carried out with the control software and is limited to some limited operation items.)
Operation Time Monitor	The cumulative operation time of each indoor unit can be viewed or output as a CSV format file. This option is not to be utilized by the Owner at this time and the charging function is not to be used at this facility.
Filter Sign Display Mask	The filter sign display at the remote controllers can be disabled.
Set Temperature Limit	The set temperature lower limit can be set for cooling and the upper limit for heating. (This is used on ME remote controllers)

4.07 CMCN: System Integration

4.08 The CMCN shall be capable of supporting integration with Building Management Systems (BMS). Power Supply (Mitsubishi utilizes model PAC-SC51KUA)

The power supply shall supply 24VDC (TB3) for the centralized controller and 30VDC (TB2) voltage for the central control transmission.

Part 5 – Execution

5.01 Installation

A. General:

Rig and install in full accordance with manufacturer's requirements, project drawings, and contract documents. Refer to the manufacturer's installation manual for full requirements.

B. Location:

Locate indoor and outdoor units as indicated on drawings. Provide service clearance per manufacturer's installation manual. Adjust and level outdoor units on support structure. Secure units and piping to meet site wind loads.

C. Components / Piping:

Installing contractor shall provide and install all accessories and piping for a fully operational system. Refer to manufacturer's installation manual for full instructions.

Traps, filter driers, and sight glasses are NOT to be installed on the refrigerant piping or condensate lines.

Standard ACR fittings rated for use with R410A are to be used for all connections. Proprietary manufacturer-specific appurtenances are not allowed.

Refrigerant pipe shall be made of phosphorus deoxidized copper, and has two types.

A. ACR "Annealed": Soft copper pipe, can be easily bent with human's hand.

B. ACR "Drawn Temper": Hard copper pipe (Straight pipe), being stronger than Type-O pipe of the same radical thickness.

The maximum operation pressure of R410A air conditioner is 4.30 MPa [623psi] . The refrigerant piping should ensure the safety under the maximum operation pressure. Refer to recommend piping specifications in Mitsubishi Electric's engineering manual. Pipes of radical thickness 0.7mm or less shall not be used.

Flare connection should follow dimensions provided in manufacturer's installation manuals.

D. Insulation:

Refrigerant lines, as well as any valves, shall be insulated end to end with ½" closed-cell pipe insulation for piping up to 1" in diameter, or ¾" for piping 1-1/8" and larger, with a thermal conductivity no greater than 0.27 BTU-in/hr sq.ft °F. If state or local codes require insulation other than that specified above, the greater insulation shall be used.

E. Electrical:

Installing contractor shall coordinate electrical requirements and connections for all power feeds with electrical contractor. Refer to Division 26 (Master Format 2004) or Division Section 16 (Master Format 1995) for additional information.

F. Third Party Controls:

Installing contractor shall coordinate all BAS/BMS control requirements and connections with controls contractor.

Part 6 – Service

6.01 Maintenance Tool Software and MN-Converter (system by Mitsubishi utilizes the model CMS-MNG-E). This system shall also include the equipment indicated in Specification section 15220 – Mechanical HVAC VRF DOAS.

A. The Maintenance Tool, via the MN-Converter, shall enable the user to monitor and record the following parameters in a centralized system.

i. Outdoor Unit

1. Operation Mode (Cooling Only, Heating Only, Cooling Main, Heating Main)
2. Compressor Frequency, amperages, and voltages
3. Compressor high- and low-side pressure
4. System Temperatures
5. Outdoor temperature
6. Status of reversing valve

ii. BC Controller

1. Valve ON/OFF status
2. Temperatures
3. Pressures

iii. Indoor Unit

1. Entering Air Temperature
2. Entering/Leaving Refrigerant Temperature
3. Superheat/Subcool temperatures
4. LEV position
5. Room temperature setpoint
6. Unit Mode and Status (Heat, Cool, Dry, Auto, Fan)

B. The Maintenance Tool shall have the additional feature of controlling the following system components manually:

i. Indoor Unit

1. Indoor Unit ON/OFF
2. Mode (Heat, Cool, Dry, Auto, Fan)
3. Room Temperature Setpoint
4. Fan speed
5. LEV Position

ii. BC Controller

1. Valve OPEN/CLOSE
2. LEV Position

- C. The Maintenance Tool shall be connectable to either the TB3 or TB7 communication bus lines on the MNET via alligator connectors.
- D. The Maintenance Tool shall be connectable to a PC via a USB cable.
- E. Trended data from Maintenance Tool shall be available to export to a data file for offline analysis.

Part 7 - VRF System Commissioning

7.01 General

- A. The VRF Manufacturer shall oversee and assist the installing contractor with the start up and commissioning of VRF equipment as outlined below. This process will be completed in two phases. Phase one shall cover the Pre-Start-Up inspection process, Phase two will cover the Physical Start-Up & Commissioning of Equipment.
- B. All *VRF System Commissioning* activities shall be completed by an employee of the VRF manufacturer whose primary job responsibilities are to provide start up and commissioning of their products; sales staff or in-house support staffs are not permitted to complete this scope of work.
- C. A factory certified representative may assist the VRF manufacturer's personnel in the completion of certain elements of work contained within this specification. Activities completed by a Factory Certified Representative shall be supervised onsite by the VRF manufacturer. Certified representatives shall not be used in lieu of the manufacturer's personnel.
- D. The installing contractor shall have been certified by the manufacturer to install VRF systems, having attended a minimum 3- day VRF Service & Installation course at an approved training center. A copy of this certificate shall be presented as part of the VRF equipment submittal process
- E. The installing contractor shall assist the VRF manufacturer in their completion of the system review and have available a technician with appropriate diagnostic tools, materials and equipment, as required, for the duration of the inspection process. The technician shall be fully licensed and insured to complete necessary duties as directed under the supervision of the VRF manufacturer.
- F. Upon completion of the Equipment Start-Up & VRF Commissioning process, the VRF manufacturer shall provide a formal report outlining the status of the system, in electronic format only. Contained within this report shall be copies of all field inspection reports, required action items and status, Manufacturers design software As-Built, equipment model & serial numbers.
- G. Completion of the Equipment Start-Up and VRF Commissioning process shall verify that the VRF system has been installed per the Engineer's design intent and complies with the VRF manufacturers engineering and installation specifications related to their equipment.

- H. Compliance with federal, state and local codes as well as other authorities having jurisdictions are not part of this process and are the responsibility of the installing contractor. Contractor to correct any issues noted by the Commissioning at no expense to the Owner or Engineer.
- I. Contact your regions Mitsubishi Professional Solutions Manager for information and pricing related to services required under this projects scope of work.

7.02 Pre Start-Up Inspection

- A. Contractor shall employ the services of the VRF manufacturer to provide a comprehensive field review of the completed VRF system installation, prior to the physical start up and operation of equipment. Upon satisfaction that the system meets the VRF manufacturer's installation requirements and specifications, the contractor shall be allowed to proceed with the physical start up and operation of equipment.
- B. Prior to the pre-start-up inspection, all systems components shall be in a final state of readiness having been fully installed and awaiting inspection.
- C. The installing contractor shall provide the VRF manufacturer a copy of the electronic design file used in the design and engineering process of the system being inspected. This electronic design file shall have been completed on software approved by the specified VRF manufacturer and shall have been updated to reflect as-built conditions.
- D. The installing contractor shall have prepared the refrigeration piping systems per equipment installation and service manuals. All refrigerant piping systems, upon completion of assembly, shall have been pressurized to a minimum 600 PSI, using dry nitrogen, and held for an uninterrupted 24HR period, with acceptable change due to atmospheric conditions.
 - a. A record of the pressure check process shall be recorded and tagged at the outdoor unit. The tag shall contain the following information: date & time of pressure check start, fill pressure, outdoor temperature at start & stop, date & time of pressure check completion, and the person's full name & company information completing the pressure check.
 - b. The installing contractor shall engage the General Contractor as a witness of the pressure check process, confirming that all steps and procedures related to the pressure check were properly followed and that the system held the holding pressure of 600PSI for a period of 24hr hours, with acceptable change due to atmospheric conditions. Witness information, including full name, company name, title, phone number and signature shall be recorded on same pressure tag used by installing contractor.
- E. Upon completion of the 600 PSI pressure check, the system shall be evacuated to a level of 500 microns, where it will be held for a period of 1HR with no deflection. The installing contractor shall utilize the triple evacuation method per the equipment install and service manuals.
 - a. Evacuation start & stop dates, times, and persons involved shall be recorded and tagged at the outdoor equipment.

- b. Installing contractor shall digitally capture a photo of the micron gauge reading, at the conclusion of the 1hr holding period, for each system and provide a copy to the VRF manufacturer. Each photo shall contain a tag providing the outdoor units Serial number.
- F. Upon the completion of the 500-micron hold, the calculated additional refrigerant charge can be added. The calculated refrigerant charge shall have been calculated using the VRF manufacturers design software.
 - a. Total refrigerant charge of the system shall be recorded and displayed at the outdoor unit by permanent means.
- G. A review of the equipment settings shall be completed, with recommendations provided to improve system performance, if applicable. Physical changes of system settings will be completed by the contractor. Electronic recording of final DIP switches shall be provided as part of the commissioning report.
- H. A comprehensive review and visual inspection shall be completed for each piece of equipment following a detailed check list, specific to the equipment being reviewed. A copy of the inspection report shall be provided as part of the manufacturers close out documentation. Any deficiencies found during the inspection process shall be brought to the attention of the installing contractor for corrective action. Any system components that are not accessible for proper inspection shall be noted as such.
- I. Indoor Equipment report shall contain
 - Model & Serial Number
 - Equipment location
 - Equipment Tag/Identification number
 - Network Address & Port Assignment
 - Digital recording of equipment settings
 - Mounting/support method
 - Seismic restraints used
 - Proper service clearance provided
 - Wiring and connection points are correct
 - High voltage reading(s) within acceptable range
 - Low voltage reading(s) within acceptable range
 - Type of Remote Controller used and its location
 - Occupied space temperature sensing location
 - Air temperature readings within acceptable range
 - Condensate pump interlock method
 - Fan E.S.P. setting
 - Air Filter condition
 - Height differential setting in heat mode
 - Noise level acceptable
 - Refrigerant pipe connected and insulated properly
 - Condensate pipe connected and insulated properly
 - Condition of connected ductwork
 - Fresh air connected

- Humidifier connected and checked
- Review of air balance report complete
- Other interlocked systems, i.e. baseboard heat, booster fan etc.

J. Outdoor Air Cooled equipment report shall contain

- Model & Serial Number
- Equipment location
- Equipment Tag/Identification number
- Network Address & Port Assignment
- Digital recording of equipment settings
- Mounting/support method
- Seismic restraints used
- High Wind Tethering method
- Proper service clearance provided
- Defrost Condensate removal addressed
- Wiring and connection points are correct
- High voltage reading(s) within acceptable range
- Low voltage reading(s) within acceptable range
- Control Network settings
- Noise level setting
- Refrigerant pipe installed and insulated properly
- Low ambient operation settings

7.03 Physical Start-Up & Commissioning of Equipment

- A. This start-up and commissioning shall also include the equipment included in the Specification section 15220 – Mechanical HVAC VRF DOAS.
- B. Upon proper equipment start up by the contractor, following the manufacturers guidelines and specifications, an employee of the VRF manufacturer shall complete a review of the system performance and complete the following tasks:
- C. Check and confirm all communication addressing of system components.
- D. Check and confirm each indoor unit, individually, is properly piped and wired by commanding the indoor unit on, in either heat or cool mode and verifying proper response.
 - a. This process shall be digitally recorded and included as part of the close out documentation.
- E. Electronically record a minimum of one-hour of operational data per refrigeration system.
- F. Electronically record selector switch positions on all indoor and outdoor equipment.
- G. The VRF manufacturer shall retain the electronically recorded data, collected during the start-up and equipment commissioning process, at a designated location within the US for future reference.

7.04 Close-Out Information

- A. The VRF manufacturer shall issue a System Performance report at the completion of all fieldwork. Contained within this report shall be an overview of the system performance, recommendations, field reports, all electronic data, and as-built design file.

7.05 VRF Equipment Warranty

- A. Having successfully completed the Pre-Inspection, Start-Up & Equipment Commissioning processes and fulfilling all requirements, as outlined in the VRF manufacturers Extended Warranty Process. Along with installing contractor being certified by the VRFR manufacturer to install VRF systems, having attended a minimum 3- day VRF Service & Installation course at an authorized training center.
- B. The equipment shall be provided with the following warranty per the VRF manufacturer's warranty policy:
 - Compressor: 7-year part only
 - Parts: 5-years part only
 - Labor: no labor coverage provided by VRF Manufacturer

Part 8 - Owner Training and Technical Support

8.01 GENERAL

- A. The VRF manufacturer shall provide the owner's representative a minimum 6-hour VRF Operation and Maintenance training class covering systems installed under this scope of work.
- B. Training program is to be provided at the time of owner occupancy.
- C. Owner shall provide a suitable location, onsite, to conduct the VRF Operation and Maintenance class.
- D. Training material shall be provided to participants in electronic format.

END OF SECTION 15210

SECTION 15220- MECHANICAL HVAC VRF DOAS

Part 1 – General

1.01 SYSTEM DESCRIPTION

The dedicated outside air system (DOAS) shall be a VRF (Variable Refrigerant Flow Zoning) System. The DOAS shall be provided with the capability to reheat air using recovered energy from the primary cooling coil. The DOAS shall be of a split system type.

The DOAS reheat system shall consist of a 10 ton modular outdoor unit, 6 port minimum BC (Branch Circuit) Controller, indoor unit, and associated controls and control system. System shall be capable of automatically determining mode necessary to provide required air conditions with no interruption to system operation except for defrost operation. The system shall only consist of one indoor unit per outdoor unit.

1.02 QUALITY ASSURANCE

- A. The units shall be listed by Electrical Test Laboratories (ETL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- D. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.
- E. System shall be composed of components which meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.

F. DELIVERY, STORAGE AND HANDLING

- 1. Unit shall be stored and handled according to the manufacturer's recommendation.

Part 2 – Warranty

- 2.01 The units shall be covered by an extended manufacturer's limited warranty for a period of five (5) years from date of installation.

In addition the compressor shall have a manufacturer's limited warranty for a period of seven (7) years from date of installation.

If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

This warranty shall not include labor except for the first year after startup and beneficial usage by the Owner.

- 2.02 Manufacturer shall have a many years of VRF system experience in the U.S. market.
- 2.03 All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed. Operation and Maintenance manuals shall be provided by the Contractor prior to substantial completion.
- 2.04 The VRF system shall be installed only by a contractor that is approved and trained for installation and service of the equipment by the manufacturer. The mandatory contractor service and install training shall be performed by the manufacturer.
- 2.05 Manufacturer of VRF equipment and associated controls shall be all from one Manufacturer to provide single source responsibility and continuity - no put together systems from different manufacturers and suppliers are allowed.

Part 3 – Products

3.01 VRF OUTDOOR HEAT PUMP UNIT

A. General:

1. The reheat dedicated outdoor air system (DOAS) shall be manufactured by the same manufacturer for both the air unit and the outdoor unit. Systems specifically designed and not by the same Manufacturer for outdoor air are not allowed -- the system must be specifically designed and installed for use as a dedicated outdoor air system with reheat to allow selection of the leaving air temperature to within one half of a degree. The outdoor units shall be equipped with multiple circuit boards that interface to the controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
2. Outdoor unit shall have a sound rating no higher than 60 dB(A). If the system does not meet the required sound level then any modifications to the unit to meet the required maximum sound level shall be done at the expense of the Contractor. Modification of the unit to lower the sound level of the unit to the maximum 60 dB(A) shall be done at the Manufacturers factory with their approval and shall not impede performance, longevity, and ease of maintenance of the unit. Final sound levels attained by the Manufacturer of the modified unit shall be provided in writing on their letterhead from the Manufacturer to the Engineer before acceptance of the equipment.
3. Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller (Single or Main) shall be insulated in accordance with the installation manual.
4. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.

5. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
6. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.
7. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperature or cooling mode down to 23°F ambient temperature, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.
8. The outdoor unit shall not cease operation in any mode based solely on outdoor ambient temperature.
9. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
10. Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend “no or reduced heating” periods shall not be allowed.

B. Unit Cabinet:

1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (-BS models)

C. Fan:

1. Each outdoor unit module shall be furnished with one or two direct drive, variable speed propeller type fan(s). The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.
2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
3. All fan motors shall be mounted for quiet operation.
4. All fans shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have vertical discharge airflow.

D. Refrigerant

1. R410A refrigerant for all systems.

E. Coil:

1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

F. Compressor:

1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors shall not be allowed.
2. A crankcase heater(s) shall be factory mounted on the compressor(s).
3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 18% of rated capacity.
4. The compressor will be equipped with an internal thermal overload.
5. The compressor shall be mounted to avoid the transmission of vibration.

G. Electrical:

1. The outdoor unit electrical power shall be 208/230 or 460 volts, 3-phase, 60 hertz.
2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz) or 414-506V (460V/60Hz) as specified on the plans.
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

H. Allowed Manufacturers:

1. Unit shall be Mitsubishi model R2-BS or approved equal.

3.02 BRANCH CIRCUIT (BC) CONTROLLER FOR DOAS

A. General:

The BC (Branch Circuit) Controllers shall be specifically used with R410A systems. These units shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The DOAS BC Controller shall be connected to only one indoor unit, the DOAS indoor unit.

B. BC Unit Cabinet:

1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant

1. R410A refrigerant shall be required.

D. Refrigerant valves:

1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH. Branches may be twinned to allow more than 54,000 BTUH.
2. Each branch shall have multiple two-position valves to control refrigerant flow.
3. Service shut-off valves shall be field-provided/installed for each branch.
4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

E. Integral Drain Pan:

1. An integral condensate pan and drain shall be provided.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253V (230V/60Hz) – Refer to Plans for Electrical.
3. The BC Controller shall be controlled by integral microprocessors.

4. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

3.03 100% OSA DUCTED INDOOR AIR UNIT WITH REHEAT

A. General:

- i. The unit shall be a ducted indoor fan coil that mounts where needed with a fixed rear return and a horizontal discharge supply, primary and reheat coil, and three modulating linear expansion devices. The shall be used with the VRF outdoor unit and BC Controller to create a DOAS. The air unit shall support individual control using DDC controllers. The air unit shall feature external static pressure settings up 0.96 in. WG, depending on voltage.

B. Indoor Unit.

- a. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, primary cooling coil, reheat coil, temperature and humidity sensors, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:

- a. The cabinet shall be ducted on both the supply and return
- b. The cabinet panel shall have provisions for a field installed filtered outside air intake.

D. Fan:

- a. The indoor unit fan shall be an assembly with two Sirocco fan(s) direct driven by a single motor.
- b. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
- c. The indoor unit shall have a ducted air outlet system and ducted return air system.

E. Filter:

- a. Outside air shall be filtered by a field-supplied filter. Unit shall have sufficient external static pressure to operate with a MERV-13 filter installed.

F. Coil:

- a. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.

- b. The tubing shall have inner grooves for high efficiency heat exchange.
- c. All tube joints shall be brazed with phos-copper or silver alloy.
- d. The coils shall be pressure tested at the factory.
- e. A condensate pan and drain shall be provided under the coil.
- f. A condensate lift mechanism shall be factory installed capable of providing up to 21-11/16" of lift.
- g. All refrigerant lines to the PEFY indoor units shall be insulated in accordance with the installation manual.

G. Electrical:

- a. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
- b. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

H. Controls:

- a. This unit shall use controls provided by the same Manufacturer as the equipment to perform functions necessary to operate the system.

I. Allowed Manufacturers:

- a. Equipment shall be Mitsubishi model PEFY-AF1200CFMR or approved equal. Manufacturer of VRF equipment and associated controls shall be all from one Manufacturer to provide single source responsibility and continuity - no put together systems from different manufacturers and suppliers are allowed.

Part 4-Operation

4.01 Dedicated Outside Air System with Reheat Capability

A. General:

The DOAS reheat system shall be rated at 87° F DB/80° F WB in cooling for both the outdoor unit and indoor unit entering air conditions. Heating rating point shall be 32° F DB/28° F WB for the outdoor unit and 32° F DB indoor unit entering air conditions.

B. System operation parameters:

- 1. The system shall operate with intake air temperature ranging from -4° F WB up to 95° F WB.

2. The unit shall be capable of intake of unmixed or untreated -4° F WB air directly to the primary coil.
3. The unit shall be capable of providing active coil operation in cooling mode down to 50° F WB.
2. In a cooling condition, the system shall be capable of providing supply air for downstream use within the following specifications at rated conditions

Operation Type	Minimum Leaving Air Condition		Maximum Leaving Air Condition	
	Degrees F, Dry Bulb	Degrees F, Wet Bulb	Degrees F, Dry Bulb	Degrees F, Wet Bulb
Cooling Only, No Reheat	50	50	60	60
Cooling Mode with Reheat	63	51.5 (45% RH)	83	67.5 (45% RH)

1. Cooling Only, No reheat uses only primary cooling coil. Leaving air temperature can be chosen between 50° and 60° F in one degree increments.
2. Cooling mode with reheat uses both primary cooling coil and reheat coil. Leaving air temperature from reheat coil can be chosen between 63° and 83° F in one degree F dry bulb increments along a line of 45% constant relative humidity.

3. In heating mode, the system shall be capable of providing 78° F DB supply air at rated conditions.

Part 5- Controls, Service, Commissioning, and Owner Training

5.01 These items, equipment, and work that are included as part of this section are also to be included in the related Specification Section 15210. Refer to Specification Section 15210 – Mechanical HVAC VRF “Part 4” through “Part 8” for additional work to be included with the DOAS.

END OF SECTION 15220 – MECHANICAL HVAC VRF DOAS

SECTION 15300 - MECHANICAL - FIRE PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Scope: The work included in this section of the specifications includes all labor, materials, equipment, and services necessary to furnish and install a complete wet pipe sprinkler system as indicated on the drawings and as herein specified.
- B. Related Sections: The following sections contain requirements that relate to the section:
 - 1. Division 15 "Plumbing" for modification of water supply piping from water source to inside of building if required.
 - 2. Division 16 "Fire Protection" for fire alarm devices not specified in this Section.
- C. Products provided but not installed under this section include the following:
 - 1. Flow Switches and Tamper switches installed on sprinkler equipment, connection to alarm system to be by others.
 - 2. Sprinkler cabinet with spare sprinklers and sprinkler wrenches. Deliver to Owner's maintenance personnel.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design and obtain approval from authority having jurisdiction for the fire protections system specified.
- B. Conduct fire hydrant flow tests as required to obtain hydraulic data needed to prepare design for hydraulically calculated systems.
- C. Hydraulically design sprinkler system according to Hazard Classifications:
As follows:

Office & Public Areas:- -Light Hazard

Storage Areas:- - Ordinary Hazard Group II

Mechanical Equipment Rooms:- - Ordinary Hazard Group I

D. Minimum Density requirements for Automatic Sprinkler System Hydraulic Design: As follows:

1. Light Hazard Occupancy: 0.10 GPM over 1500 Sq. Ft.
2. Ordinary Hazard Group II: .20 GPM over 1500 Sq. Ft.
3. Ordinary Hazard Group I: .15 GPM over 1500 Sq. Ft.

Exceptions can be applied as per current NFPA #13 codes.

1.03. SUBMITTALS

A. Product data for fire protection systems components. Including the following:

1. Valves.
2. Specialty valves, accessories, and devices.
3. Alarm Devices, including electrical data.
4. Fire Department Connection.
5. Sprinklers, escutcheons, and hangers.
6. Piping.

B. Sprinkler System drawings prepared according to NFPA #13. Submit required number of sets to authority having jurisdiction for review, comment and approval. Include system hydraulic calculations.

C. Test reports and certificates as described in NFPA #13. Include "Contractor's Material & Test Certificate for above ground and below ground piping.

D. Maintenance Data for each type of fire protection specialty specified compiled in a three ring binder as required by Division One submittal section.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms whose equipment, specialties and accessories are listed by product name and manufacturer in UL Fire Protection Equipment

Directory and FM Approval Guide and that conforms to other requirements indicated.

- B. Comply with requirements of authority having jurisdiction for submittals, approvals, materials, hose threads, installation, inspections, and testing.
- C. Comply with requirements of Owner's Insurance underwriter for submittals, approvals, materials, installation, inspections and testing.
- D. Licensed Engineer: Submit design drawings and design calculations. Include stamp and signature of registered engineer licensed in Louisiana certifying compliance with specifications to serve as the professional responsible for the entire sprinkler system.
- E. Installer Qualifications: Firms qualified to install and alter fire protection piping, equipment, specialties, and accessories, and repair and service equipment. A qualified firm is one that is experienced in such work, familiar with precautions required, and compliance with the authority having jurisdiction.
 - 1. Must have 5 years experience.
 - 2. Welders must be certified.
- F. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:
 - NFPA 13 - "Standard for the Installation of Sprinkler Systems"
 - NFPA 24 - "Private Fire Service Mains and Their Appurtenance"

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to the following:
 - 1. Specialty Valves and Water Motor Alarm Devices:
 - Gen Sprinkler Co. Div., Grinnell Corp.
 - Viking Corp.
 - 2. Waterflow Indicators and Supervisory Switches:

Gem Sprinkler Co, Div., Grinnell Corp.
Potter Electric Signal Co.

3. Fire Department Connections:

Gem Sprinkler Co., Div., Grinnel Corp.
Potter-Roemer Div., Smith Industries, Inc.

4. Sprinklers:

Gem Sprinkler Co., Div., Grinnell Corp.
Viking Corp.

5. Indicator Valves:

Kennedy Valves Div., McWane, Inc.
Grinnell Supply Sales Co., Grinnell Corp.

6. Fire Protection Service Gate and Check Valves:

Kennedy Valves Div., McWane, Inc.
Gem Sprinkler Co., Div., Grinnel Corp.

7. Grooved Couplings for Steel Piping:

Grinnell Supply Sales Co., Grinnell Corp.
Victaulic Company of America

2.02 MATERIALS

A. Pipes and Tubes

1. Ductile-Iron Pipe: AWWA C115, ductile-iron barrel with iron-alloy threaded flanges, 250-psig (1725 kPa) minimum working pressure rating, and AWWA C104 cement-mortar lining.
2. Steel Pipe: ASTM A 53, Schedule 40 in sizes 6 inches (150 mm) and smaller and Schedule 30 in sizes 8 inches (200 mm) and larger, black and galvanized, plain and threaded ends, for welded, threaded, cut-groove, and rolled-groove joints.
3. Steel Pipe: ASTM A 135, Schedule 10 through 5-inch (125 mm) sizes and NFPA 13 specified wall thickness for 6-inch (150 mm) through 10-inch

(250 mm) sizes, with plain ends, black and galvanized, for rolled-groove and welded joints.

B. Pipe and Tube Fittings

1. Cast-Iron Threaded Fittings: ASME B16.4, Class 250, standard pattern, with threads according to ASME B1.20.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3, Class 300, standard pattern, with threads according to ASME B1.20.1
3. Grooved-End Fittings for Steel Pipe: UL-listed and FM-approved, ASTM A 536, Grade 65-45-12 ductile iron or ASTM A 47 Grade 32510 malleable iron, with grooves or shoulders designed to accept grooved couplings.

C. Joining Materials

1. Flanges Joints for Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.
2. Brazing Filler Metals: AWS A5.8, Classification BcuP-3 or BcuP-4.
3. Couplings for Grooved-End Steel Pipe and Grooved-End Ferrous Fittings: UL 213, AWWA C606, ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing, with enamel finish. Include synthetic-rubber gasket with central-cavity, pressure-responsive design, and ASTM A 183 carbon-steel bolts and nuts; and locking pin, toggle, or lugs to secure grooved pipe and fittings.

D. Fire Protection Service Valves: General: UL listed and FM-approved, with 175-psig (1200KPa) non-shock minimum working pressure rating.

1. Indicating Valves, 2-1/2 inches (65mm) and Smaller: Butterfly or ball type, bronze body with threaded ends, and integral indicating device.
2. Gate Valves, 2-1/2 inches (65 mm) and Larder UL 262, iron body, bronze mounted, taper wedge, outside screw and yoke, rising stem. Include replaceable, bronze wedge facing risings and flanges ends.

E. Specialty Valves

1. Alarm Check Valves: UL 193, 175-psig (1200 kPa) working pressure, designed for horizontal or vertical installation, with cast-iron, flanged inlet and outlet, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gauges, precision retarding chamber, and fill line attachment with strainer.

F. Sprinklers

1. Sprinkler types and categories are as indicated and required by application. Furnish automatic sprinklers with nominal ½-inch (12.7 mm) orifice for “Ordinary” temperature classifications rating except where otherwise indicated and required by application.
2. Sprinkler types, features, and options include:
 - a. Recessed Quick-Response sprinklers, including escutcheon.
 - b. Upright Quick-Response sprinklers.
3. Sprinkler Finishes: chrome-plated and bronze.
4. Sprinkler Escutcheons: Material, types, and finishes for following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers and specified with sprinklers.
5. Sprinkler Cabinets: Finished steel cabinet and hinged cover, with space for minimum of 6 spare sprinklers plus sprinkler wrench, suitable for wall mounting. Include number of sprinklers required by NFPA 13 and 1 wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each style sprinkler on Project.

G. Specialty Sprinkler Fittings: UL-listed and FM-approved, made of steel, ductile iron, or other materials compatible with system materials and applications where used.

H. Sprinkler Alarm Test Fittings: Ductile-iron housing with 1-1/2-inch (40mm) inlet and outlet, integral test valves, combination orifice and sight glass, and threaded or locking-lug ends.

I. Free Standing Type Fire Department Connections: UL 405, cast-brass body; NH-standard thread inlets according to NFPA 1963 and matching local fire

department threads; and threaded NPS outlet. Include lugged cap, gasket, and chain; lugged swivel connection inlet; and wall escutcheon plate with marking "AUTO SPKR." IF Indicated to be wall mount on plans utilize a wall mount system.

1. Connections: Two 2-1/2-inch (65 mm) inlets and 4-inch (100 mm) outlet. Verify flow capacity and requirements prior to bid. Upsize connections and size as required for flow rate.
2. Finish: Polished chrome plated.
3. Furnished to Division 15, 15100 for their installation, if remote mounted, see plans.
4. Threads for Prairieville Fire Department is 2 1/2 NST, Contact Ray Poche (225) 673-6663

J. Alarm Devices:

1. Water-Motor-Operated Alarm: UL 753, mechanical operation type, 10-inch (250 mm) diameter, cast-aluminum alarm gong, with red enamel factory finish. Include Pelton-wheel-type operator with nylon shaft bearings, and shaft length and sleeve to suit wall thickness and construction; 3/4-inch (20 mm) inlet and 1-inch (25mm) drain.
2. Waterflow Indicators: UL 346, electrical-supervision type, vane-type waterflow detector, rated to 250 psig (1725 kPa), and designed for horizontal or vertical installation. Include 2 SPDT (single-pole, double throw) circuit switches to provide isolated alarm and auxiliary contact, 7 ampere, 125 volts a.c. (7 A, 125 V a.c.) and 0.25 ampere, 24 volts d.c. (0.25 A, 24 V d.c.); complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover that sends a signal when cover is removed.
3. Supervisory Switches: UL 753, for valves, electrical-supervision type, SPDT (signal-pole, double-throw), normally closed contacts, designed to signal controlled valve in other than full open position.

- K. Pressure Gauges: UL 393, 3-1/2 to 4-1/2 inches (90 to 115 mm) diameter dial, with dial range of 0-250 psig (0-1600 kPa).

PART 3 - EXECUTION

3.01 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Sprinkler System Piping: Refer to Part 2 of this Section for detailed specifications on pipe and fittings products listed below. Use pipe, tube, fittings, and joining methods according to the following applications. Piping may be joined with flanges instead of indicated joints. Use grooved-end fittings with grooved couplings that are made by the same manufacturer and that comply with listing when used together for grooved-coupling joints.
 - 1. Sizes 2 Inches (50 mm) and Smaller: ASTM A 53, A 135, or A 795; Schedule 40 steel pipe with threaded ends, cast-iron or malleable-iron threaded fittings, and threaded joints.
 - 2. Sizes 2-1/2 Inches (65 mm) to 6 Inches (150 mm): ASTM A 135 or A 795, Schedule 10 steel pipe with rolled-groove ends, grooved-end steel pipe fittings, and grooved-coupling joints.
- B. Pipe between Fire Department Connections and Check Valves: Use galvanized-steel pipe instead of black-steel pipe when steel pipe is specified for applications below. Do not use welded joints.
- C. Joint Construction
 - 1. Refer to Division 15 Section “Basic Mechanical Materials and Methods” for basic piping joint construction.
 - 2. Grooved-End Pipe and Grooved-End Fitting Joints: Use grooved-end fittings and grooved couplings that are made by the same manufacturer and that are listed for use together. Groove pipe and assemble joints with grooved coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer’s written instructions.
- D. Service Entrance Piping
 - 1. Connect fire protection piping to water service piping of size and in location indicated for service entrance to building. Water service piping is specified in Division 15, Section 15100.
 - 2. Install shutoff valve, check valve, pressure gauge, drain, and other accessories indicated at connection to water service piping.

E. Piping Installations

1. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
2. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2-inch (65 mm) and larger connections.
3. Install “Inspector’s Test Connections” and sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
4. Install sprinkler piping with drains for complete system drainage.
5. Install ball drip valves to drain piping between fire department connections and check valves, and where indicated. Drain to floor drain or outside building.
6. Install alarm devices in piping system.

F. Hangers and Supports: Comply with NFPA 13.

G. Valve Installations

1. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer’s written instructions, and the authority having jurisdiction.
2. Gate Valves: Install fire-protection service valves supervised-open, located to control sources of water supply except from fire department connections. Where there is more than 1 control valve, provide permanently marked identifications signs indicating portion of system controlled by each valve.
3. Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain line connection.

E. Sprinkler Applications

1. Rooms without Ceilings: Upright quick response sprinklers.
2. Rooms with Suspended Ceilings: Recessed quick response sprinklers.
3. Sprinkler Finishes: Use sprinklers with following finishes:

- a. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax-coated where exposed to acids chemicals, or other corrosive fumes.
- b. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

I. Sprinkler Installations

1. Install sprinklers in patterns, symmetrical, center of tile in suspended ceiling.
2. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type Quick-Response sprinklers supplied from heated space.
3. Install sprinkler heads in Gym, in exposed Mechanical Rooms and in other areas subject to impact damage with wire cage protection.

K. Field Quality Control

1. Perform field acceptance tests of each fire protection system.
2. Report test results promptly and in writing to Architect.
3. Report test results promptly and in writing to authority having jurisdiction when required.

L. Cleaning: Clean dirt and debris from sprinklers. Replace sprinklers having paint other than factory finish with new sprinklers. Cleaning and reuse of painted sprinklers is prohibited.

M. Demonstration

1. Demonstrate equipment, specialties, and accessories. Review operating maintenance information.
2. Schedule demonstration with at least 7 days' advance notice.

END OF SECTION 15300

SECTION 16010
ELECTRICAL - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

- A. The General Conditions and all pertinent Sections are a part of these Specifications and the Contractor shall consult them in detail for instructions pertaining to his Work. He shall consult all other Sections of the Specifications to determine if he is required to perform any Work relative to that particular Section.

1.02 SCOPE OF WORK

- A. The Work contemplated under this Division comprises the furnishing of all labor and materials required for the complete installation of electrical wiring for lighting, power, and control circuits from the various panelboards to each ultimate outlet hereinafter specified and/or shown on the accompanying Drawings. All Work shall be done in accordance with the National Electrical Code, 2011 Edition.
- B. This Work includes the installation of connecting wiring, both service and controls, for all motors, motor control, safety devices, and miscellaneous electrical equipment provided under other Divisions of the Specifications.
- C. The Specifications are intended to describe a complete, workable electrical distribution system and bidders shall report any discrepancies or omissions preventing such workability prior to the time their bids are submitted.
- D. The Work covered by these Specifications shall be as shown on the Drawings and called for herein, and shall be comprised generally of the following:
1. Provide all conduit, conductors, apparatus, devices, etc.
 2. Provide all lighting fixtures complete with lamps.
 3. Provide electrical service to all mechanical devices and fixed equipment and appliances requiring same. This includes furnishing and installing any required cords, plugs, pigtails, flexible connections, disconnecting means, etc.
 4. Provide outlets and raceways for telephone and computers.
 5. Provide Fire Alarm System.
 6. Provide conduit for HVAC controls.
 7. Provide temporary service required for construction. Consult Entergy office (tel.225-382-4812: David Barbay) for up and down charges.

- E. All equipment installed under this Division shall be installed in strict accordance with the instructions of the manufacturer.
- F. The Contractor is referred to Drawings and Specifications for Work of other Trades (Architectural, Structural, HVAC, Plumbing, etc.) for details and information relative to those elements of the Project. Coordinate with all Trades for proper rough-ins and non-interference with other elements. His Work shall be done in strict accordance with local and state ordinances governing this class of Work.
- G. This Work shall be installed to meet existing conditions as found at the building site and to accommodate the Work of other Trades. The Contractor shall be held responsible for the timely placing of conduit and switch and outlet boxes in walls, partitions, and slabs while same are under construction.

1.03 EQUIVALENT PRODUCTS

- A. Reference to or Specification of a particular manufacturer or brand name is not intended to indicate a preference for a specified product but to indicate a standard of quality and performance.
- B. Requests for substitutions will be considered by the Engineer when submitted in accordance with Architect's instructions in other Divisions of these Specifications.
- C. Pre-bid equivalency review will be required on all items requiring Shop Drawings.

1.04 SHOP DRAWINGS

- A. The following Shop Drawings shall be submitted prior to commencing Work, and within thirty (30) days of awarding of Contract:
 - 1. Lighting Fixtures
 - 2. Wiring Devices, Floor Boxes
 - 3. Apparatus, Surge Protection Devices
 - 4. Fire Alarm System
- B. All electrical Shop Drawings shall be bound in sets by the Contractor and submitted at one time.

1.05 LAWS, PERMITS AND INSPECTIONS

- A. The Contractor shall, at his own cost, obtain necessary permits, pay all legal fees and charges, and comply with all state and municipal building and safety laws, ordinances, and regulations relating to the building and the public health and safety.

1.06 SAFETY PRECAUTIONS

- A. The Contractor shall furnish and place proper guards for prevention of accidents. He shall provide and maintain any other necessary construction required to secure safety of life or property, including maintenance of sufficient lights during all night hours to secure such protection.
- B. Temporary electric services during construction shall be maintained in perfect condition. Frayed, loose, or open connections shall not be used for temporary services. The Contractor shall use only equipment in first class working condition for construction services. Temporary service shall be installed in accordance with the latest edition of the National Electrical Code.

1.07 GUARANTEE

- A. The Contractor shall be required to keep the Work installed by him in repair and perfect working order for one (1) year from date of completion and final acceptance. The Contractor shall furnish, free of cost to Owner, all materials and labor necessary to comply with this guarantee. This guarantee shall not include lighting fixture lamps.

PART 2 - PRODUCTS

2.01 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. All materials shall be new and listed by UL (or other independent testing laboratory recognized by the authority having jurisdiction) as conforming to its standards. Work shall be executed in a workmanlike manner and present a neat, finished appearance when completed.

2.02 REJECTED WORK AND MATERIALS

- A. Should the Contractor introduce any materials different from those called for and described in Specifications, or shown on the Drawings, it must on notification from the Architect and/or Engineer, be immediately removed from the building premises.

2.03 SPECIFIED PRODUCTS AND SUBSTITUTIONS

- A. Specified products shall be furnished unless equivalent products meeting the approval of the Architect and/or Engineer have been submitted for review in accordance with Paragraphs 1.03 and 1.04 of this Section.
- B. Only product information included with request for substitutions will be used as basis of evaluation. Burden of proof that product offered for consideration is

equivalent or superior to that specified rests on submitter and same shall be responsible for furnishing products meeting or exceeding Specifications if substitution is allowed.

2.04 PRODUCTS NOT SPECIFIED BY NAME

- A. All products not specified by name shall be as manufactured by a reputable manufacturer and shall conform to normal construction standards of quality.

2.05 PRODUCTS IN OTHER SECTIONS OF SPECIFICATIONS

- A. Refer to other Sections of these Specifications for additional product requirements.

PART 3 - EXECUTION

3.01 SITE INSPECTION/EXISTING CONDITIONS

- A. Prospective Contractors are strongly advised to visit the site prior to bidding, inspect the existing conditions at this facility, and satisfy themselves as to the difficulties attendant to the accomplishment of this Project as designed. Failure to do so will not relieve the Contractor from the responsibility to provide the complete electrical system as required under these conditions.

3.02 ADDITIONS AND CHANGES

- A. The accompanying Drawings show approximate locations of feeders, branch circuits fixtures, apparatus, etc. The Drawings are largely diagrammatic and should not be scaled for exact locations; refer to Architectural Drawings for dimensions.
- B. The Contractor shall review and study drawings and details shown on Architectural, Structural, and Mechanical Drawings, on Equipment Manufacturer's Shop Drawings, and on Equipment Rough-in Drawings for dimensions and locations before installation. Field connections, non-interference with other utilities and trades, and architectural, structural, and mechanical features will determine exact locations.
- C. Should any discrepancy appear on Drawings, or between Drawings and Specifications, bring same to attention of the Architect prior to signing of Contract. Failing this, comply with interpretation rendered by Architect.
- D. In event conflicts occur necessitating departures from Drawings, submit report including details of planned departure and reasons therefore as soon as practicable for review by Architect. Do not proceed without consent of the Architect.

3.03 SUPERVISION

- A. The Contractor shall provide competent supervision of the Work done from beginning to completion and final acceptance. To the best of his ability he shall keep the same foreman and workmen through the Project duration.
- B. During the progress of the Work it shall be subject to inspection by the representative of the Architect and/or Engineer, and at these specified times, the Contractor shall furnish required information.

3.04 CLEANING UP

- A. Upon completion of all installation, lamping, and testing, thoroughly inspect all exposed portions of the electrical installation and completely remove all exposed labels, soil, markings, and foreign materials.

3.05 TESTS

- A. After installation is complete and at such time as the Architect and/or Engineer may direct, the Contractor shall conduct an operating test for approval. Equipment shall be demonstrated to operate in accordance with requirements of these Specifications.
- B. The test shall be performed in the presence of Architect and/or Engineer. The Contractor shall furnish all instruments and personnel required for the test.

3.06 RECORD DRAWINGS

- A. If required under other Divisions of the Specifications, the Contractor shall maintain a "clean" copy of the Electrical Drawings on the job site upon which he will record any significant changes from installation shown on the Drawings for the purpose of preparing Record Drawings.

END OF SECTION OF 16010

SECTION 16100
ELECTRICAL - BASIC MATERIALS & METHODS

PART 1 - GENERAL

1.01 Refer to Section 16010.

PART 2 - PRODUCTS

2.01 RACEWAYS AND FITTINGS

- A. Raceways used in the Project shall be galvanized rigid steel (GRC) outdoors, electrical metallic tubing (EMT) indoors, and Schedule 40 PVC underground, unless indicated otherwise on the Drawings.
- B. In all raceways a grounding conductor must be pulled in with its power conductors, sized in accordance with the overcurrent protection of the circuit. The grounding conductors shall be properly bonded at all terminations and shall have green insulation.
- C. All cut threads on rigid galvanized steel conduit and all damaged galvanized surfaces shall be treated to prevent corrosion.

2.02 CONDUCTORS

- A. All conductors shall be copper.
- B. Unless otherwise indicated on Drawings, all conductors shall have THHN/THWN 600 volt insulation.
- C. All conductors #8 and larger shall be stranded. Smaller conductors may be stranded at Contractor's option, provided proper terminations are made.
- D. All conductors shall be continuous with no splices from outlet to outlet or junction box to junction box.
- E. Use identified (white) neutrals and color-coded phase wire (black, red, blue for 208 volt system) for all branch circuit wiring. Use identified (green) grounding conductors.

2.03 OUTLET BOXES

- A. At all outlets for lighting fixtures, wall switches, wall receptacles, telephones, etc.

outlet boxes designed for use with the type of construction employed shall be installed.

- B. Outlet boxes shall be as manufactured by Raco, Steel City, or equivalent.
- C. Outlet boxes and covers shall be of such form and dimensions as to be adapted to their specific usage, location, and size and number of conduits connecting thereto.
- D. Typically, boxes shall be a minimum of 1½" deep when used in conjunction with plaster covers and 2" deep when installed without plaster covers.
- E. Conduit device boxes, equal to Raco or Steel City type "GW" masonry boxes or standard boxes with square cornered plaster rings shall be installed in tile or block walls and partitions.
- F. See also paragraph 2.04 D & E, below.

2.04 WIRING DEVICES

- A. Wiring devices shall be equivalent to the following:
 - 1. Switches ("Style Line")
 - a) Toggle Type - Hubbell HBL2101 and HBL2103 (15A, single pole and 3-way) or HBL2121 and HBL2123 (20A, single pole and 3-way), as required.
 - b) Dimmers for LED's - 0-10v. as manufactured by Leviton, Lutron, or equivalent.
 - 2. Receptacles ("Style Line")
 - a) Duplex - Hubbell HBL2162 (20A) or HBL2152 (15A)
 - b) USB Charger type - Hubbell USB15X2 (15A) or USB20X2 (20A) as required.
 - c) Special receptacles - as required for the load to be served.
 - 3. Other devices - equivalent in quality to the above.
 - 4. Equivalent devices by Leviton, P & S, GE, or Eagle are acceptable.
- B. Finish of all devices shall be selected from standard colors: brown, ivory, white, black or gray, to coordinate with room finishes.

- C. All cover plates in finished spaces shall be smooth nylon or polycarbonate to match device finish unless specified otherwise.
- D. Floor outlets - shall be rectangular combination power and communications consisting of Hubbell B423321 2-gang, deep cast-iron fully adjustable box with S3825 cover on one side for duplex receptacle and S3825 cover on other side for communications. Provide S3084 carpet/tile flange.
- E. Weatherproof receptacles shall be mounted horizontally and covered with Hubbell WP26MH (in-use) wet location snap cover. Provide gasketing and/or caulking as required to prevent water from entering boxes. If caulking is required it shall be applied neatly between wall surface and gasket, not to the cover itself, to facilitate servicing.

PART 3 - EXECUTION

3.01 GENERAL WIRING METHODS

- A. Unless otherwise indicated, wiring for all systems as called for in these Specifications and shown on Drawings shall consist of insulated conductors installed in raceways.

3.02 FIRESTOPPING

- A. All penetrations of fire rated ceilings, walls, or other construction shall be properly sealed using listed materials and approved methods.

3.03 INSTALLATION OF RACEWAYS AND FITTINGS

- A. Conceal all conduit in floor slabs, walls, or ceiling spaces unless specifically otherwise indicated on Drawings.
- B. Where conduit is allowed to be exposed, install the conduit parallel with or at right angles to structural members, walls, and lines of the building and run as inconspicuously as possible.
- C. Keep all conduits at least 6" away from the covering on hot water pipes.
- D. Keep ends of conduits closed during construction.
- E. Use conduit unions where union joints are required; do not use running threads. Where conduits are installed in concrete slabs, on the ground, underground, or exposed to the weather, make all joints light-tight and gas-tight.

- F. All conduit shall be adequately secured from the building structure and shall be installed clear of suspended ceilings and equipment requiring servicing. Use conduit clamps and fasteners, not tie wire.
- G. Conduit connections shall not run rigid to motors, mechanical equipment, and troffer or other recessed lighting fixtures. Flexible conduit not less than 12" long shall be used to connect all motors and fixtures; where used outdoors, flexible conduit shall be liquid-tight.
- H. Bury all underground conduit, except under concrete slabs placed on fill, to a depth of at least 2' below finished grade unless otherwise indicated on the Drawings. All underground runs shall be routed so as to avoid conflicts with foundations, structural, plumbing, or other systems.
- I. All 90's up from PVC underground runs shall be made with rigid galvanized steel conduit fitted with appropriate adapters to the PVC. PVC factory 90's may be used where possibility of cutting of plastic during conductor pulling is minimal.
- J. All conduit entering outlet boxes, fixtures, apparatus, etc. shall be properly bushed and reamed. Use insulated throat bushings in panel boxes, pull boxes, cabinets, etc.
- K. Conduits passing through roof shall do so in properly sized pitch pockets, roof jacks, or other devices specified by the Architect in other Divisions.
- L. The conduit system shall not be used as the equipment ground. Identified (green) insulated grounding conductors, sized in accordance with the National Electrical Code, table 250-95, shall be pulled into all raceways with circuit conductors. All non-current-carrying metal portions of the wiring system and connected equipment shall be properly bonded together and grounded.
- M. All grounding conductors shall have green insulation. Larger conductors with black insulation used as grounding conductors shall be identified at every accessible point with green vinyl electrical tape.
- N. Raceways installed in concrete slabs: Install raceways as close to center of concrete slab thickness as practicable without disturbing slab reinforcement. Do not install in slab raceways having outside diameters which exceed 1/3 of slab thickness and in no case raceways greater than 1" trade size. Place raceway in slab so that there will be not less than 1" concrete thickness between surface of slab and outside of raceway. Do not space raceways closer than 3 diameters on centers except at cabinet locations. At cabinet locations space and arrange raceways so as not to affect structural strength of slab. If problem arises, increase slab thickness as approved by Architect. Ordinarily raceways 1" and smaller shall be installed in the slab. Larger conduits shall be installed below the slab and if the slab is

structural, pile-supported they shall be suitably hung from the slab with non-corrosive hangers (galvanized rods, etc.)

- O. Raceways crossing concrete slab expansion joints: Where raceways, embedded in concrete, cross expansion joints, install conduit expansion fittings.
- P. Bends and offsets in PVC Conduit: Wherever possible use factory elbows. Make field bends of PVC conduit with benders and infra-red type heating devices specifically designed for the purpose which product uniform heating of section to be bent. Use of torch or other flame-type devices is not acceptable. Cut out and discard any section of conduit showing evidence of scorching.
- Q. Above suspended ceilings where available structure for support of conduit is excessively distant from the ceiling, branch circuit conduits and boxes may be supported with "Caddy" fasteners on main runners of suspended ceiling grid. Install so as not to interfere with removal of ceiling tiles for accessibility. Feeder conduits and groups of branch circuit conduits shall be supported from the structure with unistrut trapeze hangers, etc.

3.04 INSTALLATION OF CONDUCTORS

- A. Except for cables and wires otherwise called for, install all conductors in conduit, raceways, or pull boxes.
- B. Make all splices electrically and mechanically secure.
- C. Pressure-type connectors, when used for wire size 6 AWG and smaller, shall be "Scotchlok" type; for wire size 4 AWG and larger use "Versitap" or heavy-duty "Locktite" type connectors.
- D. Insulate all splices with a minimum of two half-lapped layers of vinyl-plastic electrical tape where insulation is required.
- E. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with friction tape or vinyl-plastic electrical tape.
- F. Cable pulling compounds shall be certified by the manufacturer as being harmless to the wiring insulation. Conductors shall be pulled into clean, completed raceways only.

3.05 INSTALLATION OF OUTLET BOXES

- A. Where outlet boxes are used to support ceiling mounted fixtures, devices, etc. the outlet box shall be firmly anchored to the structural members of the building. Suspended ceiling construction shall not be used to support such boxes unless

permission is obtained from the Architect, and in all such cases proper T-bar supports shall be used. (See paragraph 3.03Q, above.)

- B. Where outlets at different levels are shown adjacent, they shall be installed in one vertical line unless conditions warrant otherwise.
- C. At locations where two or more devices are shown adjacent and at the same mounting height, they shall be installed in one outlet box and covered with one face plate. NOTE: Devices controlling loads powered from different systems (such as, 120 and 277 volt) shall be installed in separate boxes.
- D. Except as otherwise specified, blank covers shall be installed on all junction boxes, capped outlets and all outlets not indicated as containing wiring devices or lighting fixtures. Covers for outlets in walls shall be as specified for wall switches and receptacles.
- E. Install junction and pull boxes in readily accessible locations. Locate so as not to be blocked by equipment, piping, ducts and the like. Whether indicated on Drawings or not, provide junction or pull boxes where required due to field conditions. No additional cost to Owner will be allowed for such boxes.
- F. Flush-mounted wall boxes shall be installed with front edge as close as possible to face of finish wall. In no case shall the set-back exceed the limits prescribed in paragraph 370-10 of the NEC and in all cases devices and plates shall be positioned as described in paragraph 410-56(e) of the NEC. Use properly sized plaster rings to facilitate this requirement ($\frac{3}{4}$ " rings for " gypsum board, etc.). Boxes shall be supported with mounting brackets between studs or other methods that ensure that boxes are solidly supported such that they cannot be pushed in by normal pressure required to insert a plug into a receptacle.

3.06 INSTALLATION OF WIRING DEVICES

- A. Wiring devices shall be installed in outlet or switch boxes suited to the purpose and shall be provided with cover plates as specified and as required for the environment.
- B. Except as otherwise indicated or required by job conditions mounting heights shall be as follows:
 - 1. Wall switches - 4'-0" A.F.F.
 - 2. Convenience outlets - install receptacles with the center of the box at 12" A.F.F. unless indicated otherwise.

3. Countertop convenience outlets -
 - a) Where backsplashes are 4" or less, mount receptacles to clear backsplashes by 2".
 - b) Where backsplashes are over 4" high, mount receptacles with top of plate at 4" above countertop.
4. Special outlets - as required to serve equipment or as shown on Plans.

3.07 SURFACE CONDITIONS

- A. Prior to all Work of this Section, carefully inspect the installed Work of all other Trades and verify that all such Work is complete to the point where this installation may properly commence. Verify that electrical installation may be made in complete accordance with all pertinent codes and regulations and the original design.
- B. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.08 PREPARATION

- A. Coordinate the installation of electrical items with the schedules for Work of other Trades to prevent unnecessary delays in the total Work. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, furnish and install all required supports and wiring to clear the encroachment.
- B. The accompanying Drawings show approximate location of feeders, branch circuits, light and power circuits, etc. Complete and accurate details in regard to locations will be determined in the field and any reasonable changes in locations shall be made before roughing-in without additional cost to the Owner.

3.09 CUTTING AND PATCHING

- A. The Contractor shall do all cutting where necessary for installation of electrical work with approval of the Architect and/or Engineer as to cutting of any structural beams or joists. All patching shall be done to the satisfaction of the Architect.
- B. Where cutting of masonry is required for installation of switches and receptacles Contractor shall exercise care that holes are not larger than required. In any case where holes are too large to be covered by standard device plates, the Contractor shall furnish oversized device plates for all devices in that room or area or masonry shall be patched to the satisfaction of the Architect.

3.10 PAINTING

- A. All painting shall be done as described in other Divisions of the Specifications. The Contractor shall leave Work installed under this Division free of rust, dirt, grease, plaster, and labels.
- B. All iron and steel installed under this Division shall be protected against rusting. Material which does not have a protective finish shall be painted at the time of installation.
- C. Equipment with a factory supplied finish, which is furnished and installed under this Division shall have scratches, chips, etc. repaired and refinished to the satisfaction of the Architect.

3.11 EXCAVATION AND BACKFILLING

- A. The Contractor shall do all excavation and backfilling required for the installation of Electrical Work.
- B. Backfill shall be done in layers of 12" fill, wetted down and tamped for each consecutive layer up to grade, to 90% standard compaction (95% under paving). After settlement fill and level any depressions to provide a level compacted surface.
- C. Excavations shall be filled as soon as possible and not left open for prolonged periods. Open excavations shall be properly attended or suitably guarded to prevent accidents.

END OF SECTION 16100

SECTION 16400
ELECTRICAL - DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 SERVICE

- A. Service to the Project is existing 120/208 volts, three phase, four wire.
- B. New panels are to be fed from the existing main distribution panel. See Drawings. No modification of the existing service is required.

1.02 DISTRIBUTION EQUIPMENT

- A. The Contractor shall furnish and install all apparatus (panelboards, disconnects, etc.) required for a complete installation.

PART 2 - PRODUCTS

2.01 PANELBOARDS

- A. The panels designated as "A" and "B" shall be Square D type NQOD. All breakers shall have an interrupting capacity of 10,000 amperes symmetrical a.c. minimum. Equivalent products by Siemens, Cutler-Hammer, or GE are acceptable.
- B. The panel designated as "MD" is existing Square D type I-Line. Add branch breakers as scheduled. Short circuit interrupting rating shall be 42,000 amperes minimum.
- C. Panels shall be arranged essentially as scheduled on Drawings.
- D. All panels shall have copper bus.
- E. Panels shall be provided with a ground bar and engraved nameplate, secured with screws. Nameplates for panels shall indicate panel designation, voltage, and source as follows:
 - PANEL A (3/16" high letters)
 - 120/208v, 3ph., 4w (1/8" high letters)
 - FED FROM MD (1/8" high letters)Secure nameplates to panel covers with screws, pop rivets, or a permanent adhesive such as silicone, "liquid nails", etc. Peel off backing or double sided tape is not acceptable.
- F. All circuit breakers shall be bolt-on type.

G. Ground and neutral shall be bonded only at the service entrance.

2.02. SAFETY DISCONNECTS

- A. Disconnects shall be Square D general duty type or equivalent for 208 volt applications. Equivalent products by Siemens, Cutler-Hammer or GE are acceptable.
- B. For each disconnect whose purpose is not readily apparent (such as by location immediately adjacent to load served), provide an engraved identifying nameplate, as specified above for panels, describing the load or use of the disconnect.
- C. Where fusing is required, fuses shall be Class RK-5, 250 volts, dual element time-delay type, with 200,000 A.I.C.

2.03 SURGE PROTECTIVE DEVICE

- A. Provide surge protective device (SPD) to protect new and existing branch circuit panels (see Riser Diagram).
- B. SPD shall be Liebert "Accu Var" model ACV120S101, or equivalent, with surge current capacity of at least 40,000 amperes per line and neutral and surge energy capacity of 550 joules per phase and neutral. Response time shall be less than .5 ns. Unit shall be certified to UL 1449. Wire size shall be #8 minimum, 1 each for each phase, neutral, and ground, twisted and kept as short as possible, between SPD and branch breaker which feeds it.
- C. Equivalent products by Siemens, Square D, or Advanced Protection Technologies are acceptable.

PART 3 - EXECUTION

3.01. INSTALLATION OF PANELS

- A. Install panels with top approximately at 6'-6" A.F.F. or to suit conditions.
- B. Provide a typewritten directory for branch circuit identification for each panel. Use permanent room numbering and names where applicable. (Note: Room numbers on Architectural drawings are not necessarily the permanent numbers. Obtain from the Architect the numbering scheme to be used for room/door placards before completing directories. Circuit identification shall include description of the load, such as lights, receptacles, HVAC, projector, etc. It is not acceptable to state, "Office" or "Lights" alone.

- C. Tighten all lugs, connectors, screws, terminals, etc. to manufacturer's specifications or UL standards.

END OF SECTION 16400

SECTION 16500
ELECTRICAL - LIGHTING

PART 1 - GENERAL

- A. Refer to Section 16010.

PART 2 - PRODUCTS

2.01 LIGHTING FIXTURES

- A. All fixtures shall be as scheduled on Drawings or equivalent. Refer to Section 16010 for equivalent products.
- B. Fixtures shall be suitable for the environment in which they will operate. Consideration shall be given to such factors as: operating temperature, dissipation of heat, maintenance of cleanliness, protection against corrosion, ease of relamping and durability of lampholders, ultraviolet and dimensional stability of lens materials, and transmission of ballast noise.
- C. Fixtures shall bear the UL Label.
- D. All fixtures shall be provided with proper accessories for hanging, mounting, joining together, and closing of ends.

2.02 BALLASTS

- A. Fluorescent ballasts shall be electronic type, energy saving, high power factor, low noise, Class "P" thermally protected, CBM certified, UL listed, and conform to ANSI Standards for light output and line transient. As applicable to the particular ballast, particularly those for F32T8 lamps, ballasts shall have the following characteristics:
1. Operate lamps in instant start mode.
 2. Operate multiple lamps as parallel circuit, operating remaining lamp(s) at full light output upon failure of other lamp(s) connected to the same ballast. Individual ballasts specifically designed and UL Listed are to operate one, two, three, or four lamps as scheduled on the drawings.
 3. Operate lamps at rated lumen output and life specified by lamp manufacturers.
 4. Operate lamps at a frequency higher than 20 kHz.
 5. Operate at rated circuit voltage (120 or 277 VAC) at an input frequency of 60Hz. And tolerate +/- 10% sustained voltage variation without damage to the ballast, and maintain light output at +/- 10% voltage variation.

6. Comply with EMI and RFI limits set by the FCC (CRF 47 Part 18) for non-consumer applications and not interfere with normal electrical equipment.
 7. Power Factor shall be not less than 0.95.
 8. Total Harmonic Distortion shall be less than 20%.
 9. Lamp Crest Factor shall be 1.7 or less.
 10. Ballast Factor shall be greater than 0.85.
 11. Sound rating shall be "A".
 12. Withstand transients shall be as specified by ANSI C.62.41 for location category A.
- B. HID ballasts shall be high power factor, low noise, UL listed, with line starting current during warm-up less than normal operating current. Ballasts shall maintain lamp operation for line voltage fluctuations of at least plus or minus 10%. Lamp wattage variations shall not exceed plus or minus 5%.

2.03 LAMPS

- A. Incandescent lamps shall be extended service type or 125-30 volt rated or low voltage as shown.
- B. Fluorescent and HID lamps shall be suitable for operation with the ballasts to which they are connected and in the position in which they are installed.
- C. Do not mix lamps of different manufacturers within type.
Acceptable manufacturers:
- General Electric
Philips
Osram - Sylvania
Venture
- D. If specified lamp is proprietary, furnish specified lamp only.

2.04 LED LIGHT FIXTURES

- A. General:
1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
 2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
 3. LED drivers shall include the following features unless otherwise indicated:
 - a. Minimum efficiency: 85% at full load.

- b. Minimum Operating Ambient Temperatures: -20°C (-4°F).
 - c. Input Voltage: 120-277v ($\pm 10\%$) at 60Hz.
 - d. Integral short circuit, open circuit, and overload protection.
 - e. Power Factor: ≥ 0.95 .
 - f. Total Harmonic Distortion: $\leq 20\%$.
 - g. Comply with FCC 47 CFR Part 15.
 - h. Where required for dimming, drivers shall include 0-10v. dimming capability.
4. LED modules shall include the following features unless otherwise indicated:
- a. Comply with IES LM-79 and LM-80 requirements.
 - b. Minimum CRI 80 and color temperature as specified in LIGHTING SCHEDULE.
 - c. Minimum Rated Life: 50,000 hours per IES L70.
 - d. Light output lumens as indicated in the LIGHTING SCHEDULE.
- B. LED Downlights:
- 1. Housing, LED driver, and LED module shall be products of the same manufacture.
- C. LED Troffers:
- 1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
 - 2. Housing, LED drives, and LED module shall be products of the same manufacture.

PART 3 – EXECUTION

3.01 INSTALLATION OF FIXTURES

- A. Install all fixtures in complete accordance with manufacturer's recommendations and all applicable codes and regulations.
- B. All fixtures shall be thoroughly cleaned prior to installation and again before final acceptance if conditions warrant.
- C. The Contractor shall install all necessary hardware for proper support and anchoring of fixtures. Fixtures may be attached to outlet boxes provided boxes will adequately support them. Otherwise support fixtures independently of outlet boxes. Vandal resistant fixtures with provisions for independent mounting to building surfaces or structure shall be supported in that fashion.
- D. Support all fixtures installed in suspended ceilings independently from the structure. Ceiling subcontractor shall provide extra wires from structure for this

Contractor's use to independently support fixtures at opposite corners by means of lances provided in the fixtures for this purpose.

3.02 FIXTURE CONNECTIONS AND WIRING

- A. Wiring to fixtures shall be in accordance with the National Electrical Code and SECTION 16100 of these Specifications.
- B. Branch circuit conductors may terminate inside fixtures only if conductors have insulation suitable for temperature encountered.
- C. Tap conductors from outlet boxes to fixtures may be as small as #14 AWG with proper insulation.
- D. Thru-wiring of fixtures shall be carefully planned so that all outlet boxes are accessible and all temperature requirements of conductors are met.
- E. All non-current carrying metallic parts of fixtures shall be grounded in accordance with the National Electrical Code.

3.03 LAMPING

- A. Lamp all fixtures with lamps of the designed rating and pattern.
- B. Lamps used extensively during construction shall be replaced before turning over to the Owner.

END OF SECTION 16500

SECTION 16600
ELECTRICAL - SPECIAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

- A. This Section consists of requirements for rough-in for the following Electrical Special Systems for the Project:
 - 1. Communications Outlets (Data and Communications)

PART 2 - PRODUCTS

2.01 COMMUNICATIONS OUTLETS

- A. Communications outlets (designated **C**) are provided for multiple uses (voice, data, etc.).
- B. Provide 4" square outlet boxes with single gang switch rings at receptacle, countertop, or indicated height. Provide blank cover plates to match device cover plates.
- C. Stub 3/4" conduits into accessible area above ceiling or as shown. Terminate with an insulating bushing.
- D. Provide other junction or pull boxes as required or shown on Drawings.
- E. Leave pull strings in all raceways.

END OF SECTION 16600

SECTION 16700
ELECTRICAL - FIRE PROTECTION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. This specification provides the requirements for the installation of a complete Addressable Analog Fire Detection System Network. The system shall include, but not be limited to: control panel, alarm initiating and indicating peripheral devices, conduit, wire and accessories required to furnish a complete operational system.
- B. Devices provided by others (sprinkler flow switches) shall be connected to the Fire Alarm System for appropriate function.
- C. System shall be Mircom FX-3500, or equivalent.

1.02 RELATED DOCUMENTS

- A. Drawings
- B. General provisions of contract, including General and Supplementary conditions
- C. Section 16010 - General Provisions
Section 16100 - Basic Materials & Methods

1.03 STANDARDS AND CODES

- A. The entire system installation and wiring shall comply with applicable provisions of the current issue of NFPA-72 (A,B,C,D as required) Life Safety Code 101, American Disabilities Act, and codes and regulations of local authorities having jurisdiction.
- B. The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
 - 1. UL 864/UOJZ, APOU Control Units for Fire Protective Signaling Systems.
 - 2. UL 268 Smoke Detectors for Fire Protective Signaling Systems.
 - 3. UL 268A Smoke Detectors for Duct Applications.

4. UL 521 Heat Detectors for Fire Protective Signaling Systems.
5. UL 464 Audible Signaling Appliances.
6. UL 1638 Visual Signaling Appliances.
7. UL 1481 Power Supplies for Fire Protective Signaling Systems.

1.04 SUBMITTALS

- A. Submittal data for the Fire Alarm System shall consist of shop drawings, and catalog cuts indicating technical data necessary to evaluate the equipment, to include dimensions of all cabinets, fabrication materials and other descriptive data necessary to fully describe the equipment proposed. Submittals shall be provided to the Engineer for review and through the Professional of Record to the Fire Marshal.
- B. A one line diagram shall be included with the submittal material including all alarm initiation devices, annunciation devices and control equipment. This diagram is to indicate the fire zoning of the building, conduit sizes will be in accordance with SECTION 16100 and wiring requirements. Also typical alarm, annunciation and control circuit diagram shall be submitted. Provide calculations to support the size of standby batteries submitted.

1.05 CONTRACT CLOSEOUT SUBMITTALS

- A. Contractor shall deliver two (2) copies of the following to the owner's representative within thirty (30) days of date of system acceptance:
 1. Installation and Programming manuals covering the installed system.
 2. The application program listing for the system as installed at the time of acceptance.
 3. Name, address and telephone of the authorized factory representative.
 4. Final life safety program loaded into system in both hard copy (in English, source code will not be acceptable) and disk format to specifying engineer within 30 days of acceptance. Program listing must be generated from actual file loaded into system.
 5. Sensitivity reports showing all sensors with address, sensitivity level, current obscuration values and number of times per device alarm

verification has occurred, current at time of acceptance, to be delivered within 30 days of acceptance.

6. "As-built" Drawings.

1.06 WARRANTY

- A. The entire installation shall be warranted by the Contractor (and his suppliers) against defects in materials, workmanship, and performance for a period of one year from date of completion and final acceptance of the facility. Contractor shall furnish free of charge to Owner all materials and labor necessary to comply with this guarantee.

1.07 TESTING

- A. Upon completion, the Contractor shall conduct a total system test for the Owner, Architect, Engineer, and Fire Marshal. At minimum the test shall include:
1. Verifying operation of all manual stations, all analog smoke detectors, analog duct detectors, and thermal detectors.
 2. Verifying line supervision of all data, indicating and control circuits.
 3. Verifying the operation of all indicating devices, audible and visual.
 4. Verifying the operation of all alarm initiated control functions.
- B. The Contractor shall verify in writing that these test functions have been successfully completed. Verification will be by factory certified technician.

1.08 FIRE ALARM SYSTEM SEQUENCE OF OPERATION

- A. A general fire alarm shall be initiated by actuation of any manual alarm station, sprinkler flow switch, verified area smoke detector or duct detection system.
- B. When an area smoke detector is initially activated, the system shall start the alarm verification mode. After the detector has processed through the reset portion of the verification mode and is activated a second time it will allow the general alarm sequence to occur. If a second alarm is activated at any time during the alarm verification period, the general alarm sequence shall occur. Activation of any contact device, i.e. pull station, shall bypass the alarm verification mode and the general alarm sequence shall occur.
- C. The fire alarm system shall have the following responses once an alarm has been initiated:

1. Display location and type of alarm at the fire alarm control panel.
 2. Sound an audible device at the fire alarm control panel.
 3. Illuminate the proper indicator at all remote annunciators.
 4. Activate all alarm indicating appliances, after a programmed time delay.
 5. Transmit voice emergency paging to designated speakers.
 6. Provide a supervised signal to notify local fire department, monitoring service, or other designated station. The Contractor shall provide a digital communicator compatible with the remote monitoring service contracted with by the Owner to satisfy this requirement.
- D. Preceding items shall occur simultaneously and shall be continuous until the activated device is returned to normal, except that the alarm indicating appliance may be silenced. However the entire alarm sequence shall occur in the event of a second alarm condition. When the actuated device has been restored to its normal condition the system may be reset.
- E. Equipment shall be supervised for opens and grounds in initiating circuits, and signal circuits.
- F. All changes of status shall be retained in the fire alarm control panel's historical log feature.

1.09 CIRCUITING GUIDELINES FOR INTELLIGENT SYSTEMS

- A. All system sensors (PHOTO/ THERMAL) shall be of the Addressable Analog type. Each individual device point number and message shall be displayed on the Master Controller's LCD.
- B. Each alarm indicating devices shall be circuited, utilizing traditional indicating circuits.

PART 2 - PRODUCTS

2.01 ACCEPTABLE EQUIPMENT MANUFACTURERS

- A. The submitted equipment shall equal or exceed the quality, performance, functions and features of the specified equipment. All substitutions of operating capabilities or equipment called for in these specifications shall be listed in writing and forwarded to the Engineer. Any such exceptions, variances or substitutions shall

be listed at the time of submittal; failure to do so shall be grounds for immediate disapproval without comment.

- B. Acceptable Manufacturers shall be engaged in the manufacture of multiplexed audio/fire panels for at least 7 years and have a fully equipped, factory trained and authorized service organization within 100 miles.

2.02 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be the best suited for the intended use and shall be provided by a single manufacturer or if provided by different manufacturers, recognized as compatible by both manufacturers.
- B. The batteries shall provide 24 hours of standby operation and 15 minutes of alarm operation (voice evac) at the end of the 24 hour standby period.

2.03 CONTROL PANEL

- A. The controller shall be modular for ease of installation, maintenance, and configuration. The controller shall be capable of supporting the number of inputs/outputs required for this project plus 100% for future growth without any change in hardware. The controller shall have an 80 character, super twist, backlit Liquid Crystal Display (LCD) that offers (2) 40 character lines.
- B. The controller shall differentiate between long term drift above the prealarm threshold (maintenance alert, indicative of the need for cleaning) and a fast rise above the prealarm threshold (indicative of a smoldering fire). The Maintenance Alert shall be annunciated as an alert on the LCD only and shall not be confused as a Trouble or an Alarm. The maintenance alert shall be routable to multiple points as application dictates. The unit shall contain a real time clock, tactile feel keypad (16 keys), with 19 functions, (2) buttons for scrolling data on the LCD, (4) front panel switches for Reset, Alarm and Trouble Silence, and Drill/All Call and (5) LED's for Normal, Alarm, Supervisory, Trouble and Test/Program. The Controller shall control up to (52) additional network remote field controllers. During the normal state, the NORMAL LED (green) shall flash, the first line of the LCD shall display the time in (HH:MM:SS) as well as the number of active points ("AP") and the number of disabled points ("DP") in the system. When the control panel goes into the alarm condition the (green) NORMAL LED extinguishes and the (red) ALARM LED shall light, the buzzer pulsates and the LCD indicates the time, the number of messages waiting, the type of alarm, the Alarm zone or device number, and the time that the ALARM occurred. The second line is dedicated to the user specified message. To acknowledge the alarm, the operator

shall press the NEXT/ACK button, and the buzzer will silence providing there isn't an additional alarm waiting. If there are additional alarms waiting the operator shall acknowledge all pending alarms before the buzzer will silence. To silence audible devices the operator shall press the ALARM SILENCE button, a new alarm shall cause the audible devices to resound. To reset the network the operator shall press the RESET button. During the TROUBLE condition, the amber TROUBLE LED shall light, the NORMAL LED shall go out, and the BUZZER shall pulsate. The display shall indicate "SUPERV. OPEN" and the zone or device number. The operator shall silence the BUZZER by acknowledging all messages and pressing the TROUBLE SILENCE button. During the SUPERVISORY condition the amber SUPERVISORY LED shall light, the NORMAL LED shall go out, and the BUZZER shall pulsate. The LCD shall indicate ("SUPERV. SHORT") and the zone number. The operator shall silence the BUZZER by acknowledging all messages and pressing the TROUBLE SILENCE button. The controller shall be capable of supporting analog circuit control modules or traditional circuit modules.

2.04 POWER SUPPLIES (Standard and Auxiliary)

- A. The Power Supply/Charger shall provide the means of automatically supplying 24 VDC operating and emergency power to the system. The power supply shall be a minimum of 80% efficient, switch mode solid state design, with built in maximum transient protection (up to 6 KV) including UL recognized EMI filter, spark gaps, transistors, and varistors. The power supply shall provide 7.0 amps ((2) 3.5 amp outputs) of usable, fully regulated, power limited 24 Vdc to operate listed signaling devices. The power supply shall provide diagnostic LEDs to notify the operator upon AC power and/or the control unit CPU failure. The power supply shall contain brown out, low battery detection, system ground fault detection and shall be capable of charging from 5 AH to 60 AH batteries of either gel electrolyte no maintenance type or nickel cadmium. Upon AC power failure the power supply shall automatically transfer the system to battery backup and power the system for 24 hours or until the AC power is restored. The auxiliary power supply shall not require connection to a control panel and use one unit space in the cabinet and shall provide all other features of the Standard Power Supply. The battery charger may be disabled to provide additional auxiliary output power if required.

2.05 INTELLIGENT ANALOG LOOP CONTROLLER

- A. The Analog Loop Card shall plug into (1) slot in the master controller and serve as the interface between the controller and the Addressable Intelligent Analog Sensors, single and multi-zone I/O Modules. The Analog loop is capable of supporting and providing positive point identification for up to (96) intelligent sensors and (96) I/O modules or (12) multi-zone I/O Modules or may be intermixed. The Analog Loop contains its own dedicated resident Central Processor Unit (CPU) and shall provide power, process, store, control and

communicate with sensors and I/O modules via a minimum 18 ga. twisted pair or optional Fiber Optics receiver and transmitter up to a maximum of 5,000 ft. on copper lines. The controller, through the Analog loop card shall provide for sensitivity adjustment and alarm verification by point, process the analog values from all intelligent devices on it's loop and determine Normal, Alarm, and Trouble conditions. Communication with up to 192 devices or addresses shall be performed every 4 seconds or less. The average time to detect an alarm shall be 3 seconds or less. The polling time for the system remains the same regardless of the number of intelligent loops in the system up to it's maximum of (24) loops.

2.06 VOICE EMERGENCY PAGING SUBSYSTEM

- A. Voice emergency paging for assembly areas (where indicated) shall be by pre-recorded evacuation message using solid state electronics and a 30 watt (minimum) amplifier listed for the purpose and provided with battery back-up.
- B. This subsystem shall be installed in the Fire Alarm Control Panel/Cabinet.

2.07 INTELLIGENT ANALOG ADDRESSABLE IONIZATION SENSOR

- A. The Intelligent Analog Addressable Ionization Sensor shall connect with (2) wires (twisted pair) to the Analog loop card. The sensor shall be easy to install into a twist-lock base. The sensor shall incorporate a built-in type identification so the system can identify the type of sensor. The sensor shall be continually monitored to measure any change in their sensitivity because of the environment (dirt, smoke, temperature, humidity, etc.). The sensor shall not require the averaging of signals. The sensor shall use the photoelectric principle to measure smoke density and shall on command from the control panel send data to the panel representing the analog value of the smoke density. The sensor shall provide advanced indication of the analog value of the level of smoke density to the panel that maintenance is required, reducing the maintenance required to inspect routinely all sensors in order to insure normal operation. The sensor sensitivity shall be adjustable by device.
- B. Where indicated on the Drawings, two detectors shall be provided to close smoke doors. These shall be 4-wire detectors and shall provide the required closure or signal from the F.A.C.P. to release the doors.
- C. For A/C duct applications, provide properly sized sampling tubes and coordinate with Mechanical Contractor for proper installation.

2.08 INTELLIGENT ANALOG ADDRESSABLE THERMAL SENSOR

- A. The Intelligent Analog Thermal Sensor shall be (2) wire (twisted pair) to the Analog Loop card. The analog thermal sensor shall be easy to install into a twist-lock base. The sensor shall incorporate a built in type identification so the

system can identify the type of sensor. The sensor shall be continually monitored to measure any change in their sensitivity because of environment (dirt, temperature, humidity, etc.). The sensor shall use dual solid state thermistors and shall monitor the ambient temperature from -10 degrees °C, to +60 degrees °C and provide a fast response to rapid increases in temperature. The sensor on command from the control panel, shall send data to the panel representing the analog value of the ambient temperature.

2.09 INTELLIGENT MONITOR MODULE

- A. The Intelligent Monitor Module shall be used to connect a supervised conventional initiating device or zone of supervised conventional initiating devices manual pull stations, etc. to one of the (2) wire intelligent analog loop cards. The Monitor module shall mount in a 4 inch square, 2 1/8 inch deep electrical box and shall be capable of Class "A" or "B" supervised wiring to the initiating device. The mini monitor module (class "B" only) shall mount behind the Manual Station in a single gang electrical box. The Monitor Module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device. The Monitor Module shall contain an integral LED that flashes each time the monitor module is polled.

2.10 INTELLIGENT CONTROL MODULE

- A. The Intelligent Control Module shall be used to connect and supervise, conventional indicating devices or zone of indicating devices that require an external power supply, such as horns, strobes, bells, speakers or telephones to one of the (2) wire intelligent analog loop cards (Class "A" or "B"). The control Module shall be capable of operating as a relay (dry contact form C), to control Door Holders, Air Handling units etc. The control module shall be capable of Class "A" or "B" supervised wiring to the indicating or control device. The Control Module shall contain an integral LED that shall flash each time the module is polled. The Control Module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device.

2.11 ISOLATION MODULE

- A. The Isolation Module shall be an automatic switch, which will open when the Intelligent loop voltage drops below 4 volts. The Isolation Module shall be placed between groups of sensors/intelligent modules on the loop in order to protect the intelligent loop if a short (less than 4 volts) should occur. If a short occurs between any two (2) isolators, then both isolators switch to an open circuit condition and isolate the group of sensors/modules between them. The remaining devices on the intelligent loop shall continue to operate and communicate normally. The number of devices between isolators shall be (25) or less. The

Isolation Module shall be designed to mount in a 4 inch square, 2 1/8 inch electrical box. Provide one isolation module per 30 sensors.

2.12 MANUAL PULL STATION

- A. Provide manual stations as shown. The double action manual station shall be of the non coded type with terminals. The red manual station shall be constructed of lexan and shall be available with an optional break glass rod. The manual station shall be used with the addressable monitor module where point addressability is required.
- B. All manual stations shall be mounted at 48" A.F.F.

2.13 SPEAKER/STROBE UNIT

- A. Provide 4" eight ohm cone type speakers with integral 100 candela (minimum), strobe. Speakers shall have matching transformers parallel connected to supervise 25 volt signal/paging circuits. Provide input power taps @ 1/4, 1/2, 1 & 2 watts.
- B. All units shall be wall mounted 80" maximum A.F.F. or as otherwise permitted by Code if more suitable for conditions. Ceiling mounted devices shall comply with all Code requirements.

2.14 STROBE UNITS

- A. Provide visual-only alarm devices (strobes) in locations shown on Plans. Strobes shall mount to 4" square boxes and display "**FIRE**" on lens.
- B. All units shall be wall mounted 80" maximum A.F.F. or as otherwise permitted by Code if more suitable for conditions. Ceiling mounted devices shall comply with all Code requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Verify that conduit size and wire quantity, size, and type is suitable for the equipment supplied. Review the proper installation of each type of device with the equipment supplier. All wiring, connections, testing, adjusting, and calibrating shall be done by a factory trained and certified technician. The entire system shall be installed in a workmanlike manner in accordance with approved manufacturers manuals and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the System Manufacturer and NEC, approved by local authorities

having jurisdiction for the purpose, and shall be installed in dedicated conduit throughout.

- B. All fire alarm wiring shall be installed in conduit. All penetration of floor slabs and fire walls, shall be fire stopped in accordance with all applicable fire codes.
- C. End of Line Resistors shall be furnished as required for mounting as directed by the manufacturer.
- D. All wiring shall be color coded throughout, to NEC standards and a minimum of No. 16 AWG, unless otherwise noted.
- E. Field Quality Control: The system shall be installed and fully tested under the supervision of trained manufacturer's representative. The system shall be demonstrated to perform all the functions as specified.

3.02 TRAINING

- A. In addition to the requirements of 1.00-E. (Closeout Submittals), and a manufacturer's recommended spare parts list, the Contractor shall provide the services of the manufacturer's trained representative for a period of eight (8) hours, during normal business hours, to instruct the Owner's designated personnel on the operation and routine maintenance of the system.
- B. The Contractor shall allow the Owner to videotape or record all instruction tours.

3.03 INSTALLER QUALIFICATIONS

- A. Installer shall be regularly engaged in the business of installing and servicing fire detection and alarm systems and shall be registered by the State Fire Marshal in accordance with LA R.S.40:1651 through 1661.

END OF SECTION 16700

SECTION 16800
ELECTRICAL - CONTROLS

PART 1 - GENERAL

1.01 SCOPE

- A. This Section consists of requirements for installation of HVAC Controls.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Basic materials used for Work of this Section are described in SECTION 16100.
- B. Thermostats, firestats, control relays, and environmental control devices, unless specified otherwise or shown otherwise on Drawings, shall be furnished under Division 15 of the Specifications and installed under Division 15 of the Specifications. All final connections are to be made by the HVAC Contractor.
- C. Conduit shall be provided under Division 16 of the Specifications.

PART 3 - EXECUTION

3.01 HVAC CONTROLS

- A. Provide conduit and boxes for thermostats for heating, ventilation and air conditioning controls. In most cases, 1/2" conduit will be sufficient; however, Contractor shall verify all requirements before installation. Stub conduit up from thermostat locations to accessible area above ceiling. Terminate with an insulating bushing.

END OF SECTION 16800