SECTION 23 81 29
VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. Furnish and install all air conditioning units. This shall include all piping, ducts and supports specified in this Division and as shown on the drawings

B. All units shall be new and manufactured for the specific purpose of providing conditioned air (heating and cooling) to the systems indicated.

C. All system components shall be installed in accordance with local codes including seismic isolation.

D. Secure all permits and local/state approval for the components as specified and included under this Section.

1.03 RELATED SECTIONS

A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.04 REFERENCES

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made part of the Contract Documents.
   1. ABMA STD 9 – Load Ratings and Fatigue Life for Ball Bearings.
   2. ABMA STD 11 – Load Ratings and Fatigue Life for Roller Bearings.
   3. AMCA 99 – Standards Handbook.
   4. AMCA 210 – Laboratory Methods of Testing Fans for Rating.
   5. AMCA 300 – Reverberant Room Method for Sound Testing of Fans.
   6. AMCA 301 – Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
   7. AMCA 500 – Test Methods for Louvers, Dampers and Shutters.
   8. ARI 410 – Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.
   9. ARI 430 – Standard for Central-Station Air-Handling Units.
   10. ARI Guideline D – Application and Installation of Central Station Air-Handling Units.
   11. NEMA MG 1 – Motors and Generators (1).
   12. NFPA 70 – National Electrical Code.
   13. SMACNA (DCS)– HVAC Duct Construction Standards – Metal and Flexible.
   14. UL 900 – Standard for Air Filter Units.
   15. UL 1096 – Electric Central Air Heating Equipment.

1.05 SUBMITTALS

A. See Section 23 00 02 and General Condition for additional submittal requirements.

B. The unit manufacturer shall submit without delay after receipt of notice of award, shop drawings for approval which shall indicate, but not be limited to, the following information in detail:
   1. Detailed drawings and data of all proposed components.
   2. To scale dimensional drawings (plans and sections) of the entire air handling unit showing all component locations, equipment arrangements, piping connections and sizes, duct connections and sizes, and all safing required.
   3. Casing and hoisting details including floor structures, internal structures, panel fabrication, insulation material and equipment supports. Location of drains and method of piping penetration and sealing of penetrations through the casings.

4. The sound power levels on all fans, fan and motor efficiency, horsepower, RPM and fan size.
5. Fan curves shall be submitted. Fan curves shall be prepared and submitted indicating performance of the fans.
6. ARI certified calculations for coil selections.
7. List of proposed component manufacturers and models, such as fans, casing, coils, humidifiers, filters, dampers, controls, door hinges, disconnect switches, controls, etc.
8. Pressure drop calculation indicating losses of all components, plenums, contractions, expansions at rated flow of unit. Pressure drop calculations are to be submitted in tabular form and shall indicate the total of all unit-associated losses plus the scheduled external static pressure. Calculations are to be based upon wet cooling coils and filters at recommended dirty change out pressure drop.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements and include start-up instructions.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data and parts listing.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Codes and Standards
1. ARI Compliance: Test and rate heat pump unit in accordance with ARI Standards.
2. NFPA Compliance: Provide heat pump unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems.
3. UL and NEMA Compliance: Provide electrical components required as part of heat pump unit, which have been listed and labeled by UL and comply with NEMA Standards.
4. NEC Compliance: Comply with National Electrical Code as applicable to installation and electrical connections of ancillary electrical components of heat pump unit.

B. Units shall comply with the EER requirements of the 2020 edition of the New York City Energy Conservation Code and ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be in accordance with DOE alternative test procedure, based on AHRI standards 340/360, 1230 and ISO standard 13256-1.

C. Refrigeration equipment shall be listed and labeled to UL 1995-1998. UL listing shall be indicated on the Shop Drawings.

D. All appliances regulated by the New York City Construction Codes shall be listed and labeled (reference MC 1101.2). Testing of material and equipment shall be in accordance with 28-113 of the Administrative Code (reference MC 301.5). Whenever the NYC Construction Codes or the Rules of the Department of Buildings requires that material be listed or labeled and material proposed to be used is not so listed or labeled, the use of such material shall be subject to prior approval by the Commissioner (Office of Technical Certification and Research OTCR) and such material shall be used only to the extent set forth in such approval. Materials that were previously approved by the Board of Standards and Appeal (BSA) or by the Department (MEA) before the effective date of the NYC Construction Codes may continue to be used, but only to the extent set forth in such approval, and only if such approval is not specifically amended or repealed by the Commissioner.

E. Refrigeration system shall be constructed in accordance with ASHRAE 15: Safety Standard for Refrigeration Systems as modified by NYC Mechanical Code Chapter 11.

F. All systems shall be provided in accordance with the NYC Construction Codes, NYC Energy Conservation Code and NYC Electrical Code.

1.07 DELIVERY, STORAGE AND HANDLING

A. Cleanliness

1. The intent of this Section is to ensure the Owner that the air handling units are manufactured, shipped, stored, field reconnected and started-up while maintaining a high degree of cleanliness. Unit interior and exterior shall be fully cleaned prior to start-up by the Contractor. Units shall be shrink-wrapped with a minimum of 10 mil plastic to protect the sections during shipping and while in storage. Once the units are received by the contractor, it shall be the contractor's responsibility to take whatever steps are necessary to deliver the units in like new condition upon start-up and turn-over to the Owner, whichever occurs the latest.

B. Manufacturing
   1. Casings shall be manufactured only after all panel components (structural members, facing sheets, etc.) have been thoroughly cleaned of any mill grease, oxidation, etc.
   2. The interior and exterior of the casing system shall be thoroughly protected from contamination from the manufacturing process through start-up procedures and Owner's acceptance.
   3. Internal components (fans, coils, air filter frames, etc.), shall arrive from their respective manufacturing facilities free of all grease and dirt.
   4. In general, any products such as caulks, gaskets, etc., employed within the unit shall be non-petroleum based products with no outgasing characteristics.

C. Shipping
   1. Shipping protection shall be provided such that both the interior and the exterior of each unit is protected from road dirt exposure during shipment. This protection shall remain on the unit until unit start-up is performed.
   2. Any units damaged in shipment shall be returned to the factory for all corrective work.

D. On-Site Storage
   1. If equipment is to be stored before use, the unit manufacturer shall have provided adequate protection at the factory to ensure that Cleanliness Standards for both the unit interior and unit exterior are met. This protection shall remain on the unit until such time as unit start-up is performed. Accommodations shall be made by the contractor to rotate fan assemblies on a periodic basis as recommended by the fan manufacturer. Fan assemblies shall be rotated without compromising Cleanliness Standards.

E. Rigging
   1. The Contractor shall be responsible for rigging under the direct supervision of the unit manufacturer.

F. Leveling
   1. The Contractor shall level all unit sections in accordance with the unit manufacturer's instructions. The contractor shall furnish and install all necessary permanent shim material to assure the levelness of the individual sections and the entire assembled unit.

1.08 WARRANTY

A. The unit manufacturer shall be responsible for and warranty the proper operation and performance of the units, all unit components, leak tightness and non-condensation of the unit casing, structural integrity of the unit including all provisions required for rigging, trucking and installation of units in the areas indicated on the drawings. Units shall be guaranteed for 1 year from date of acceptance of project by owner. Units shall be installed by certified Mitshubhishi contractor who has completed the required Mitshubhishi electric three day service course and obtained all the necessary installation training from Mitshubhishi. Provide extended manufacturers limited warranty for a period of five (5) years, and seven (7) years for the compressor.

B. During the above warranty period, if any part should fail to function properly due to defects in workmanship or material, it shall be replaced by the manufacturer at no cost to the owner.

PART 2 - PRODUCTS

2.01 GENERAL

2.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 2014 (Reaffirmed 2020).

C. AMCA 99 - Standards Handbook; 2025.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2025.

E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

J. UL 900 - Standard for Air Filter Units; Current Edition, Including All Revisions.

K. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

L. The system shall be of the variable capacity, air conditioning system and shall be a split system consisting of multiple evaporators, DDC controls and outdoor unit. Multiple indoor units may be connected to a single outdoor unit, each of which can be independently controlled. The units shall be designed and tested for use with refrigerant R-410A and be equipped with refrigerant line fittings which permit mechanical or sweat connection.

M. The size, the cooling and heating capacities shall be as indicated on the Drawings.

N. Units shall be factory assembled, piped and internally wired. Units shall be UL listed and carry a UL label. Units shall be factory tested.

1. Y-SERIES OUTDOOR UNIT
   a. General:
2. The Y-Series PUHY outdoor unit shall be specifically used with CITY MULTI VRF components. The PUHY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped, wired and run tested at the factory.
3. The model nomenclature and unit requirements are shown below. All units requiring a factory supplied twinning kit shall be piped together in the field, without the need for equalizing line(s).

OUTDOOR UNIT MODEL NOMENCLATURE		
208/230 VOLT		**TWINNING KIT**
MODEL NUMBER	**UNITS**	
PUHY-P312TSKMU-A	**(1) PUHY-P72TKMU-A** **(2) PUHY-P120TKMU-A**	**CMY-Y300CBK2**

4. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 65 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 55 dB(A) twinned while in night mode operation.
5. Both refrigerant lines from the outdoor unit to indoor units shall be insulated.

6. The outdoor unit shall have an accumulator with refrigerant level sensors and controls, high pressure safety switch, over-current protection, DC bus protection, low ambient controls and 20 gauge hot dipped galvanized snow/hail guard.
7. Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
8. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
    a. Unit Cabinet:
9. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.
    a. Fan:
10. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan/fans.
11. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed. The fan shall be factory set for operation under 0 inch. WG external static pressure, but capable of normal operation under a maximum of 0.24 inch. WG external static pressure via dipswitch.
12. The fan motor shall be mounted for quiet operation.
13. The fan shall be provided with a raised guard to prevent contact with moving parts.
14. The outdoor unit shall have vertical discharge airflow.
    a. Refrigerant
15. Units shall be provided with R410A refrigerant.
16. Units shall be provided with Polyolester (POE) oil.
    a. Coil:
17. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
18. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
19. The coil shall be protected with an integral metal guard.
20. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
21. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.
    a. Compressor:
22. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors shall not be acceptable.
23. A crankcase heater(s) shall be factory mounted on the compressor(s).
24. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 5% to 100% of rated capacity, depending upon unit size.
25. The compressor shall be equipped with an internal thermal overload and shall be internally isolated to avoid transmission of vibration.
    a. Electrical:
26. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz as indicated on drawings.
27. The outdoor unit shall be controlled by integral microprocessors.
28. 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.
29. PLFY-P**NBMU-ER2 (4-WAY CEILING-RECESSED CASSETTE WITH GRILLE) INDOOR UNIT
    a. A. General
30. The 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.

a. Unit Cabinet:

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

a. Fan:

36. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor and shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
37. The indoor fan shall consist of three (3) speed settings, Low, Mid, High. 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.
38. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
39. The indoor unit shall have switches that can be set to provide optimum airflow based on ceiling height and number of outlets used.
40. 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. 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.
41. Filter:
42. Return air shall be provided with washable filter.

a. Coil:

43. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
44. The tubing shall have inner grooves for high efficiency heat exchange.
45. All tube joints shall be brazed with phos-copper or silver alloy.
46. The coils shall be pressure tested at the factory.
47. A condensate pan and drain shall be provided under the coil.
48. 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.
49. Both refrigerant lines to the PLFY indoor units shall be insulated.

a. Electrical:

50. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz and as indicated on drawings.

a. Controls:
    1) This unit shall use controls provided by Mitsubishi Electric 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 and three (3) digital outputs capable of being used for customizable control strategies.

5) Manufacturer to provide drain pan level sensor powered by a 20-year life lithium battery. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.
6) The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

51. PLFY-P**NCMU-ER4 (4-WAY CEILING-RECESSED CASSETTE WITH GRILLE) INDOOR UNIT
    a. General:
52. The 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.
    a. Unit Cabinet:
53. 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.
54. The cabinet panel shall have provisions for a field installed filtered outside air intake.
55. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.
    a. Fan:
56. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor and shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
57. The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
58. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
59. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.
    a. Filter:
60. Return air shall be provided with a washable filter.
    a. Coil:
61. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
62. The tubing shall have inner grooves for high efficiency heat exchange.
63. All tube joints shall be brazed with phos-copper or silver alloy.
64. The coils shall be pressure tested at the factory.
65. A condensate pan and drain shall be provided under the coil.
66. 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.
67. Both refrigerant lines to the PLFY indoor units shall be insulated.
    a. Electrical:
68. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz as indicated on drawings.
    a. Controls:
69. This unit shall use controls provided by Manufacture of unit to perform functions necessary to operate the system.
    1) 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.

2) 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 dead band from set point.
3) Indoor unit shall include no less than four (4) digital inputs and no less than three (3) digital outputs capable of being used for customizable control strategies.
4) Manufacturer to provide drain pan level sensor powered by a 20-year life lithium battery. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.
5) The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

O. F. Controls:
1. The Remote and Centralized control panels shall be fabricated from a plastic material with a neutral color. Each control panel must have a LCD (Liquid Crystal Display) that shows room temperature, set point, mode of operation (on/off/cool/heat) and fan speed.
2. Electrical Characteristics
   a. The electrical voltage from each circuit board to the controls shall be 12 volts DC. The voltage may fluctuate up or down depending on communication packets being sent and received.
   b. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit then to the outdoor unit. Control wiring shall run from the indoor unit terminal block to the controller associated with that unit.
   c. Wiring shall be 2 conductor 16 or 18 gauge twisted pair stranded wire with a shield.
   d. The wire shall be shielded and connected to the appropriate terminals within the indoor units and outdoor unit.
   e. Control wiring for the simple MA controllers 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.
   f. Control wiring for the centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit to the system controller to the power supply.
3. 3. The remote controller shall be furnished by the same manufacturer of the equipment and installed in a location as per the owners discretion. Multiple timer modes shall be available. The timer mode shall allow selective use depending on the application configuration. The range of room temperature setting shall not be limited by the initial setting. By setting the room temperature range narrower than usual setting, cooling/heating operation with excessive temperature shall be prevented thus saving energy easily. The remote controller shall be equipped with simplified button locking function.

OPERATION MODE - SWITCHING:	**SWITCHES BETWEEN COOL/DRY/AUTO/FAN/HEAT. OPERATION MODES VARY DEPENDING ON THE AIR CONDITIONER UNIT. AUTO MODE.**
TEMPERATURE SETTING:	**SETS THE TEMPERATURE FOR A SINGLE GROUP. RANGE OF TEMPERATURE SETTING SHALL BE:** **COOL - 66° TO 86°** **HEAT - 63° TO 83°**

FAN SPEED SETTING:	**HI/MID-2/MID-1/LOW - USED FOR 4 SPEED INDOOR UNITS** **HI./MID/LOW - USED FOR 3 SPEED INDOOR UNITS** **HI/LOW - USED FOR 2 SPEED INDOOR UNITS**
AIR FLOW DIRECTION:	**AIR FLOW DIRECTION ANGLES ARE: 100%, 80%, 60%, 40% AND SWING. LOUVER SHALL BE ABLE TO BE TURNED ON OR OFF.**
PERMIT/PROHIBIT LOCAL OPERATION:	**PROHIBITS OPERATION OF EACH LOCAL REMOTE CONTROLLER FUNCTION THAT INCLUDES: START/STOP, OPERATION MODE, SET TEMPERATURE, AND RESET FILTER.**
PROHIBITION/PERMISSION	**ENABLES OR DISABLES THE OPERATION OF COOLING OR HEATING.**
INDOOR UNIT INTAKE TEMPERATURE:	**MEASURE THE INTAKE TEMPERATURE OF THE INDOOR UNIT WHEN THE INDOOR UNIT IS OPERATING.**
ERROR CODE DISPLAY:	**WHEN AN ERROR HAS OCCURRED WITHIN THE AIR CONDITIONER UNIT, THE AFFLICTED UNIT AND THE ERROR CODE ARE DISPLAYED.**
TIME OPERATION:	**ONE DAY TIMER: ON/OFF SETTING OF ONE TIME ON ONE DAY SHALL BE ABLE TO BE APPLIED. DAILY TIMER: ON/OFF SETTING BY THE ONE DAY TIMER SHALL BE ABLE TO BE REPEATED FOR EVERYDAY. AUTO OFF TIMER: OFF TIMER SHALL BE ABLE TO BE SET IN A RANGE FROM 30 MINUTES TO 4 HOURS.**
TEST RUN:	**OPERATES AIR CONDITIONER UNITS IN TEST RUN MODE.**
SETPOINT TEMPERATURE RANGE LIMIT:	**THE RANGE OF ROOM TEMPERATURE SETTING SHALL BE ABLE TO BE LIMITED BY THE INITIAL SETTING. THE LOWEST LIMIT TEMPERATURE SHALL BE ABLE TO BE MADE HIGHER THAN THE USUAL (66º) AT COOLING/ DRYING, WHILE THE UPPER LIMIT TEMPERATURE SHALL BE ABLE TO BE MADE LOWER AT HEATING.**
LOCKING FUNCTION (AUTO LOCK FUNCTION):	**SETTING/RELEASING OF SIMPLIFIED LOCKING FOR REMOTE CONTROL SWITCH SHALL BE ABLE TO BE PERFORMED INCLUDING:** **• LOCKING OF ALL SWITCHES** **• LOCKING OF ALL SWITCHES EXCEPT START/STOP SWITCH**
EXTERNAL INPUT/OUTPUT:	**BY CONNECTING A PROGRAM TIMER, A WEEKLY SCHEDULE SHALL BE ABLE TO BE**

	CONTROLLED. EXTERNAL START/STOP CONTROL AND EMERGENCY STOP NEED NOT SUPPORTED.

4. CENTRALIZED CONTROLLER: (AG-150A)

a. The AG-150A Centralized Controller shall be capable of controlling a maximum of 50 indoor units across multiple CITY MULTI outdoor units. The AG-150 Centralized Controller shall be approximately 7-1/2”x12” in size and shall be powered from a Power Supply Unit (PAC-SC51KUA). The AG-150 Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. The AG-150A Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the AG-150A Centralized Controller shall include on/off, operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, and fan), temperature setting, fan speed setting, and airflow direction setting. Since the AG-150A provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the AG-150A Centralized Controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

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.** **AUTO MODE IS AVAILABLE FOR THE R2/WR2-SERIES ONLY.**	**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**
SET TEMPERATURE RANGE LIMIT	**THE RANGE OF ROOM TEMPERATURE SETTING CAN BE LIMITED BY THE INITIAL SETTING. THE LOWEST LIMIT**	**EACH GROUP**	**EACH GROUP**

ITEM	DESCRIPTION	OPERATION	DISPLAY
	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.		
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
SCHEDULE OPERATION	ANNUAL/WEEKLY/TODAY SCHEDULE CAN BE SET FOR EACH GROUP OF AIR CONDITIONING UNITS. OPTIMIZED START SETTING IS ALSO AVAILABLE. *1. THE SYSTEM FOLLOWS EITHER THE CURRENT DAY, ANNUAL SCHEDULE, OR WEEKLY, WHICH ARE IN THE DESCENDING ORDER OF OVERRIDING PRIORITY. TWENTY-FOUR EVENTS CAN SCHEDULED PER DAY, INCLUDING ON/OFF, MODE, TEMPERATURE SETTING, AIR DIRECTION, FAN SPEED AND OPERATION PROHIBITION. FIVE TYPES OF WEEKLY SCHEDULE (SEASONAL) CAN BE SET. SETTABLE ITEMS DEPEND ON THE FUNCTIONS THAT A GIVEN AIR CONDITIONING UNIT SUPPORTS.	*2 EACH BLOCK, GROUP OR COLLECTIVE	EACH GROUP
OPTIMIZED START	UNIT STARTS 5 - 60 MINUTES BEFORE THE SCHEDULED	EACH BLOCK, GROUP OR	EACH BLOCK, GROUP OR

ITEM	DESCRIPTION	OPERATION	DISPLAY
	TIME BASED ON THE OPERATION DATA HISTORY IN ORDER TO REACH THE SCHEDULED TEMPERATURE AT THE SCHEDULED TIME.	COLLECTIVE	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	INDIVIDUALLY PROHIBIT OPERATION OF EACH LOCAL REMOTE CONTROL FUNCTION (START/STOP, CHANGE OPERATION MODE, SET TEMPERATURE, RESET FILTER). *3. CENTRALLY CONTROLLED IS DISPLAYED ON THE REMOTE CONTROLLER FOR PROHIBITED FUNCTIONS.	EACH BLOCK, GROUP OR COLLECTIVE	*3 EACH GROUP
ROOM TEMP	DISPLAYS THE ROOM TEMPERATURE OF THE GROUP.	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 *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	N/A	*4 EACH UNIT OR COLLECTIVE

ITEM	DESCRIPTION	OPERATION	DISPLAY
	UNIT ADDRESS, ERROR CODE AND SOURCE OF DETECTION		
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-	*5 COLLECTIVE	*5 COLLECTIVE

ITEM	DESCRIPTION	OPERATION	DISPLAY
	YG10HA-E) SOLD SEPARATELY.		
FREE CONTACT INTERLOCK **CONTROL**	**OPERATION OF INDOOR GROUPS, GENERAL EQUIPMENT OR FREE CONTACT OUTPUTS BASED ON GROUP(S) CONDITIONS OR FREE CONTACT(S) INPUT STATES.**	**EACH GROUP, OUTPUT OR COLLECTIVE**	**N/A**

1) All AG-150A Centralized Controllers shall be equipped with one RJ-45 Ethernet port to support interconnection with a network PC via a closed/direct Local Area Network (LAN).
2) The AG-150A Centralized Controller shall be capable of performing initial settings via the 9” high-resolution, backlit, color touch panel on the controller or via a PC using the AG-150A Centralized Controller’s initial setting browser.

B. Standard software functions shall be available so that the building manager can securely log into each AG-150A via the PC’s web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics.

C. G. Provide an automatic defrost cycle to prevent coil freeze-up during the operation

PART 3 - EXECUTION

4.01 GENERAL

A. Install unit in accordance with manufacturer’s installation instructions. Install unit plumb and level, firmly anchored in location indicated, and maintain manufacturer’s recommended clearances.

4.02 ELECTRICAL WIRING

A. Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer’s electrical connection diagram submittal to the electrical contractor.

4.03 PIPING CONNECTIONS

A. Install and connect devices furnished by the manufacturer but not specified to be factory mounted. Furnish a copy of manufacturer’s piping connection diagram submittal to the piping contractor.

4.04 SUPPLY AND DRAIN WATER PIPING

A. Connect drain connections to the air conditioning unit. Provide pitch and trap per manufacturer’s instructions and local codes.

4.05 START UP

A. Start up air conditioning unit in accordance with manufacturer’s start up instructions. Test controls and demonstrate compliance with requirements.

END OF SECTION 23 81 29