AIR DEVICE SCHEDULE

TAG	SERVICE	MANUFACTURER AND MODEL	FACE SIZE	NECK SIZE	CFM	FINISH	MATERIAL	NOTES
A	SUPPLY	TITUS TMS	24"x24"	6"ø	0-100	WHITE	STEEL	1,2,4
				8"ø	101-225			
				10"ø	226-325			
				12"ø	326-475			
B	RETURN	TITUS PAR	24"x24"	6"ø	0-150	WHITE	STEEL	4
				8"ø	151-250			
				10"ø	251-350			
				12"ø	351-450			
				14"ø	451-550			
EX	SUPPLY AND RETURN	EXISITING TO REMAIN	24"x24"	6"ø	0-100	--	--	1,2,3,4,5
				8"ø	101-225			
				10"ø	226-325			

NOTES:
1. 4-WAY UNLESS SHOWN DIFFERENT
2. PROVIDE OPP BLADE DAMPER AT EACH SUPPLY OR EXH UNLESS BALANCING DAMPER IS PROVIDED AT RUNOUT TAKEOFF
3. CONTRACTOR TO PROVIDE NEW DIFFUSER TO REPLACE EXISTING DIFFUSER BEING USED/REPLACED IF THE EXISTING DIFFUSER NECK SIZE IS FOUND TO BE TOO SMALL
4. PROVIDE PROPER INSTALLATION TRIM KIT BASED ON CEILING TYPE DIFFUSER IS BEING INSTALLED IN.
5. CONTRACTOR SHALL CLEAN AND PAINT EXISTING DIFFUSERS TO LIKE NEW CONDITION.

FAN SCHEDULE

PROJECT: AACOG - WX & ART

TAG	EF-1
SERVICE	EXHAUST
AREA SERVED	114 JAN
FAN TYPE	CABINET FAN
AIR FLOW CFM	75
EXT. STATIC PRES	0.5" WG
DRIVE	DIRECT
MOTOR DATA	80 W
VOLTS/PH/CYCLES	115/1/60
ACCESSORIES	
FACTORY DISCONNECT	NO
BACKDRAFT DAMPER	GRAVITY
FAN SPEED CONTROLLER	YES
NOTES	1
GREENHECK MODEL OR EQ.	SP-B110

NOTES:
1. FAN SHALL BE CONTROLLED BY A SWITCH.

DX SPLIT SYSTEM SCHEDULE

PROJECT: AACOG - WX & ART

INDOOR UNIT	
TAG	FCU-1
SERVICES	138 IT/WORK/STOR
CONFIGURATION	WALL MOUNTED
VOLTS/PH/CYCLES	208/1/60
MCA / MOCP, AMPS	18.3 / 20
FAN DATA	
SUPPLY, CFM	700
OUTSIDE AIR, CFM	--
EXTERNAL STATIC, IN. WC.	0.9
COOLING PERFORMANCE	
AIR ENT EVAP COIL, DB/WB °F	75 / 63
AIR LVG EVAP COIL, DB/WB °F	55 / 54
SENSIBLE COOLING, BTU/H	13,000
TOTAL COOLING, BTU/H	16,500
ACCESSORIES	
FILTER TYPE	WASHABLE
FACTORY DISCONNECT	YES
SINGLE POINT WIRING	YES
CONCEALED CONDENSATE PUMP	YES
SMOKE DETECTOR / LOCATION	NONE
DAIKIN MODEL OR EQUAL	FTK18NMVJU
FAN SPEED FOR ABOVE MODEL	HIGH
CONDENSING UNIT	
TAG	CU-1
AMBIENT TEMP, °F	107
MINIMUM SYSTEM AHRI SEER	14.0
SPEED	SINGLE
OPERATES DOWN TO, °F	20
VOLTS/PH/CYCLES	208/1/60
REFRIGERANT	R-410A
HAIL GUARD	YES
DAIKIN MODEL OR EQUAL	RK18NMVJU

NOTES
- REQUIRED BTUHS ARE NET; FAN HEAT HAS NOT BEEN SUBTRACTED
- SINGLE POINT ELEC CONNECTION INCLUDES INTERNAL FUSING AND CONTACTORS FOR STARTERS FOR MOTORS.
- PROVIDE LOW AMBIENT KIT AS REQUIRED.

MECHANICAL LEGEND

- MECHANICAL EQUIPMENT
- PLENUM SLOT DIFFUSER
- SUPPLY AIR DEVICE
- RETURN AIR DEVICE
- EXHAUST AIR DEVICE
- CONICAL TAP WITH DAMPER
- MOTORIZED DAMPER
- MANUAL BALANCING DAMPER
- RIGID DUCTWORK
- FLEX DUCT
- (T) ZONE THERMOSTAT @ 48" A.F.F.
- (S) ZONE TEMPERATURE SENSOR
- A/### DIFFUSER TAG / AIRFLOW
- FCU-# EQUIPMENT TAG
- # KEYNOTE
- POINT OF CONNECTION
- POINT OF DISCONNECTION

MECHANICAL GENERAL NOTES

A. REMOVE ALL UNUSED EXISTING DUCTWORK. CAP EXISTING TAPS OF DUCT MAINS WITH SHEET METAL CAPS AND SEAL AIRTIGHT.
B. REMOVE ALL EXISTING DEVICES AND EQUIPMENT THAT ARE NOT TO BE REUSED.
C. CONTRACTOR SHALL PROPERLY SEAL AND CAP ALL UNUSED DUCT TAPS AND NEW DUCTWORK. CONTRACTOR SHALL REPLACE ALL DAMAGED EXISTING FLEX DUCT AS REQUIRED.
D. CONTRACTOR SHALL COORDINATE ALL WORK WITH THE BUILDING ENGINEER.
E. ALL OTHER AREAS OF THE FLOOR NOT WITHIN THE SCOPE OF WORK SHALL REMAIN UNCHANGED.
F. REPAIR ALL EXISTING DUCTWORK LEAKS AND DAMAGED INSULATION AS REQUIRED.
G. EXISTING DUCTWORK WAS TAKEN FROM AS-BUILT DRAWINGS AND FIELD INVESTIGATION. CONTRACTOR SHALL FIELD VERIFY EXACT DUCTWORK CONDITIONS.
H. BUILDING IS A CONCRETE STRUCTURE WITH THE 2-HOUR RATING AT THE CONCRETE SLAB. CEILING IS NOT PART OF THE RATED ASSEMBLY. CEILING RADIATION FIRE DAMPERS ARE NOT REQUIRED.

NOTE TO PLAN CHECKER: BUILDING IS EXISTING AND RENOVATED SPACE IS CONDITIONED. BUILDING ENVELOPE CALCULATIONS ARE NOT REQUIRED.

1633 BROADWAY SAN ANTONIO TEXAS 78215
I N S I T E Architects Inc.
210 226 4195

AACOG - WX & ART
TITAN PLAZA
SAN ANTONIO, TEXAS

DRAWN BY: MPL

DATE: 06/16/20

REVISED:

STATE OF TEXAS
CLAYTON F. CLEMENTS
109793
LICENSED
PROFESSIONAL ENGINEER
06/16/2020

SHEET TITLE: MECHANICAL SCHEDULES, LEGEND AND NOTES

SHEET: **M1**

ENGINEERS
PLANNERS
SCIENTISTS
CONSTRUCTION MANAGERS
KCI TECHNOLOGIES
13750 SAN PEDRO AVE, STE 640
SAN ANTONIO, TX 77002
Ph: 713-237-9800
Texas Registered Engineering Firm F-10573

HVAC DESIGN CRITERIA
INDOOR TEMPERATURE:
75ºF COOLING (MINIMUM ALLOWED BY 2018 IECC, SECTION C302.1)
72ºF HEATING (MAXIMUM ALLOWED BY 2018 IECC, SECTION C302.1)

HUMIDITY CONTROL: THIS PROJECT HAS NO DIRECT CONTROL OF HUMIDITY

OUTDOOR DESIGN CONDITIONS (SAN ANTONIO, TEXAS) PER 2017 ASHRAE FUNDAMENTALS HANDBOOK CHAPTER 14:
- 97.6ºF DB, 73.5ºF WB SUMMER; 29.9ºF DB WINTER
- 3222 DEGREE DAYS COOLING; 1380 DEGREE DAYS HEATING
- CLIMATE ZONE 2A

CODE INFORMATION:
APPLICABLE CODES INCLUDE BUT ARE NOT LIMITED TO:

CITY OF SAN ANTONIO BUILDING CODE:	2018 IBC, AMENDED
CITY OF SAN ANTONIO MECHANICAL CODE:	2018 IMC, AMENDED
CITY OF SAN ANTONIO COMMERCIAL ENERGY CONSERVATION CODE:	2018 IECC AMENDED

FIRE AND SMOKE DAMPER REQUIREMENTS – 2018 IBC
BUILDING IS FULLY SPRINKLERED

FIRE WALLS (717.5.1): FIRE DAMPERS ARE REQUIRED

FIRE BARRIERS (717.5.2): FIRE DAMPERS ARE REQUIRED. EXCEPTIONS:
1. Penetrations are tested in accordance with ASTM E 119 or UL 263 as part of the fire-resistance-rated assembly.
2. Ducts are used as part of an approved smoke control system in accordance with Section 909 and where the use of a fire damper would interfere with the operation of a smoke control system.
3. Such walls are penetrated by ducted HVAC systems, have a required fire-resitance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.

SHAFT ENCLOSURES (717.5.3): FIRE & SMOKE. EXCEPTIONS:
1. Fire damper not required in 22'' vertical sub ducts in exhaust shafts with continuous upward flow to the outside.
2. In Group R occupancies, equipped throughout with an automatic sprinkler system , smoke dampers are not required at penetrations of shafts where toilet room exhaust openings are installed with steel exhaust sub ducts, having a wall thickness of at least 0.019 inch (24 GA.) and that extend at least 22 inches vertically; and an exhaust fan is installed at the upper terminus of the shaft that is, powered continuously in accordance with the provisions of Section 909.11, so as to maintain a continuous upward airflow to the outside.

FIRE PARTITIONS (717.5.4): FIRE DAMPERS ARE REQUIRED WHERE DUCTS PENETRATE FIRE PARTITIONS.
EXCEPTIONS:
1. FIRE DAMPERS ARE NOT REQUIRED IN TENANT SEPARATION OR CORRIDOR WALLS IN BUILDINGS EQUIPPED WITH AN AUTOMATIC SPRINKLER SYSTEM.
2. FIRE DAMPERS ARE NOT REQUIRED FOR STEEL DUCTS THAT ARE LESS THAN 100 SQUARE INCHES, HAVE A MINIMUM THICKNESS OF 0.0217 INCHES (24 GA.), AND WITH NO OPENINGS SERVING THE CORRIDOR.

CORRIDOR WALLS (717.5.4.1):
1. SMOKE DAMPERS ARE REQUIRED WHEN CORRIDOR IS REQUIRED TO HAVE SMOKE AND DRAFT CONTROL DOORS PER 715.4.3.

EXCEPTION
a. SMOKE DAMPERS ARE NOT REQUIRED IN CORRIDOR PENETRATIONS WHERE THE DUCT IS CONSTRUCTED OF STEEL NOT LESS THAN 0.019 INCHES (24 GA.) IN THICKNESS AND THERE ARE NO OPENINGS SERVING THE CORRIDOR.
b. SMOKE DAMPERS ARE NOT REQUIRED WHERE THE BUILDING IS EQUIPPED THROUGHOUT WITH AN APPROVED SMOKE CONTROL SYSTEM IN ACCORDANCE WITH SECTION 909 AND SMOKE DAMPERS ARE NOT NECESSARY FOR THE OPERATION AND CONTROL OF THE SYSTEM.
c. SMOKE BARRIERS (717.5.5): SMOKE DAMPERS REQUIRED. EXCEPTIONS: DAMPER NOT REQUIRED WHEN STEEL DUCT OPENINGS ARE LIMITED TO ONE SMOKE COMPARTMENT.

THROUGH PENETRATIONS, NOT IN SHAFTS (717.6.1): FIRE DAMPER REQUIRED AT FLOOR PENETRATIONS.
EXCEPTIONS: A DUCT IS PERMITTED TO PENETRATE THREE FLOORS OR LESS WITHOUT A FIRE DAMPER AT EACH FLOOR, PROVIDED IT MEETS ALL OF THE FOLLOWING REQUIREMENTS:
1. THE DUCT SHALL BE CONTAINED AND LOCATED WITHIN THE CAVITY OF A WALL AND SHALL BE CONSTRUCTED OF STEEL NOT LESS THAN 0.019 IN. (26-GAGE) THICKNESS.
2. THE DUCT SHALL OPEN INTO ONLY ONE DWELLING OR SLEEPING UNIT AND THE DUCT SYSTEM SHALL BE CONTINUOUS FROM THE UNIT TO THE EXTERIOR OF THE BUILDING.
3. THE DUCT SHALL NOT EXCEED 4-INCH NOMINAL DIAMETER AND THE TOTAL AREA OF SUCH DUCTS SHALL NOT EXCEED 100 SQ. INCHES IN ANY 100 SQUARE FEET OF FLOOR AREA.
4. THE ANNULAR SPACE AROUND THE DUCT IS PROTECTED WITH MATERIALS THAT PREVENT THE PASSAGE OF FLAME AND HOT GASES SUFFICIENT TO IGNITE COTTON WASTE WHERE SUBJECTED TO ASTM E 119 TIME-TEMPERATURE CONDITIONS UNDER A MINIMUM POSITIVE PRESSURE DIFFERENTIAL OF 0.01 INCH OF WATER AT THE LOCATION OF THE PENETRATION FOR THE TIME PERIOD EQUIVALENT TO THE FIRE-RESISTANCE RATING OF THE CONSTRUCTION PENETRATED.
5. GRILLE OPENING LOCATED IN A CEILING OF A FIRE-RESISTANCE-RATED FLOOR/CEILING OR ROOF/CEILING ASSEMBLY SHALL BE PROTECTED WITH A LISTED CEILING RADIATION DAMPER IN ACCORDANCE WITH SECTION 716.6.2.1.

RATED FLOOR OR CEILING ASSEMBLIES (717.6.2.1): CEILING RADIATION DAMPER REQUIRED. DAMPER SHALL BE TESTED IN ACCORDANCE WITH UL 555C AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCITONS AND LISTING.

OUTSIDE AIR REQUIREMENTS: PER ASHRAE 62.1- 2013

OFFICE CONFERENCE ROOMS:	5 CFM PER PERSON, 0.06 CFM PER SQ.FT.
OFFICE SPACES:	5 CFM PER PERSON, 0.06 CFM PER SQ.FT.
RECEPTION AREAS:	5 CFM PER PERSON, 0.06 CFM PER SQ.FT.
STORAGE (DRY MATERIALS):	5 CFM PER PERSON, 0.06 CFM PER SQ.FT.
BREAK AREAS:	5 CFM PER PERSON, 0.12 CFM PER SQ.FT.
CORRIDORS:	0 CFM PER PERSON, 0.06 CFM PER SQ.FT.

ENERGY CODE PER 2018 IECC CHAPTER 4 (NOT ASHRAE 90.1) - MANDATORY
SAN ANTONIO IS ZONE 2A WARM-HUMID

SECTION C403 BUILDING MECHANICAL SYSTEMS

C403.1.1 Calculation of heating and cooling loads.
Engineer has performed HVAC load calculations using Trace 700

C403.2.2 Ventilation.
Natural or Mechanical ventilation in accordance with governing code or if none is present – IMC Chapter 4. Mechanical ventilation system shall be capable of turning down to a minimum code prescribed volumetric flow rate (CFM).

C403.3.1 Equipment sizing.
Equipment shall not be sized larger than the load calculation output. If heating or cooling dominate in a climate, the lesser of the two shall be sized as small as possible with available equipment options.
Exceptions:
1. Redundant standby equipment and systems with proper controls to avoid simulations operation with primary equipment.
2. Lead/lag equipment with a summed capacity greater than the load generated in C403.2.1 shall be provided with proper controls to stage equipment.

C403.3.2 HVAC Equipment performance and requirements.
Scheduled equipment shall at a minimum meet the minimum efficacy requirements published in applicable table(s).

C403.4 Heating and cooling system controls.
Each heating and cooling system shall be provided with thermostatic controls.

C403.4.1 Thermostatic controls.
At least one temperature sensor shall be provided for each zone.
At least one humidity sensor shall be provided for each humidity control device (dehumidification or humidification).
Exceptions:
1. Independent perimeter heating/cooling systems designed for one or more zones given that all the following are meet.
   a. At least one temperature sensor for each zone. Each building orientation (within 45°) shall have a zone and shall not exceed 50 continuous feet.
   b. Temperature sensor shall be located with served zone.

C403.4.1.2 Deadband.
Zone(s) with heating and cooling thermostatic controls shall be provided with a deadband of 5°F or greater. Within this deadband, cooling/heating shall be shutoff or turned down to a minimum.
Exceptions:
1. Thermostats requiring manual changeover between heating and cooling modes.
2. Occupancies or applications requiring precision in indoor temperature control as approved by the code official.

C403.4.1.3 Set point overlap restriction.
When a zone has separate heating and cooling controls, a limit switch, mechanical stop, or DDC logic shall prevent simultaneous heating and cooling and maintain a deadband as described in the previous section.

C403.4.2 Off-hour controls.
Each zone shall be provided with thermostatic setback controls that are controlled by either an automatic time clock or programmable control system.
Exceptions:
1. Zones that will be operated continuously
2. Zones with a full HVAC load demand not exceeding 6,800 Btu/h and having a readily accessible manual shutoff switch

C403.4.2.1 Thermostatic setback capabilities.
Thermostatic setback controls shall have the capability to set back or temporarily operate the system to maintain zone temperatures down to 55°F or up to 85°F.

C403.4.2.2 Automatic setback and shutdown capabilities.
Seven day operational programming shall be provide via automatic time clock or programmable controls. System should be able to recover operation schedule after the power has been lost for a minimum of 10 hrs. Systems shall also have temporary manual override for up to 2 hours via manual switch, manual timer, or occupancy sensor.

C403.4.2.3 Automatic start capabilities.
HVAC system shall have the ability of automatic start with logic to optimize the start time to bring the occupied zones to setpoint immediately before being occupied.

C403.4.3.3.1 Temperature deadband.
Systems with heat rejection and heat addition shall have an operation deadband of 20°F or greater.
Exception: A deadband of 20°F or less is permitted if a loop temperature optimization controller is provided and programmed to determine the most efficient operating temperature based on real-time conditions of demand and capacity.

C403.11.1 Duct and plenum insulation and sealing.
If supply and return air ducts and plenums are located in an unconditioned space, then ductwork shall be insulated with a minimum of R-6 insulation. If supply and return air ducts and plenums are located outside the building envelope, then ductwork shall be insulated with a minimum of R-8 (Climate Zone 1-4) or R-12 (Climate Zone 5-8) insulation.
Exceptions:
1. Where located within equipment.
2. Where the design temperature difference between the interior and exterior of the duct or plenum is not greater than 15°F.

Ducts, air handlers, and filter boxes shall be sealed.

C403.11.2 Duct construction.
Ductwork shall be constructed and erected in accordance with the International Mechanical Code.

C403.11.2.1 Low-pressure duct systems.
Longitudinal (parallel to airflow) and transverse (perpendicular to airflow) joints, seams and connections of supply and return ducts operating at 2 inches w.g. static or less, shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the International Mechanical Code.
Exception: Locking-type longitudinal joints and seams, other than the snap-lock and button-lock types, need not be sealed as specified in this section

403.11.3 Piping insulation.
Piping serving as part of a heating or cooling system shall be thermally insulated in accordance with Table C403.11.3.
Exceptions:
1. Factory-installed piping within HVAC equipment tested and rated in accordance with a test procedure referenced by this code.
2. Factory-installed piping within room fan-coils and unit ventilators tested and rated according to AHRI 440 (except that the sampling and variation provisions of Section 6.5 shall not apply) and AHRI 840, respectively.
3. Piping that conveys fluids that have a design operating temperature range between 60°F and 105°F.
4. Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
5. Strainers, control valves, and balancing valves associated with piping 1 inch or less in diameter.
6. Direct buried piping that conveys fluids at or below 60°F.

C403.11.3.1 Protection of piping insulation.
Piping insulation exposed to the elements shall be protected from damage such as but not limited to sunlight, moisture, equipment maintenance, wind, and solar radiation degradation. Use of adhesive tape for this section shall not be permitted.

SECTION C408 MAINTENANCE INFORMATION & SYSTEM COMMISSIONING

C408.1 General.
This section covers the maintenance, commissioning, and functional testing of the building systems.

C408.1.1 Building operations and maintenance information.
The building operations and maintenance documents shall be provided to the owner and shall consist of manufacturers' information, specifications and recommendations; programming procedures and data points; narratives; and other means of illustrating to the owner how the building, equipment and systems are intended to be installed, maintained and operated. Required regular maintenance actions for equipment and systems shall be clearly stated on a readily visible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.

C408.2 Mechanical systems and service water-heating systems commissioning and completion requirements.
The registered design professional or approved agency shall provide evidence of completed code section regulated mechanical commissioning before final mechanical and plumbing inspections.

Construction document notes shall clearly indicate provisions for commissioning and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner or owner's authorized agent and made available to the code official upon request in accordance with Sections C408.2.4 and C408.2.5.
Exceptions: The following systems are exempt:
1. Mechanical systems and service water heater systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h cooling capacity and 600,000 Btu/h combined service water-heating and space-heating capacity.
2. Systems included in Section C403.3 that serve individual dwelling units and sleeping units.

C408.2.1 Commissioning plan.
A commissioning plan shall be developed by a registered design professional or approved agency and shall include the following items:
1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.
3. Functions to be tested including, but not limited to, calibrations and economizer controls.
4. Conditions under which the test will be performed. Testing shall affirm winter and summer design conditions and full outside air conditions.
5. Measurable criteria for performance.

C408.2.2 Systems adjusting and balancing.
HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications. Test and balance activities shall include air system and hydronic system balancing.

C408.2.2.1 Air systems balancing.
Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers used for air-system balancing are prohibited on constant-volume fans and variable-volume fans with motors 10 hp and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.
Exception: Fans with fan motors of 1 hp or less are not required to be provided with a means for air balancing.

C408.2.3 Functional performance testing.
Functional performance testing specified in Sections C408.2.3.1 through C408.2.3.3 shall be conducted.

C408.2.3.1 Equipment.
Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and sequence of operation, including under full-load, part-load and the following emergency conditions:
1. All modes as described in the sequence of operation.
2. Redundant or automatic back-up mode.
3. Performance of alarms.
4. Mode of operation upon a loss of power and restoration of power.

Exception: Unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(3) that do not require supply air economizers.

C408.2.3.2 Controls.
HVAC and service water-heating control systems shall be tested to document that control devices, components, equipment and systems are calibrated and adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

C408.2.4 Preliminary commissioning report.
A preliminary report of commissioning test procedures and results shall be completed and certified by the registered design professional or approved agency and provided to the building owner or owner's authorized agent. The report shall be organized with mechanical and service hot water findings in separate sections to allow independent review. The report shall be identified as "Preliminary Commissioning Report" and be provided with a completed "Commissioning Compliance Checklist" (Figure C408.2.4). Presented document package shall identify:
1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation.
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.
4. Results of functional performance tests.
5. Functional performance test procedures used during the commissioning process, including measurable criteria for test acceptance.

C408.2.4.1 Acceptance of report.
Buildings, or portions thereof, shall not be considered as acceptable for a final inspection pursuant to Section C105.2.6 until the code official has received the Preliminary Commissioning Report from the building owner or owner's authorized agent.

C408.2.4.2 Copy of report.
The code official shall be permitted to require that a copy of the Preliminary Commissioning Report be made available for review by the code official.

C408.2.5 Documentation requirements.
The construction documents shall specify that the documents described in this section be provided to the building owner or owner's authorized agent within 90 days of the date of receipt of the certificate of occupancy.

C408.2.5.1 System balancing report.
A written report detailing the completed activities and measurement conducted in accordance with Section C408.2.2.

C408.2.5.2 Final commissioning report.
A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner or owner's authorized agent. The report shall be organized with mechanical system and service hot water system findings in separate sections to allow independent review. The report shall include the following:
1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests that cannot be performed at the time of report preparation due to climatic conditions.

C408.3 Functional testing of lighting controls.
Controls for automatic lighting systems shall comply with this section.

C408.3.1 Functional testing.
Prior to passing final inspection, the registered design professional shall provide evidence that the lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's instructions.

C408.3.1.1 Occupant sensor controls.
Where occupant sensor controls are provided, the following procedures shall be performed:
1. Certify that the occupant sensor has been located and aimed in accordance with manufacturer recommendations.
2. For projects with seven or fewer occupant sensors, each sensor shall be tested.
3. For projects with more than seven occupant sensors, testing shall be done for each unique combination of sensor type and space geometry. Where multiples of each unique combination of sensor type and space geometry are provided, not less than 10 percent, but in no case less than one, of each combination shall be tested unless the code official or design professional requires a higher percentage to be tested. Where 30 percent or more of the tested controls fail, all remaining identical combinations shall be tested.

For occupant sensor controls to be tested, verify the following:
3.1. Where occupant sensor controls include status indicators, verify correct operation.
3.2. The controlled lights turn off or down to the permitted level within the required time.
3.3. For auto-on occupant sensor controls, the lights turn on to the permitted level when an occupant enters the space.
3.4. For manual-on occupant sensor controls, the lights turn on only when manually activated.
3.5. The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation.

C408.3.2 Documentation requirements.
The construction documents shall specify that the documents described in this section are provided to the building owner or representative within 90 days from the date of receipt of the certificate of occupancy.

C408.3.2.1 Drawings.
Construction documents shall include the location and catalogue number on each piece of equipment.

C408.3.2.2 Manuals.
An operating and maintenance manual shall be provided and include all of the following:
1. At least one service company with name and address to service installed equipment
2. A narrative of equipment operation and recommended setpoints
3. Submittal data indicating all selected options for each lighting device.
4. Operation and maintenance manuals for each piece of lighting equipment. Manuals shall have clear identifiable sections for recommended maintenance actions, cleaning, and recommended relamping.
5. A schedule for inspecting and recalibrating all lighting controls.

C408.3.2.3 Report.
A test result report shall be provided with the following:
1. Functional performance test(s) results.
2. Deficiencies found during testing along with their respective or recommended fix.

HVAC GENERAL NOTES (APPLY TO ALL SHEETS)
- DRAWINGS ARE DIAGRAMMATIC; CONFIRM DIMENSIONS AND LOCATIONS IN THE FIELD.
- RUNOUTS TO INDIVIDUAL AIR DEVICES ARE SAME SIZE AS AIR DEVICE NECK UNLESS OTHERWISE NOTED.
- DUCT SIZES SHOWN ARE FREE AREA.
- SEE ARCHITECTURAL REFLECTED CEILING PLANS FOR TYPE OF CEILING AND LOCATION OF CEILING DEVICES.
- SEE ARCH ELEVATIONS FOR LOCATION OF WALL MTD DEVICES.
- PLENUMS ARE CROWDED AND NOT ALL OBSTACLES ARE INDICATED. ALLOW FOR ADDITIONAL DUCT OR PIPE OFFSETS OR TRANSITIONS NOT INDICATED ON DRAWINGS.
- SEAL ALL PENETRATIONS OF FLOORS, RATED WALLS, EXTERIOR WALLS
- CONTRACTOR SHALL SUBMIT DRAWINGS FOR ALL PERMITS IN A TIMELY MANNER AND PAY ALL PERMIT FEES.
- PROVIDE ANY REQUIRED TEMPORARY UTILITIES.
- THE LISTING OF PRODUCT MANUFACTURERS, MATERIALS AND METHODS ARE THE BASIS OF DESIGN AND ARE INTENDED TO ESTABLISH A STANDARD OF QUALITY. THE ENGINEER SHALL BE THE SOLE JUDGE OF QUALITY AND EQUIVALENCE OF EQUIPMENT, MATERIALS AND METHODS. WHERE SUBSTITUTED OR ALTERNATIVE EQUIPMENT IS PROPOSED ON THE PROJECT BEFORE BIDDING, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THAT THE EQUIPMENT WILL FIT THE SPACE AVAILABLE, INCLUDING ALL REQUIRED CODE AND MAINTENANCE CLEARANCES, AND TO COORDINATE ALL EQUIPMENT REQUIREMENTS WITH OTHER CONTRACTORS.
- INSTALL ALL EQUIPMENT TO PROVIDE CLEARANCE AROUND ALL HVAC EQUIPMENT CONFORMING TO MANUFACTURER'S MINIMUM RECOMMENDED SPACE FOR MAINTENANCE AND/ OR AIR FLOW AND SUFFICIENT TO ALLOW INSPECTION, SERVICE, REPAIR OR REPLACEMENT WITHOUT REMOVING ELEMENTS OF PERMANENT CONSTRUCTION OR DISABLING THE FUNCTION OF FIRE RESISTANCE RATED ASSEMBLIES.
- DO NOT RUN DUCT OR PIPE ABOVE ELECTRICAL PANELS.
- ALL WORK IN OR ABOVE OCCUPIED AREAS SHALL BE AT OWNERS CONVENIENCE AND MAY BE DURING EVENINGS OR WEEKENDS. SCHEDULE ALL SERVICE INTERRUPTIONS IN ADVANCE WITH OWNER.
- ONLY OWNER'S REPRESENTATIVE MAY SHUT OFF EQUIPMENT OR DISCONNECT UTILITIES.

1633 BROADWAY
SAN ANTONIO TEXAS 78215

I N S I T E
Architects Inc.
210 226 4195

AACOG - WX & ART
TITAN PLAZA
SAN ANTONIO, TEXAS

DRAWN BY: MPL

DATE: 06/16/20

REVISED:

STATE OF TEXAS — CLAYTON F. CLEMENTS — 109793 — LICENSED PROFESSIONAL ENGINEER
06/16/2020

SHEET TITLE: MECHANICAL SPECIFICATIONS

SHEET: **M2**

ENGINEERS PLANNERS SCIENTISTS CONSTRUCTION MANAGERS
KCI TECHNOLOGIES
13750 SAN PEDRO AVE, STE 640
SAN ANTONIO, TX 77002
Ph: 713-237-9800
Texas Registered Engineering Firm F-10573

- BEFORE SUBMITTING A BID, IT WILL BE NECESSARY FOR EACH CONTRACTOR WHOSE WORK IS INVOLVED TO VISIT THE SITE AND ASCERTAIN FOR HIMSELF THE CONDITIONS TO BE MET IN INSTALLING THE WORK AND MAKE PROVISIONS FOR THE CONDITIONS IN HIS FINAL PRICE. FAILURE OF THE CONTRACTOR TO COMPLY WITH THIS REQUIREMENT SHALL NOT BE CONSIDERED JUSTIFICATION FOR THE OMISSION OR FAULTY INSTALLATION OF ANY WORK COVERED BY THE CONTRACT DOCUMENTS. THE BID SHALL INCLUDE ALL THE WORK REQUIRED OR NECESSARY TO COMPLY WITH THE WORK SHOWN ON THE DRAWINGS AND IDENTIFIED IN THE SPECIFICATIONS. NO EXTRAS WILL BE ALLOWED FOR CONDITIONS THAT COULD BE READILY OBSERVED.

HVAC SPECIFICATIONS

23 05 00 BASIC MECHANICAL REQUIREMENTS

Demolition: Remove ducts/pipe to above ceiling or below floor. Re-support any remaining duct/pipe that was supported by demolition walls. Damage to existing materials/equipment will be repaired at no additional cost. Give demolished equipment to Owner, dispose of if Owner does not want. Refrigerants become the property of the Contractor and shall be removed per EPA regulations and AHRI Standard 770.

Warranty: Guarantee labor and materials for 1-year. Warranties begin upon Owner's acceptance of substantial completion of the installation.

Shop drawings: Submit complete information on all equipment, air devices, valves, duct accessories and controls. Submit complete ductwork and piping shop drawings, based on approved equipment and field observation of building conditions. Submit detailed layout of mechanical rooms and yards. Incomplete submittals will be returned to the contractor un-reviewed. No time extensions or cost increases will be allowed for delays caused by return of incomplete submittals.

Startup Services: Engage equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications/warranties. Complete installation and startup checks according to manufacturer's written instructions. Prepare a written startup report that records the results of tests and inspections.

Operations and maintenance instructions: Provide 3 copies of operation and maintenance manuals to Owner. Provide within 90 days after the date of system acceptance. These manuals shall be in accordance with industry-accepted standard such as ASHRAE Guideline 1 and shall include, at a minimum, the following:

a. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
b. Operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
c. Names and addresses of at least one service agency.
d. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
e. A complete narrative of how each system is intended to operate, including suggested setpoints. Provide instruction on system operation to Owner's representatives.

Record drawings: Within 90 days after the date of system acceptance, provide record drawings in Revit Format (using the same software version the project was designed in), plus full size hard copy. Revit models may be available from Engineer for a fee. Record drawings shall include as a minimum the installed location and performance data on each piece of equipment, air devices, control sensors, control panels, general configuration of duct and pipe distribution system including sizes, and the terminal air or water design flow rates.

Coordination: Provide Electrical Contractor with electrical requirements of approved equipment in sufficient time to order panel boards, disconnects, etc.

Access doors: Provide *Milcor* or equal as required for access to all valves, filters, controls, dampers or other devices requiring attention. Doors shall match wall or ceiling rating. Architect must approve location and appearance of all access doors. Access panels for fire or smoke dampers shall be openable without the use of tools.

Sleeves: Provide metal sleeves where pipes or control wiring penetrate walls

Overflow drain pans: Provide under all furred in units. Pans to be minimum 24 gauge galvanized sheet steel; minimum 1-1/2" deep and not less than 3" larger than unit or coil dimensions. Provide separate 3/4" drain from pan to conspicuous location; provide escutcheon plates at ceiling penetrations. When allowed by local authority, contractor may provide a float switch in the overflow pan, instead of discharge piping. Float switch shall shut unit off if standing water is detected in the overflow drain pan. Pans equipped with float switch shall have screw cap nipple on bottom or side of pan to allow water to be drained from pan.

23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.
Install securely on firm foundation. Mount ball bearing motors with shaft in any position. Install engraved nameplates. Ground and bond motors.

- Single-Phase Motors: Permanent split-capacitor type, where available; otherwise, use split-phase start/capacitor run or capacitor start/capacitor run motor. Bearings: Prelubricated anti-friction ball bearings, rated for minimum ABMA 9, L-10 life of 200,000 hours. Internal thermal protection that automatically opens power supply circuit when winding temperature exceeds a safe motor insulation value. Terminal lugs to match branch circuit conductor quantities, sizes and materials.

23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING & EQUIPMENT

Pipe, duct and equipment hangers and supports shall be per the local code. Support piping at a minimum every 10' or less for 1" and larger pipe, every 6' on 3/4" or smaller. With copper pipe use copper hangers or tape at contact point. If pipe is insulated, support shall be on exterior of insulation. Provide shield to prevent acute compression of insulation.

Support flex ducts per manufacturer's installation instructions (provide instructions for inspector review). Alternate acceptable flex duct support is 26 gage, 1.5 inch wide galvanized iron straps on 4-foot maximum spacing.

Roof curbs & sleepers (required for all roof mounted equipment):

- Galvanized steel shell and base, mitered cant and step to match deck insulation thickness, internally reinforced, treated wood nailer, and fully welded for water and air tightness. Roof curbs shall match the roof pitch and provide level surface for equipment; provide with rigid insulation with sealed edges (see internal liner specification 23 31 00), and be compatible with the roof type. Minimum 12 inches around unit from top of finished roof surface to top of wood nailer; maximum difference between surfaces shall be 30 inches. If dimension is larger than 30 inches contact engineer for further instructions. Sleepers shall be provided with Roofscreen Drycap or equal manufacturer and method.
- For mechanical rooftop units used for comfort or process cooling or heating on metal roof deck, mechanical contractor shall use BRD NIC-DS-52-E, BRD Hushcore DS-52, or equal manufacturer and method.
- Manufacturer shall provide a professional engineer stamped anchoring information for curb and/or bracket to conform to above stated wind requirements and local code.
- Acceptable curb & sleeper manufacturers: Thybar, Vibro-Acoustics, CDI, Kinetics, BRD, & equipment Manufacturer.
- Any detail provided by KCI on mechanical sheets is for reference only.

23 05 53 IDENTIFICATION FOR HVAC PIPING & EQUIPMENT

- Equipment: Permanent label (stencil, metal tag or engraved plastic) with unit tag or name and area or space served.
- Piping: Provide pipe markers every 20 feet. Identify service and flow direction. Install in clear view and align with axis of piping.
- Fire damper access doors: See fire damper specifications.
- Ceiling tacks: Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment. Color code: equipment: Yellow. Fire dampers/smoke dampers: Red. Valves: Blue.

23 05 93 TESTING, ADJUSTING AND BALANCING (TAB) FOR HVAC

Balance may be by a qualified employee of the mechanical contractor. Technician shall be AABC or NEBB certified.

Balance in accordance with NEBB Procedural Standards –1999 Procedural Standards for Building Systems, or AABC 2002 Associated Air Balance Council Test and Balance Procedures.

Adjust system to achieve air quantities shown, then adjust volumes to provide constant temperature (±2 °F) throughout the zone. Adjust fan sheaves, when applicable and where available. Calibrate all thermostats. Mark setpoints on all dampers and valves. Return to project at 1 and 3 month intervals after completion to make balance adjustments in response to Owner's perceived comfort.

Linear Slots shall have their air flow properly adjusted, depending on location in space. For slots located on exterior walls –

1. Single slots shall adjusted to supply air horizontally across to wash ceiling or exterior wall.
2. 2-slots shall be adjusted so that one air stream supplies air horizontally toward the window and the secondary airstream supplies air horizontally across the ceiling.
3. Slots located in interior spaces; or, away from outside walls shall be adjusted to supply air horizontally across the ceiling, either in one direction, or opposed.

Submit report (NEBB or AABC format) and include –

- General data: Nameplate data on all equipment. Outside air temp and humidity; cfm each supply, exhaust and return grille and actual room temperatures and humidities vs. setpoints
- Fans: Volume and static pressure; fan rpm and amps
- DX air handlers, fan coils or furnaces: supply and return air temp (DB & WB), volume and static pressure; fan rpm and amps. Outside air cfm.
- DX condensing units: Condensing air temp, units amps

Air systems shall be balanced to meet air quantities shown at each air device; and, in a manner to first minimize throttling losses in the effected system. Then, for fans with fan system power greater than 1 HP, fan speed shall be adjusted to meet design flow conditions.

Tolerances

- Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
- Air Outlets and Inlets: Plus or minus 10 percent

HVAC control systems shall be tested to ensure that control elements are calibrated, adjusted, and in proper working condition. Submit test documentation.

Perform inspections in the presence of construction manager or commissioning authority. Owner, construction manager, or commissioning authority may randomly select measurements, documented in the final report, to be rechecked within 90 days. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day. Recheck and adjust for failed measurements.

No adjustment to existing air handlers and fans serving the area are allowed without Owner's express knowledge and consent.

23 07 13 DUCT INSULATION

Flame spread less than 25, smoke developed less than 50 as per ASTM E84, NFPA 255, UL273.
Minimum required installed R values for non-residential projects (excluding film resistance) are:

1. In shafts, plenums, or fur-downs not used for return air (but inside building insulation envelope):
   a. In all climate zones: Supply R6; Return R6; Exhaust or relief: R6; Conditioned outside air R6

External duct wrap: foil face rigid or flexible fiberglass with vapor retarder. R value stenciled on outside. ASTM A96 Water Vapor Permeance: 0.5 perms maximum. Mold Growth per ASTM C1338- No Growth. GREENGUARD Environmental Institute Certified. Vapor Retarder Jacket conforming to ASTM C 1136 Type II: Foil Scrim Kraft (FSK), or White polypropylene– scrim–kraft (PSK). 2'' Staple flange on longitudinal seam. Adhere to duct with vapor barrier type adhesive. Overlap all joints. Vapor seal all joints or breaks with reinforcing mesh imbedded in vapor barrier coating.

Vapor Barrier Coating: Vimasco Vapor-Block 749, Foster 30-65, Childers Chil-Perm #CP-34, or equivalent.
Reinforcing mesh: Foster Mast-a-Fab, Childers Chil Glas #10, or equivalent.

Insulate backs of supply diffusers when in attics or when ceiling plenum is not used for return air.

Internal liners- see section 23 31 00.

23 07 16 HVAC EQUIPMENT INSULATION

Flame spread less than 25, smoke developed less than 50 as per ASTM E84, NFPA 255, UL 273.

23 07 19 HVAC PIPING INSULATION

Pipe insulations, mastics and jackets located in environmental air plenums shall have maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

Primary condensate drains
Inside buildings: 3/4" Armaflex (or equal) with ASTM E84 25/50 for entire length. No insulation required outdoors. Insulation of secondary (overflow) condensate drains not required.

Refrigerant suction line piping:
1" Armaflex; Rated up to -40°F and having a ASTM E84 25/50 across all used insulation thicknesses

- Outdoor Applications - Painted with manufacturer's recommended water retardant ultraviolet solar radiation protective coating. Exterior cladding may be applied to lines with no degradation to performance and with engineer's approval.
- Exposed Indoor Applications - Black or white with paintable surface. Final finish color to be determined by architect.

Refrigerant liquid line piping:
1" Armaflex. Rated up to 250°F and having a ASTM E84 25/50 across all used insulation thicknesses

- Outdoor Applications - Painted with manufacturer's recommended water retardant ultraviolet solar radiation protective coating. Exterior cladding may be applied to lines with no degradation to performance and with engineer's approval.
- Exposed Indoor Applications - Black or white with paintable surface. Final finish color to be determined by architect.

23 21 13 HYDRONIC PIPING

Air vents at high points; drains at low points. Provide dielectric unions between dissimilar metals. Piping inside environmental air plenums shall meet the flame and smoke requirements of section 23 07 19.

- HVAC condensate drains: Inside building use insulated copper in environmental air plenums. Inside (but not in environmental air plenums) may use insulated PVC. Outside building, use uninsulated UV-resistant PVC. Slope to outlet min 1/8'' per foot. Provide trap (unless HVAC unit is internally trapped) and clean out plugs. Size condensate drain per applicable code; size shall not be less than outlet size of unit or less than 3/4 inches. Discharge condensate to an approved location inside or outside building. Do not discharge into a gutter system if that gutter discharges onto a public walk or street.

23 08 00 COMMISSIONING OF HVAC

All projects less than 480,000 Btu/h cooling capacity and 600,000 Btu/h combined service water-heating and space-heating capacity or with systems that serve individual dwelling and sleeping units: Test and balance contractor shall observe HVAC control systems and document that all control elements are calibrated, adjusted, and in proper working condition.

23 09 23 ELECTRIC CONTROLS FOR HVAC

Electric, programmable multistage thermostats, automatic changeover, battery backup. Honeywell TB8220 series or equal.

23 09 93.11 SEQUENCES OF OPERATION

ALL SYSTEMS

A. **Dead Bands:** Where used to control both heating and cooling, automatic changeover zone thermostatic controls shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum. Exceptions: Special applications where wide temperature ranges are not acceptable (retirement homes, data processing, museums, and or varied hospital areas) and are approved by the authority having jurisdiction.
B. **Automatic Shutdown.** Each HVAC system shall have controls that can start and stop the system under different time schedules for seven different daytypes per week, are capable of retaining programming and time setting during loss of power for a period of at least 10 hours, and include an accessible manual override, or equivalent function, that allows temporary operation of the system for up to two hours.
C. **Setback Controls.** Heating systems have the capability to automatically restart and temporarily operate the system to maintain *zone* temperatures above a heating setpoint adjustable down to 55°F or lower. Cooling systems shall have the capability to automatically restart and temporarily operate the system as required to maintain *zone* temperatures below a cooling setpoint adjustable up to 85°F or higher or to prevent high space humidity levels.
D. **Optimum (Automatic) Start Controls.** Individual heating and cooling air distribution systems, served by one or more supply fans, shall have optimum start controls. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint and the amount of time prior to scheduled occupancy.
E. **Adjustments to sequences of operation.** Make programming, set point, and other changes to the Sequences of Operation as directed by Engineer as a result of submittal/ shop drawing review, commissioning activities or issues discovered during the warranty period.

Operating Hours

A. Occupied Hours
   a. Also known as "normal operation" or "daytime operation". Zone devices shall maintain occupied zone temperature setpoint and humidity. Ventilation and exhaust system shall be energized. System shall default to "occupied mode".
   b. Contractor to verify occupied hours with building owner, tenant, and/or building engineer. Hours could differ from business and office hours.
B. Unoccupied Hours
   a. Also known as "nighttime operation". Hours covers zones that are not occupied. Zone devices shall maintain unoccupied zone temperature setpoint and humidity. Ventilation system shall be energized to unoccupied set point which is set to satisfy 2013 ASHRAE 62.1.
C. Occupied Bypass
   a. Temporary setting to switch a predetermined "unoccupied" zone to "occupied". Temporary override time period shall be user adjustable. Owner or building engineer shall determine if override option to be available to tenant from space sensor face or through web portal. If provided, override button(s) shall be able to activate and cancel override.

COMPUTER ROOM AND IT CLOSET UNITS

A. Unit is intended to operate 24-hours per day; programmable /setback thermostat is not required.
B. Supply fan runs continuously.
C. Space thermostat cycles compressor to maintain zone set point.
D. Humidistat activates humidifier / dehumidification sequence to maintain setpoint.

23 31 00 HVAC DUCTS

Do not fabricate duct from these drawings, confirm all dimensions and available space in field. Dimensions given on drawings are inside free area, sheet metal is larger on lined duct. Branch takeoffs to have 45 degree entry fitting with volume damper. Elbows to be radius type with minimum centerline radius 1.5 times width or mitered elbows with single thickness turning vanes. Snap-lock is prohibited for medium and high pressure duct classifications.

Sheet metal: Use galvanized sheet metal, conforming to current SMACNA for construction, reinforcing, support and other aspects.
PRESSURE CLASS:
Supply from single zone units: +1"
Return: –1"
Exhaust: -1" upstream of fan, 1" downstream

DUCT SEALING:
Definitions (per ASHRAE SYSTEMS & EQUIPMENT 2008 TABLE 18-1):
Seal Level A: All transverse joints and longitudinal seams, and all duct wall penetrations
Seal Level B: All transverse joints and longitudinal seams
Round or flat oval spiral seams need not be sealed
Transverse joints include connections (including but not limited to spin-ins, taps, branches, access door frames, duct connections to equipment)
Duct wall penetrations include but are not limited to screws, pipe, tubes, rods, wires & non self-sealing fasteners

Supply and outside air ducts, all locations; return or exhaust ducts, outdoors: Seal Level A.
Return or exhaust ducts, indoors: Seal Level A
Seal all metal ducts using Hardcast or equal mastic plus fiberglass scrim.

Sealant: Foster 32-19 or Childers CP-146. Do not use oil or solvent base sealants inside buildings. Do not exceed LEED/SCAQMD volatile organic compound limits inside buildings. Tape sealants are not allowed

Externally insulated ducts shall be sealed before being insulated. Sealants of exterior ducts shall form a water and air-tight seal, bond to the metal involved, remain flexible with metal movement and have a service temperature range of –30ºF to +175ºF. If exposed to direct sunlight, sealant shall be UV and ozone resistant. Foster 32-19 or Childers CP-146.

DUCT LINER / INSULATION SCHEDULE:

- Rectangular supply: Unlined, externally insulated, except that 25 feet closest to fan or air units shall be internally lined
- Round supply: Unlined, externally insulated
- Return duct- Internal liner
- Exhaust- No liner, no insulation; except that exhaust ducts in non-conditioned attics shall be externally insulated

Liner Product (when specified in duct description above):

- Acceptable Manufacturers: *Johns Manville Linacoustic; Certainteed Tough Gard or equal,*
- Density: 1.5 PCF (pounds per cubic foot)
- Comply with latest version of
- Material
  - Thermal - ASTM C1071, ASTM C518
  - Sound – ASTM C1071, ASTM C423, ASTM E795
- Fungi Resistance - ASM C1338 & G21
- Fire/Smoke - UL 723, ASTM E84, NFPA 259
- Greengaurd certified
- Attachments and adhesives: Foster 85-60, Childers CP-127, or equivalent with 90% coverage and stick clips. Leading edges and transverse joints to be sealed with Foster 81-42W (white), CP-50AMV1 (white), CP-135 (black), or equivalent.

Liner Thickness: R-values shall meet duct insulation values spec'd in section 23 07 13. In addition to meeting R-values, the following minimum thicknesses shall be maintained for acoustic reasons:

- Supply duct: 1".
- Return ducts: 1/2" except that within 15 feet of fan or air unit use 1".

Flex duct
Shall not exceed 5 feet in length, nor be bent more than 90 degrees. Flex duct shall be same size as diffuser neck. Flexmaster 5B, 5M, 6B, 6M or eq. Nylon, CPE or foil/fiberglass/polyester laminate, supported by helically wound spring steel wire; fiberglass insulation; vapor barrier film. Product shall have listed marks by either ETL, or UL and shall have minimum 25/50 Flame/Smoke ratings. Pressure Rating: 6-inches WG positive; 1-inch WG negative. Vapor barrier Perm rating of 0.10 or less per ASTM E96 procedure A. Insulation: R value to meet that required for ductwork. Inner core shall maintain shape and full free area at 90 degree bends without glues or reinforcement.

23 33 00 AIR DUCT ACCESSORIES

Provide manual balancing dampers in all supply and exhaust branches. Provide manual balancing dampers in outside air and return ducts to each air unit. Provide manual balancing damper at each motorized duct damper location.

MANUAL VOLUME DAMPERS: per SMACNA HVAC Duct Construction Standards - Metal and Flexible. Single blade dampers for duct sizes up to 6 x 30 inch. Multi-Blade Damper: opposed blade pattern. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware. Except in round ductwork 12 inches and smaller, furnish end bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

Furnish locking, indicating quadrant regulators on single and multi-blade dampers. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters to allow full insulation thickness. Where rod lengths exceed 30 inches furnish regulator at both ends.

All balance damper operators shall be accessible via access panel, lay-in ceiling or remote cable operator. All motorized damper operators shall be accessible and shall not block the air stream.

Outdoor air, supply and exhaust air dampers shall have a maximum leakage rate of 4 cfm per square foot at one inch water gauge.

DUCT ACCESS DOORS: per SMACNA, rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish same insulating value as adjacent duct, plus sheet metal cover. Less than 12 inches sq., secure with sash locks. Up to 18 inches sq.: two hinges and two sash locks. Up to 24 x 48 inches: Three hinges and two compression latches. Access panels with sheet metal screw fasteners or requiring use of tools are not acceptable. Stencil or label fire and smoke damper access doors per local requirements

FLEXIBLE CONNECTIONS: per SMACNA. Fabric crimped into 24 gage galvanized metal edging strip. Fabric: Approx. 3 inches wide. UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A.

DUCT TEST HOLES: air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

FIRE DAMPERS: Type B or C, Static UL labeled with1-1/2 hr rating as per UL 555 and as per NFPA 90A and local building code. Label access doors "FIRE DAMPER ACCESS". Install as per manufacturer's instructions (submit copy with shop drawings). Use slimline dampers at wall grilles. Closure pressure and velocity rating shall be appropriate for system. Use dynamic labeled dampers in systems intended to operate with fans on during a fire. Use curtain type with blades outside of airstream for replaceable fusible link packages. Use multiple-blade type for factory installed electric switch and resettable device packages. Provide wall and/or duct access door to inspect and reset elements, or provide remote visual indication via the fire alarm panel or local device.

SMOKE DAMPERS
Class I as per UL 555S. Provide electric operator, controlled by area detectors acting through fire alarm panel. When smoke dampers are behind a grille; use damper designed for operator access thru the grille. Select damper with sleeve length suitable for project conditions.

COMBINATION FIRE and SMOKE DAMPERS: Conform to requirements for fire dampers and smoke dampers

23 37 13 AIR INLETS AND OUTLETS

For air devices located in lay-in ceilings, vendor shall confirm ceiling grid type and size prior to ordering air devices. Acceptable Manufacturers: Titus, Price, MetalAire, Nailor, Kreuger

23 41 00 HVAC AIR CLEANING DEVICES

Filters shall be 2", 30 percent efficiency as per ASHRAE 52.2 -2017, Maximum initial resistance at 500 fpm = 0.25". *AAF 'Perfect Pleat HC M8'* or equal. Use standard sizes only.

Provide construction filters for the duration of this project in all air units serving the project area and in air units serving other areas on the same floor.
Replace with new filters after balancing and adjusting is complete. Provide temporary filter media over all return or exhaust grilles in project area, to keep construction dust out of air systems.

23 81 26 SPLIT-SYSTEM AIR-CONDITIONERS

- Comply with the latest applicable sections of ASHRAE 15, 62.1, & 90.1. Comply with latest version of AHRI 110.
- Indoor Units
- Chassis: Galvanized steel, with removable and insulated panels. Space or accessory for a minimum 1" thick filter. Integral minimum 2" deep stainless steel condensate drain pan extended downstream of leaving face with a minimum 1% slope in at least two planes towards a drain connection to collect condensate from condensate producing components, coil piping connections, coil headers, and return bends. If exposed in space, manufacturer's standard paint with option for Architect to choose paint color. Provide controls transformer and supply and return duct flanges.
- Insulation: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411 or ASTM E 84. Manufacturer recommended adhesive complying with NFPA 90A or NFPA 90B. Surfaces exposed to airstream shall have aluminum-foil faced or erosion-resistant coating and comply with ASHRAE 62.1.
- Coils:
  - Refrigerant Coils: Copper tube with mechanically bonded aluminum fins and thermal or reversing expansion valve.
- Fan: Factory balanced statically and dynamically.
- Fan Motor(s): shall comply with section 23 05 13. Integral thermal protection and permanent lubrication. Multitapped multispeed for single stage compressor(s) in associated condensing unit(s). Staged Multispeed for multispeed compressor(s) in associated condensing unit(s). Fully modulating for fully modulating compressor(s) in associated condensing units.

AIR COOLED CONDENSING UNITS: UL or CSA listed, AHRI certified, and meeting the minimum efficiencies set forth in the latest ASHRAE 90.1. Copper tube, aluminium fin coils. Provide with crankcase heaters, vibration isolation, overload protection, time delay relay, filter drier, sight glass, and anti-short cycle relay. All units larger than 10 tons shall be provided with dual compressors.

ENGINEERS
PLANNERS
SCIENTISTS
CONSTRUCTION
MANAGERS
KCI TECHNOLOGIES
13750 SAN PEDRO AVE, STE 640
SAN ANTONIO, TX 77002
Ph: 713-237-9800
Texas Registered Engineering Firm F-10573

1633 BROADWAY
SAN ANTONIO TEXAS
78215

I N S I T E
Architects Inc.
210 226 4195

AACOG - WX & ART
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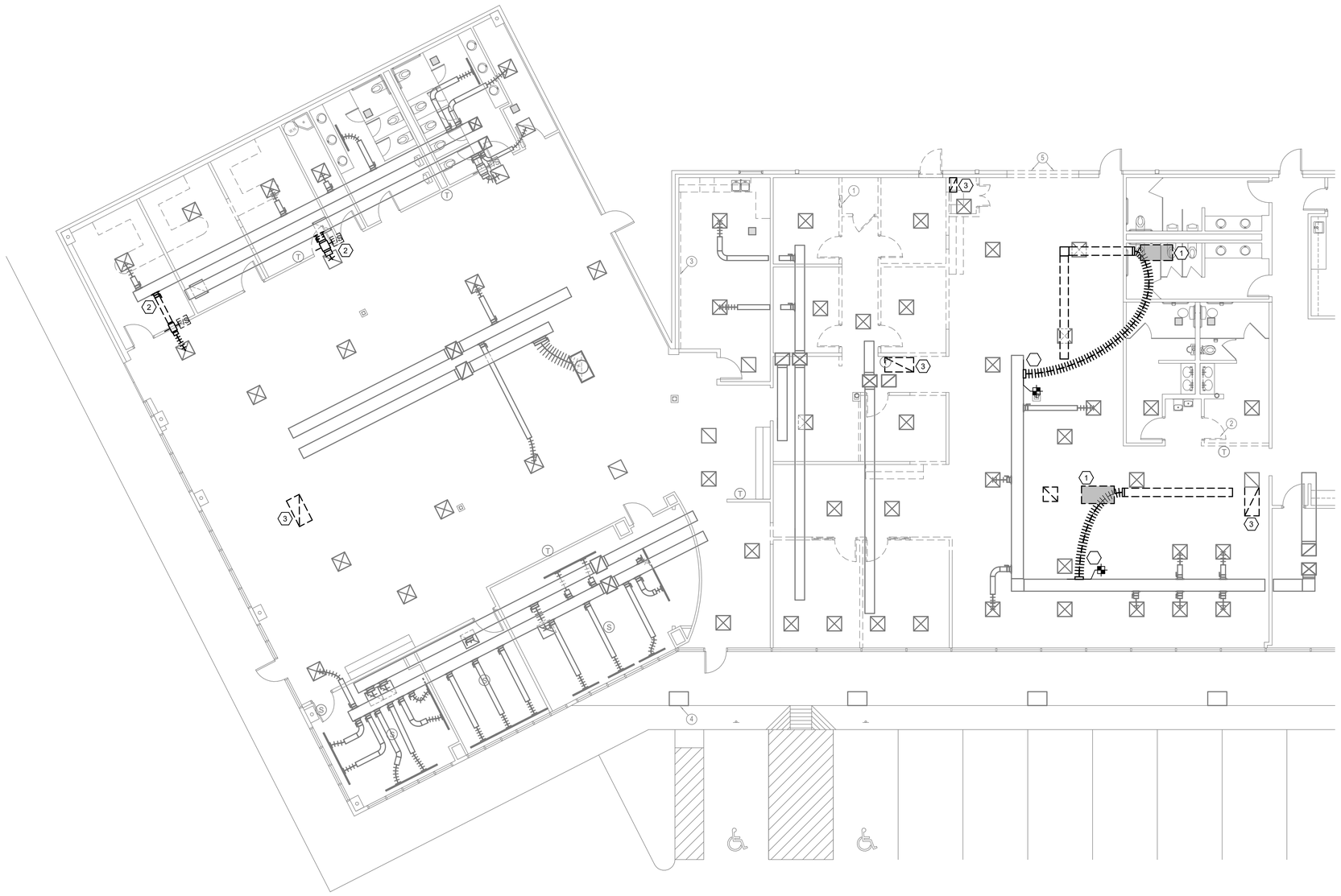
SHEET: **M2.1**



KEYED NOTES

1. EXISTING ABANDONED FAN COIL UNIT SHALL BE REMOVED. REMOVE ASSOCIATED CONDENSING UNIT AND ALL ASSOCIATED PIPING. COORDINATE DISPOSAL WITH BUILDING ENGINEER.
2. REMOVE EXISTING DUCTWORK AND FIRE/SMOKE DAMPER AS SHOWN. COORDINATE DISPOSAL WITH BUILDING ENGINEER.
3. DEMOLISH EXISTING RETURN GRILLE. COORDINATE WITH BUILDING ENGINEER FOR STOCK STORAGE.

1 MECHANICAL DEMO PLAN

1/8" = 1'-0"

1633
BROADWAY
SAN ANTONIO
TEXAS
78215

INSITE
Architects
Inc.
210 226 4195

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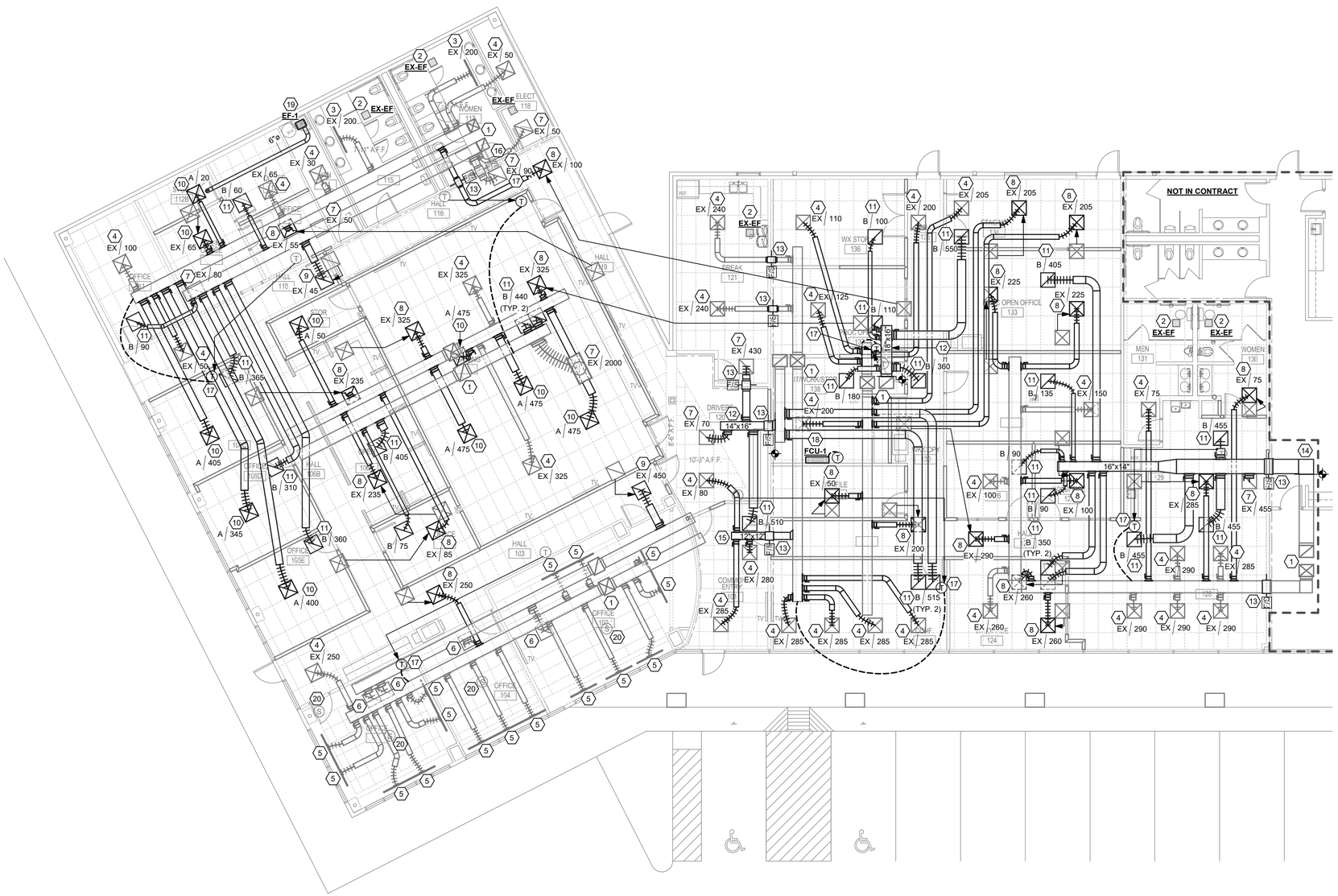
MANAGERS
KCI TECHNOLOGIES
13750 SAN PEDRO AVE, STE 640
SAN ANTONIO, TX 77002
Ph: 713-237-9800
Texas Registered Engineering
Firm F-10573



KEYED NOTES

1. EXISTING ROOFTOP UNIT ON ROOF SHALL REMAIN AND BE REUSED. CONTRACTOR SHALL PERFORM FULL SERVICE MAINTENANCE WHICH SHALL INCLUDE BUT SHALL NOT BE LIMITED TO FILTER REPLACEMENT, CONDENSER COIL CLEANING, EVAPORATOR COIL CLEANING, CONDENSATE AND DRAIN PAN CLEANING, VOLTAGE CHECKS, REFRIGERANT PRESSURE CHECK, FAN AND MOTOR CHECK, THERMOSTAT COMMUNICABILITY CHECK, BELT INSPECTION AND RETENSIONING (IF APPLICABLE AND IF REQUIRED). NOTIFY ARCHITECT AND ENGINEER OF ANY DEFICIENCIES. REBALANCE FAN TO CFM VALUES AS INDICATED ON DRAWINGS.
2. EXISTING EXHAUST FAN SHALL REMAIN AND BE REUSED. MAINTAIN EXISTING AIR QUANTITY.
3. EXISTING SUPPLY SLOT SHALL REMAIN AND BE REUSED. REBALANCE TO CFM VALUE INDICATED. PROVIDE NEW SPIN-IN AND FLEX DUCT AS REQUIRED. SEE SCHEDULE AND DETAILS.
4. EXISTING SUPPLY AIR DEVICE SHALL REMAIN AND BE REUSED. REBALANCE TO CFM VALUE INDICATED. PROVIDE NEW SPIN-IN AND FLEX DUCT AS REQUIRED. SEE SCHEDULE AND DETAILS.
5. EXISTING SUPPLY AIR DEVICE SHALL REMAIN AND BE REUSED. MAINTAIN EXISTING AIR QUANTITY.
6. EXISTING DUCTED RETURN GRILLE SHALL REMAIN AND BE REUSED. MAINTAIN EXISTING AIR QUANTITY.
7. EXISTING DUCTED RETURN GRILLE SHALL REMAIN AND BE REUSED. REBALANCE TO CFM VALUE INDICATED. PROVIDE NEW SPIN-IN AND FLEX DUCT AS REQUIRED. SEE SCHEDULE AND DETAILS.
8. EXISTING SUPPLY AIR DEVICE SHALL BE RELOCATED AS SHOWN. BALANCE TO CFM VALUE INDICATED. REUSE EXISTING SPIN-IN AND FLEX DUCT AS ALLOWABLE. PROVIDE NEW SPIN-IN AND FLEX DUCT AS REQUIRED. CAP AND SEAL UNUSED DUCT OPENINGS AIR TIGHT. SEE SCHEDULE AND DETAILS.
9. EXISTING RETURN GRILLE SHALL BE RELOCATED AS SHOWN. BALANCE TO CFM VALUE INDICATED. REUSE EXISTING SPIN-IN AND FLEX DUCT AS ALLOWABLE. PROVIDE NEW SPIN-IN AND FLEX DUCT. CAP AND SEAL UNUSED DUCT OPENINGS AIR TIGHT. SEE SCHEDULE AND DETAILS.
10. NEW SUPPLY AIR DEVICE SHALL BE LOCATED AS SHOWN. BALANCE TO CFM VALUE INDICATED. PROVIDE NEW SPIN-IN AND FLEX DUCT. SEE SCHEDULE AND DETAILS.
11. NEW DUCTED RETURN GRILLE SHALL BE LOCATED AS SHOWN. BALANCE TO CFM VALUE INDICATED. PROVIDE NEW SPIN-IN AND FLEX DUCT. SEE SCHEDULE.
12. PROVIDE NEW RETURN DUCTWORK AND CONNECT TO EXISTING DUCT AT POINT INDICATED. SIZE AND ROUTE AS SHOWN.
13. NEW FIRE/SMOKE DAMPER SHALL BE LOCATED AS SHOWN. SEE DETAIL AND SPECIFICATIONS FOR FURTHER REQUIREMENTS.
14. PROVIDE NEW RETURN DUCTWORK AND CONNECT TO EXISTING DUCT AT POINT INDICATED. FIELD VERIFY SIZE OF EXISTING DUCTWORK AND MATCH EXISTING DUCT SIZE.
15. PROVIDE NEW SUPPLY DUCTWORK. SIZE AND ROUTE AS SHOWN.
16. EXISTING FIRE/SMOKE DAMPER SHALL REMAIN AND BE REUSED.
17. NEW OR RELOCATED THERMOSTAT SHALL BE LOCATED AS SHOWN. PROVIDE NEW CONTROL WIRING AS REQUIRED.
18. NEW WALL MOUNTED DX FAN COIL UNIT SHALL BE LOCATED AS SHOWN. FIELD VERIFY EXACT FINAL LOCATION BEFORE BID AND CONSTRUCTION. COORDINATE CONNECTION OF CONCEALED CONDENSATE PUMP WITH ELECTRICIAN. ROUTE 3/4" CONDENSATE LINE TO SINK TAILPIECE IN 129 COFFEE. MAINTAIN ALL MANUFACTURER'S RECOMMENDED CLEARANCES. ROUTE UNIT'S REFRIGERANT PIPING TO CONDENSING UNIT LOCATED ON ROOF. COORDINATE ROUTING OF REFRIGERANT PIPING WITH BUILDING ENGINEER PRIOR TO INSTALLATION. PROVIDE FACTORY PROGRAMMABLE TSTAT AS SHOWN. SEE SCHEDULE AND DETAILS.
19. NEW CEILING MOUNTED CABINET EXHAUST FAN SHALL BE LOCATED AS SHOWN. ROUTE EXHAUST DUCTWORK AS SHOWN AND UP TO ROOF. SEE SCHEDULE.
20. EXISTING CONTROLLER FOR CARRIER RTU FOR TEMPERATURE READING SENSOR SHALL REMAIN. CONTRACTOR SHALL PROVIDE MAINTENANCE AND CONFIRM OPERATION.

1 MECHANICAL RENOVATION PLAN

1/8" = 1'-0"

1633 BROADWAY SAN ANTONIO TEXAS 78215

I N S I T E Architects Inc.

210 226 4195

AACOG - WX & ART

TITAN PLAZA
SAN ANTONIO, TEXAS

DRAWN BY: MPL

DATE: 06/16/20

REVISED:

STATE OF TEXAS
CLAYTON F. CLEMENTS
109793
LICENSED PROFESSIONAL ENGINEER
06/16/2020

SHEET TITLE: MECHANICAL RENOVATION PLAN

SHEET: **M4**

KCI TECHNOLOGIES
ENGINEERS
PLANNERS
SCIENTISTS
CONSTRUCTION MANAGERS
13750 SAN PEDRO AVE, STE 640
SAN ANTONIO, TX 77002
Ph: 713-237-9800
Texas Registered Engineering Firm F-10573

KEYED NOTES

1 EXISTING ROOFTOP UNIT ON ROOF SHALL REMAIN AND BE REUSED. CONTRACTOR SHALL PERFORM FULL SERVICE MAINTENANCE WHICH SHALL INCLUDE BUT SHALL NOT BE LIMITED TO FILTER REPLACEMENT, CONDENSER COIL CLEANING, EVAPORATOR COIL CLEANING, CONDENSATE AND DRAIN PAN CLEANING, VOLTAGE CHECKS, REFRIGERANT PRESSURE CHECK, FAN AND MOTOR CHECK, THERMOSTAT COMMUNICABILITY CHECK, BELT INSPECTION AND RETENSIONING (IF APPLICABLE AND IF REQUIRED). NOTIFY ARCHITECT AND ENGINEER OF ANY DEFICIENCIES. REBALANCE FAN TO CFM VALUES AS INDICATED ON DRAWINGS.

2 EXISTING ABANDONED CONDENSING UNIT SHALL BE REMOVED. REMOVE ALL ASSOCIATED PIPING. COORDINATE DISPOSAL WITH BUIDLING ENGINEER.

3 NEW CONDENSING UNIT SHALL BE LOCATED ON ROOF AS SHOWN. COORDINATE PLACEMENT OF UNIT IN FIELD WITH STRUCTURAL DRAWINGS/ENGINEER. MAINTAIN ALL MANUFACTURER'S RECOMMENDED CLEARANCES. SEE SCHEDULE AND DETAILS.

1 MECHANICAL ROOF PLAN

1/8" = 1'-0"

1633
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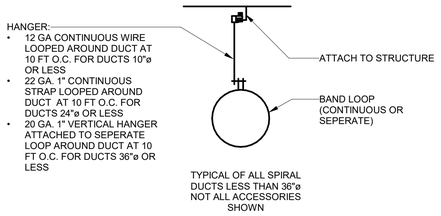
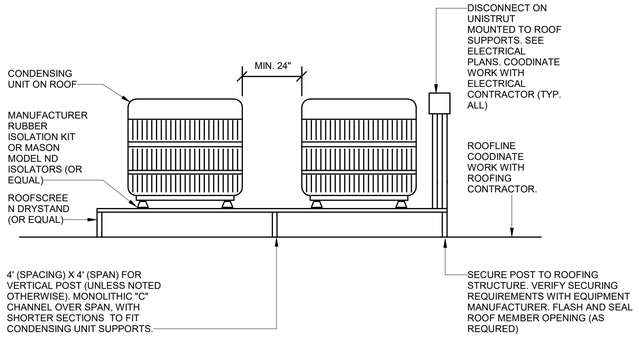
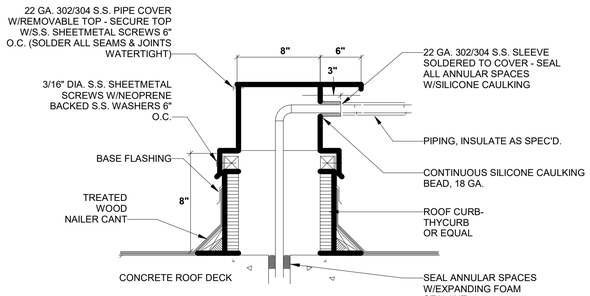


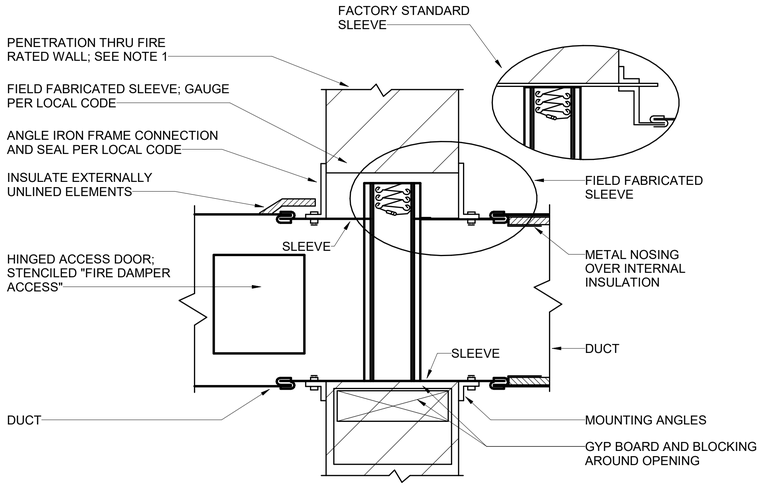
7 SPIRAL DUCT HANGER
NOT TO SCALE



8 CONDENSING UNIT PLATFORM
NOT TO SCALE



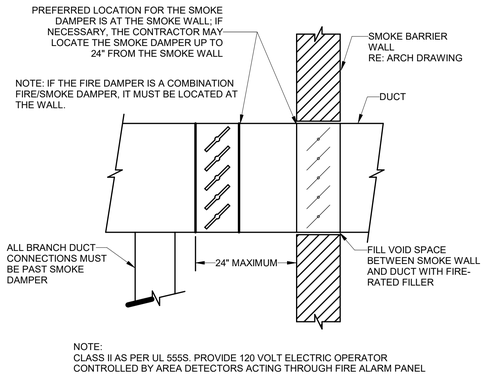
9 PIPE THRU ROOF
NOT TO SCALE



NOTES:

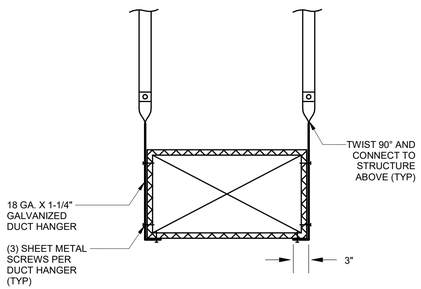
1. MAKE OPENING 1/8" PER FOOT LARGER THAN DAMPER DIMENSIONS WITH 1/4" MIN REQD
2. MOUNTING ANGLES, SLEEVE GAUGE, LENGTH OF SLEEVE, SLEEVE ATTACHMENT, AND OTHER CONSTRUCTION DETAILS SHALL BE PER DAMPER SUPPLIERS INSTRUCTIONS TO MAINTAIN UL LISTING AND TO CONFORM WITH NFPA 90A OR LOCAL REQUIREMENTS
3. DAMPER CONSTRUCTED AND TESTED PER UL 555, UL LABLED, 1-1/2 HOUR FIRE RATING W/ 212°F FUSIBLE LINK
4. SEAL BETWEEN WALL AND SLEEVE W/ APPROVED FIRE STOP MATERIAL
5. TYPE 'B' DAMPER SHOWN; 'C' DAMPERS ARE SIMILAR. DO NOT USE TYPE 'A' WITH THE CURTAIN EXTENDING INTO THE AIR STREAM

4 CURTAIN TYPE FIRE DAMPER-VERIT. MTD. 1-1/2 HR
NOT TO SCALE

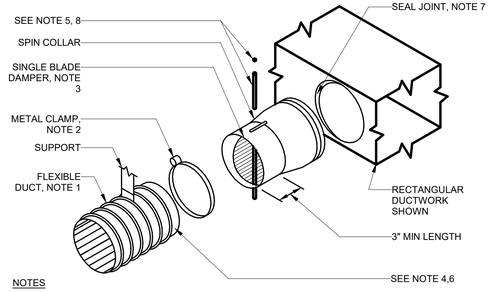


NOTE:
CLASS II AS PER UL 555S. PROVIDE 120 VOLT ELECTRIC OPERATOR CONTROLLED BY AREA DETECTORS ACTING THROUGH FIRE ALARM PANEL

5 SMOKE DAMPER INSTALLATION
NOT TO SCALE



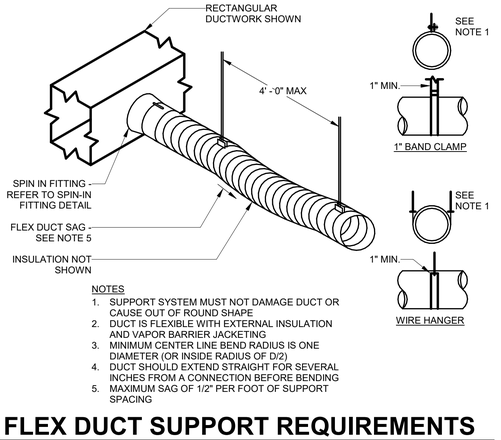
6 DUCT HANGER
NOT TO SCALE



NOTES

1. SUPPORT AS REQUIRED
2. BAND FLEX TO COLLAR 1/2" MIN FROM OUTBOARD END OF COLLAR
3. INSTALL SPIN COLLAR DAMPER IN OPEN POSITION; FINAL ADJUSTMENT BY TAB CONTRACTOR
4. PULL FLEXIBLE DUCTWORK INSULATION UP TO END OF SPIN COLLAR AT EDGE OF RECTANGULAR DUCTWORK; SEAL VAPOR BARRIER W/ PRESSURE SENSITIVE TAPE (UL 181B-FX OR 181A-P) TO PREVENT MOISTURE MIGRATION
5. PROVIDE EXTENSION RODS TO ACCOMMODATE INSULATION, PULL TO EDGE OF DUCTWORK AS REQUIRED AND SEAL TO EFFECT VAPOR BARRIER
6. POP RIVET OR #10 SHEET METAL SCREWS, MIN 3 EACH AT 120° INTERVALS, CONNECTING STOVEPIPE TO COLLAR. ENSURE RIVETS OR SCREWS DO NOT INTERFERE W/ DAMPER
7. TAPE AND SEAL ALL JOINTS TO PREVENT LEAKAGE
8. INSTALL LOCKING QUADRANT AND HANDLE ON BOTTOM OF DUCT FOR EASE OF SERVICE (SHOWN ON TOP FOR EASE OF ILLUSTRATION ONLY)

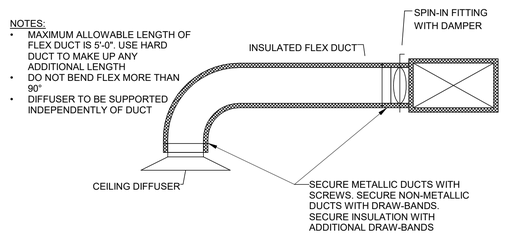
1 SPIN-IN FITTING WITH DAMPER
NOT TO SCALE



NOTES

1. SUPPORT SYSTEM MUST NOT DAMAGE DUCT OR CAUSE OUT OF ROUND SHAPE
2. DUCT IS FLEXIBLE WITH EXTERNAL INSULATION AND VAPOR BARRIER JACKETING
3. MINIMUM CENTER LINE BEND RADIUS IS ONE DIAMETER (OR INSIDE RADIUS OF D/2)
4. DUCT SHOULD EXTEND STRAIGHT FOR SEVERAL INCHES FROM A CONNECTION BEFORE BENDING
5. MAXIMUM SAG OF 1/2" PER FOOT OF SUPPORT SPACING

2 FLEX DUCT SUPPORT REQUIREMENTS
NOT TO SCALE



3 DIFFUSER CONNECTION
NOT TO SCALE

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