AUSTIN Independent School District | Contract and Procurement Services

ADDENDUM No. 4
Request for Competitive Sealed Proposals (CSP)
21CSP037 Renovations at Bedichek Middle School

October 2nd, 2020

Received by bidder:

Date:_____

Name:_____

Signature:_____

Item 1: New Asbestos Abatement

Item 2: New and Revised Drawings and Specifications

Item 1:

New Asbestos Abatement revisions dated September 21st, 2020, can be found under 21CSP037 on planroom.millerids.com

Item 2:

New and Revised Drawings and Specifications can be found under 21CSP037 on planroom.millerids.com

ASBESTOS ABATEMENT GUIDE

For the

ASBESTOS ABATEMENT AT
BEDICHEK MIDDLE SCHOOL
PRIOR TO LIMITED RENOVATION INVOLVING
CIVIL, STRUCTURAL AND MEP UPGRADES
6800 BILL HUGHES ROAD
AUSTIN, TX 78745

Prepared for

Austin Independent School District
AISD Service Center
5101 E. 51st Street
Austin, Texas 78723

Prepared by

PROFESSIONAL SERVICE INDUSTRIES, INC. (PSI)
Three Burwood Lane
San Antonio, Texas 78216
(210) 342-9377

PSI Project No. 0435-4268

Issue Date: December 2, 2019
Revision Date: September 21, 2020

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
DSHS License No. 10-5652
Expiration Date: March 28, 2021

TABLE OF CONTENTS

SECTION 1.0 - SCOPE OF WORK

1.1 Purpose

This Asbestos Abatement Guide or Work Plan gives general methods and work procedures to be used by the selected Asbestos Abatement Contractor for the safe removal of asbestos-containing materials (ACMs). This plan is to be used in coordination with all applicable federal, state, and local regulations as well as the general abatement specifications as found in the *Texas Department of State Health Services (TDSHS) Texas Asbestos Health Protection Rules (TAHPR) in Title 25 of the Texas Administrative Code Part 295.31-295.73 (25 TAC 295.31-295.73), United States Environmental Protection Agency (EPA) Asbestos Hazard Emergency Response Act (AHERA) in Title 40 of the Code of Federal Regulations Part 763 Subpart E (40 CFR 763 Subpart E), EPA National Emission Standard for Hazardous Air Pollutants (NESHAP in 40 CFR 61 Subpart M, United States Department of Labor, Occupational Safety and Health Administration (OSHA) Asbestos in Construction Standard for Class I, II, III, IV Asbestos Work operations in 29 CFR 1926.1101 and the Resilient Floor Covering Institute (RFCI) guidelines*. The asbestos abatement contractor has to be licensed by the Texas Department of State Health Services (DSHS) and all supervisors and workers have to have current DHSHS asbestos licenses. In addition, the asbestos waste material must be transported by a DSHS Asbestos licensed Transporter. The asbestos-containing waste material must be disposed of in a Class I landfill that will accept it, per Texas Asbestos Health Protection Rules, (TAHPR) Chapter 295.31-Chapter 295.73, Texas Administrative Code-Title 25 – Part 1.

1.2 Scope

This project includes removal of ACMs as identified in this specification and /or as directed by the Owner's contract documents. These operations shall be in compliance with OSHA Class II, EPA AHERA and TDSHS guidelines. The Scope of work is as follows:

a. Contractor shall submit pre-work submittals (1 copy) for review and approval prior to work. The submittals shall contain, but not limited to all licenses, personnel information, performance, labor and payroll bonds and TDSHS and EPA Notification. Contractor is directed to fill out and submit the TDSHS Notification for the Owner based on the timetable as set forth by the Owner's schedule.

b. Contractor shall supply all the necessary tools, equipment, labor, construction/abatement activity materials, waste transportation/can (enclosed disposal unit) and delivery of the waste to an appropriate waste disposal facility to complete the work as specified by these guidelines and/or by contract agreement.

c. The Owner shall supply a source of water and electrical power for the project. As necessary, the Contractor shall be responsible for providing sanitary facilities for his employees. The asbestos regulated units (ARUs) shall be paid by the Owner.

d. Contractor, as a minimum shall isolate the work area in accordance with the appropriate sections of *25 TAC 295.60 and 29 CFR 1926.1101 (g)* as well as this work plan. A temporary airtight barrier, as required, shall be constructed to separate the work areas from the occupied areas in order to maintain service to those areas of the building(s).

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
DSHS License No. 10-5652
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e. Contractor shall remove and dispose of the following ACMs as indicated on the referenced drawings and as directed by the Owner's representative:

- Remove and dispose of approximately 743 linear feet of asbestos-containing pipe insulation and fittings with white mastic (the only ACM layer) on pipe risers and runs within the crawlspace under the original 1972 'A' Building. Alternate No. 6 -Phase 6: At the discretion of the District, the pipes may be enclosed in plastic prior to the concrete spalling and cracking structural repairs within the crawlspace. If this option is selected by the District, the contractor will enclose the pipes with plastic instead of removing the ACM pipe insulation. Subsequently, the contractor will remove the plastic or leave the plastic in place when the structural repairs are complete at the discretion of the District.
- Remove and dispose of approximately 270 cubic feet of asbestos-containing loose debris within the crawlspace under the original 1972 'A' Building. These debris have intermixed pipe insulation that has delaminated from the pipe systems within the crawlspace.
- Remove and dispose of approximately 48 linear feet of asbestos-containing white A/C ductwork mastic and 35 linear feet of white mastic from elbows and seams of pipe systems in AHU 3.
- Remove and dispose of approximately 128 linear feet of asbestos-containing white A/C ductwork mastic and 63 linear feet of white mastic from elbows and seams of pipe systems in AHU 6.
- Remove and dispose of approximately 96 linear feet of asbestos-containing white A/C ductwork mastic and 60 linear feet of white mastic from elbows and seams of pipe systems in AHU 7.
- Alternate No. 5 – Phase 5: Remove and dispose of approximately 132 linear feet of asbestos-containing white A/C ductwork mastic and 67 linear feet of white mastic from elbows and seams of pipe systems in AHU 13.
- Alternate No. 5 – Phase 5: Remove and dispose of approximately 132 linear feet of asbestos-containing white A/C ductwork mastic and 67 linear feet of white mastic from elbows and seams of pipe systems in AHU 14.
- Remove and dispose of approximately 200 square feet of asbestos-containing drywall materials consisting of joint compound and texture within the 100 Wings (Rooms 100-193), Room 236, Theater, and Cafeteria. Removal areas will be spot abatements where the replacement of lighting in the cafeteria, classrooms and corridors with LED fixtures and emergency lighting—including the replacement of ceiling grid and tiles— throughout the campus will impinge upon these materials. The areas for spot abatements will be determined by the District during the abatement project. Alternate No. 3 – Phase 3: Remove and install new ceiling in the cafeteria, which will increase the amount of asbestos-containing drywall to be abated depending on the quantity to be impinged upon, which will be determined by the District.
- Remove and dispose of approximately 5 linear feet of asbestos-containing asbestos-cement (A/C) pipe riser (aka, "Transite") on the southside exterior grounds of the Cooling Tower. The pipe comes out of the ground and is approximately 8 inches in inner diameter.

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DSHS License No. 10-5652
Expiration Date: March 28, 2021

- Alternate No. 4 – Phase 4: Remove and dispose of approximately 20 each of asbestos-containing gaskets associated with pipe systems and connections that will be impinged upon by the removal and replacement of two chillers and two chiller pumps within the Central Plant (also called Mechanical Room).

  The abatement areas are further described on the drawings and photos in the appendix.

f. Contractor shall construct a three-chamber wet decontamination unit for the work area. The decontamination chamber shall be equipped with a shower capable of delivering hot and cold water. An adequate supply of soap, shampoo and disposable towels shall be maintained for workers at egress.

g. Contractor shall *coordinate all work times with the Owner's Individual Asbestos Consultant (IAC) or Project Manager* and is directed to submit, adjust, and amend the TDSHS Notification for the Owner based on his accessibility.

h. Contractor is to *submit close out documents* within 15 days of completion, to include but not limited to waste manifest, personal testing (PEL/STEL), licenses and project logs.

This project shall be performed in accordance with this Asbestos Abatement Guide as well as applicable OSHA, EPA, and State of Texas requirements. The Texas Department of State Health Services (DSHS) adopted rules dated December 4, 1998, and revised March 2003 will be enforced. Prior to initiating work, proper written notification to appropriate agencies shall be performed in accordance with EPA and Texas DSHS requirements.

END OF SECTION 1.0

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
DSHS License No. 10-5652
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SECTION 2.0 – PROTECTIVE CLOTHING AND EQUIPMENT

2.1 Protective Clothing

Each authorized person involved in asbestos removal shall wear protective disposable coveralls, coated canvas or rubber gloves, head covering, and non-skid foot coverings whenever he/she is within the regulated area. The protective clothing shall be made of a material impervious to asbestos fibers.

2.2 Respirators

a. Contractor shall comply with *29 CFR 1926.1101 (h) and the OSHA General Industry Respiratory Protection Standard in 29 CFR 1910.134* and initiate appropriate respirator program. A minimum of half-mask respirators with dual HEPA (High Efficiency Particulate Air) filters shall be used during work area preparation and removal of non-friable materials. A minimum of half-face powered air purifying respirators (PAPR) with HEPA filtration shall be utilized during the removal of friable materials. The contractor is responsible for the appropriate selection of respirators.

b. All respirators shall be approved by the National Institute of Occupational Safety and Health (NIOSH) for use in asbestos-containing atmospheres.

c. Each worker must perform positive and negative air pressure fit tests each time a respirator is put on or as respirator designs permit. Supplied air respirators shall be tested for adequate flow as specified by the manufacturer.

d. No one wearing a beard or other facial hair which will prevent a proper respirator seal shall be allowed to wear a respirator or enter the regulated area.

END OF SECTION 2.0

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
DSHS License No. 10-5652
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SECTION 3.0 – EMERGENCY PLANNING

3.1 Procedures

a. The contractor shall develop emergency planning procedures prior to abatement initiation. This plan shall consist of, but not be limited to, emergency exit plans, notification procedures, and fire extinguisher locations. Both the contractor and the Owner shall agree on these procedures.

b. Telephone numbers of all emergency response personnel shall be predominately posted in the clean room and equipment room. The location of the nearest telephone shall also be given.

END OF SECTION 3.0

PREPARED BY: 

Steve Bohannon
Individual Asbestos Consultant
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SECTION 4.0 – SITE PREPARATION FOR ASBESTOS REMOVAL

4.1 Worksite Enclosure

Contractor shall isolate the work area (regulated area) per *TDSHS regulation 25 TAC 295.60, EPA regulation 40 CFR 61.145I(3)(B), and OSHA Standard 29 CFR 1926.1101*. The regulated areas shall be roped off and marked with clearly written warning labels in order to keep unauthorized personnel out of the regulated area. The regulated area shall encompass the whole identified removal area expected to have an airborne asbestos fiber concentration greater than 0.01 fibers per cubic centimeter (f/cc) and/or 70 structures per square millimeter (s/mm^2) as a result of the removal activities and not of other non-related activities conducted in the building.

a. All movable objects shall be removed from the containment area. Cleaning of contaminated items shall be performed if the items are to be salvaged or reused. Otherwise, they shall be properly disposed of as asbestos waste. All non-movable objects that remain in the containment area shall be covered with a minimum of four-mil plastic sheeting, secured in place.

b. Regulated areas within which asbestos abatement is to be conducted shall be separated from adjacent areas by impermeable barriers such as plastic sheeting attached securely in place. All openings between containment areas and adjacent areas, including but not limited to windows, doorways, elevator openings, corridor entrances, ventilation openings, drains, ducts, grills, grates, diffusers, and skylights shall be sealed. All penetrations that could permit air infiltration or air leaks through the barrier shall be sealed, with the exceptions of the make-up air provisions and the means of entry and exit. ***A critical barrier must also be placed across the entire ceiling in the work area if the ceiling is a drop-in ceiling and not a hard ceiling and not to be abated (i.e., inverted prep).***

c. No seams shall be located at wall-to-wall joints. Where a fire hazard exists, all plastic sheeting will be certified by the Underwriters Laboratory (UL) as being fire retardant. Where feasible, when containment walls which exceed 260 linear feet must be constructed, a viewing window will be included in the wall for each 260 linear feet or fraction of that distance which will permit the viewing of at least 51% of the abatement work area. The window shall be constructed of Plexiglas which measures approximately 18 inches by 18 inches. The bottom of the window will be at a reasonable viewing height from the outside floor.

d. Contractor shall provide enough negative air units to ensure four air exchanges inside the regulated area at all times. Contractor shall supply a sufficient quantity of negative pressure ventilation units equipped with *ANSI 29.2-79 Local Exhaust Ventilation Requirement* and EPA guideline document *EPA 560/5-83-002 Guidance for Controlling Friable Asbestos-Containing Materials in Buildings*. The documents recommend 0.02 inches of water pressure differential between outside and inside the enclosure. Openings made in the enclosure to accommodate these units shall be air tight. The unit should be placed at the best location so that air is forced to move most optimally across the entire enclosure.

4.2 Decontamination Facility

The enclosure shall consist of an enclosed work area and a decontamination area which consists of a change room, shower, and equipment room immediately adjacent to and contiguous with the work area. Waste water from the shower shall be filtered using a 5-micron and a 20-micron filter before being routed to the sanitary sewer system.

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
DSHS License No. 10-5652
Expiration Date: March 28, 2021

END SECTION 4.0

SECTION 5.0 – ASBESTOS REMOVAL AND DISPOSAL PROCEDURES

5.1 Class I Work

Class I Work means activities involving the removal of TSI, surfacing ACM, and presumed asbestos-containing material (PACM). This scope of work does include the removal of these materials.

- Remove and dispose of approximately 743 linear feet of asbestos-containing pipe insulation and fittings with white mastic (the only ACM layer) on pipe risers and runs within the crawlspace under the original 1972 'A' Building. Alternate No. 6 -Phase 6: At the discretion of the District, the pipes may be enclosed in plastic prior to the concrete spalling and cracking structural repairs within the crawlspace. If this option is selected by the District, the contractor will enclose the pipes with plastic instead of removing the ACM pipe insulation. Subsequently, the contractor will remove the plastic or leave the plastic in place when the structural repairs are complete at the discretion of the District.
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- Remove and dispose of approximately 96 linear feet of asbestos-containing white A/C ductwork mastic and 60 linear feet of white mastic from elbows and seams of pipe systems in AHU 7.
- Alternate No. 5 – Phase 5: Remove and dispose of approximately 132 linear feet of asbestos-containing white A/C ductwork mastic and 67 linear feet of white mastic from elbows and seams of pipe systems in AHU 13.
- Alternate No. 5 – Phase 5: Remove and dispose of approximately 132 linear feet of asbestos-containing white A/C ductwork mastic and 67 linear feet of white mastic from elbows and seams of pipe systems in AHU 14.

5.1.1 CLASS I WORK.

The following steps are intended to cover the removal of asbestos-containing thermal system insulation utilizing glove bag systems:

a. Regulate the work area where airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

b. Demarcate the work area with signs and barrier tape.

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
DSHS License No. 10-5652
Expiration Date: March 28, 2021

c. Access to regulated areas shall be limited to authorized personnel only.

d. All persons entering a regulated area are required to wear respirators. The minimum respiratory protection for this scope of work is a ½ mask air purifying respirator with HEPA filters unless fiber concentrations require greater protection. The Contractor is responsible for proper and appropriate respirator selection.

e. A Competent Person shall supervise all asbestos work.

f. Use only vacuum cleaners equipped with HEPA filters to collect all debris and dust containing ACM or PACM.

g. Use wet methods, or wetting agents, to control employee exposure during asbestos handling, mixing, removal, cutting, application, and cleanup, except when there is an electrical hazard or other hazard.

h. Each glove bag (6-mil thick plastic and seamless at the bottom) shall be installed so that it completely covers the circumference of pipe or other structure where the work is being done.

i. Glove bags shall be smoke tested for leaks and leaks sealed prior to use.

j. Glove bags may only be used once and may not be moved.

k. Prior to removal, glove bags shall be collapsed by removing air within them using a HEPA vacuum.

l. Glove bags shall not be used on surfaces whose temperature exceeds 150º

m. Before beginning the operation, loose and friable material adjacent to the glove bag operation shall be wrapped and sealed in two layers of 6-mil plastic or otherwise rendered intact.

n. Where system used attached waste bag, such bag shall be connected to collection bag using hose or other material that shall withstand pressure of ACM waste and water without losing its integrity.

o. Sliding valve or other device shall separate waste bag from hose to ensure no exposure when the waste bag is disconnected.

p. At least two (2) persons shall perform Class I glove bag removal operations.

q. After removal, conduct final visual inspection with the Project Manager.

r. Encapsulate exposed pipe and inside the glove bag.

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
DSHS License No. 10-5652
Expiration Date: March 28, 2021

5.2 Class II Work

Class II Work means activities involving the removal of ACM that is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing floor tile and mastic, cement board, construction mastics, sink undercoating, chalkboards, HVAC duct mastic, laboratory tabletops, and vapor barrier material. This scope of work includes the removal of the following:

- Remove and dispose of approximately 200 square feet of asbestos-containing drywall materials consisting of joint compound and texture within the 100 Wings (Rooms 100-193), Room 236, Theater, and Cafeteria. Removal areas will be spot abatements where the replacement of lighting in the cafeteria, classrooms and corridors with LED fixtures and emergency lighting—including the replacement of ceiling grid and tiles— throughout the campus will impinge upon these materials. The areas for spot abatements will be determined by the District during the abatement project. Alternate No. 3 – Phase 3: Remove and install new ceiling in the cafeteria, which will increase the amount of asbestos-containing drywall to be abated depending on the quantity to be impinged upon, which will be determined by the District.
- Remove and dispose of approximately 5 linear feet of asbestos-containing asbestos-cement (A/C) pipe riser (aka, "Transite") on the southside exterior grounds of the Cooling Tower. The pipe comes out of the ground and is approximately 8 inches in inner diameter.
- Alternate No. 4 – Phase 4: Remove and dispose of approximately 20 each of asbestos-containing gaskets associated with pipe systems and connections that will be impinged upon by the removal and replacement of two chillers and two chiller pumps within the Central Plant (also called Mechanical Room).

  The abatement areas are further described on the drawings and photos in the appendix.

5.2.1 Class II Work

The following steps are intended to cover the removal of asbestos-containing materials. *Resilient Floor Covering Institute (RFCI)* procedures may be used as an option for removal of the small areas of floor tile in this project if the crew is trained and certified in the procedure.

a. Regulate the work area where airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

b. Demarcate the work area with signs and barrier tape.

c. Access to regulated areas shall be limited to authorized personnel only.

d. All persons entering a regulated area are required to wear respirators. The minimum respiratory protection for this scope of work is a respirator with HEPA filters unless fiber concentrations require greater protection. The Contractor is responsible for proper and appropriate respirator selection.

e. A Competent Person shall supervise all asbestos work.

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Steve Bohannon
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f. Use only vacuum cleaners equipped with HEPA filters to collect all debris and dust containing ACM or PACM.

g. Use wet methods, or wetting agents, to control employee exposure during asbestos handling, mixing, removal, cutting, application, and cleanup, except when there is an electrical hazard or other hazard.

h. Critical barriers shall be placed over all openings to the regulated area. ***A critical barrier must also be placed across the entire ceiling in the work area if the ceiling is a drop-in ceiling and not a hard ceiling and not to be abated (i.e., inverted prep).***

i. All objects within the regulated area shall be covered with impermeable drop cloths or plastic sheeting that is secured by duct tape or equivalent.

j. Prep all non-asbestos walls with 4-mil plastic splash guard.

k. Prep all non-asbestos floors with two layers of 6-mil plastic.

l. Construct decontamination and load-out units

m. Establish negative pressure

n. Conduct pre-abatement visual inspection with the Project Manager.

o. All impermeable objects that are not ACM must be HEPA vacuumed or wet wiped, then passed through the bag out as non-ACM waste.

p. Remove ACM while spraying the materials with amended water. Materials should be removed intact, unless the contractor demonstrates that intact removal is not possible.

q. Promptly cleanup and dispose of waste material and debris contaminated with asbestos in leak-tight containers. Vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) shall be used to clean floors.

r. Wet wipe and clean entire work area.

s. Conduct final visual inspection with PM.

t. Encapsulate the entire work area.

u. Conduct final visual inspection with PM.

5.3 Waste Disposal

a. Disposal bags shall be 6-mil polyethylene bags, or TDSHS approved equivalent, that are preprinted with labels as required by the applicable *Occupational Safety and Health Administration (OSHA) regulation* and *EPA NESHAPS Standard 40 CFR Part 61, Subpart M*. All asbestos waste shall be double-bagged and goose necked at the top to prevent fiber release.

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
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Expiration Date: March 28, 2021

b. The contractor shall take care to prevent asbestos material from clinging to the outside of the filled bags or containers. The bags shall be HEPA vacuumed and/or wet-wiped prior to leaving the work area.

c. The waste transporter shall have a TDSHS asbestos transporter license.

c. Authorized persons shall be protected by disposable clothing and a minimum of half-face respirator while loading asbestos waste.

e. The enclosed cargo area of the truck or dumpster shall be lined with 6-mil polyethylene sheeting to prevent contamination from leaking containers. Trucks and dumpsters shall have lockable enclosed cargo areas.

f. Waste containers shall not be thrown into or out of the truck cargo area or dumpster.

g. Asbestos waste shall be disposed of in an approved landfill according to current state requirements.

h. A proper manifest shall be required of all off-site asbestos shipments per *Texas Commission on Environmental Quality (TCEQ) regulations 21 TAC 335.10* and *EPA NESHAPS Standard 40 CFR Part 61, Subpart M.* The Owner shall be responsible for signing the waste manifest. PSI shall review the manifest prior to removal of waste from the site. PSI will not be responsible for signing the waste manifests.

i. A copy of the waste manifest shall be sent to PSI and the Owner upon completion of the project.

END OF SECTION 5.0

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
DSHS License No. 10-5652
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SECTION 6.0 – CLEAN-UP PROCEDURES

6.1 Work Area Clean-up

a. The work area and the decontamination area shall be thoroughly cleaned after all work is finished.

b. The area shall be cleaned with a HEPA vacuum and/or wet-wiped.

c. After vacuuming and/or wet-wiping, all of plastic sheeting shall be sprayed with an encapsulant and then disposed of as asbestos-waste.

d. Contractor shall remove all waste materials and equipment from the job site within 24 hours of project completion.

END OF SECTION 6.0

PREPARED BY: Steve Bohannon

Steve Bohannon
Individual Asbestos Consultant
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SECTION 7.0 - AIR MONITORING PLAN

7.1 General Procedures

Monitoring of airborne concentrations of asbestos fibers shall be in accordance with *TDSHS regulation 25 TAC 295.58 (i), OSHA regulation 29 CFR 1926.1101(f) and Appendices A and B, and EPA AHERA regulation 40 CFR 763.90 Subpart E,* and as specified in this plan.

7.2 Monitoring Prior to Abatement

Area monitoring shall be performed in the ACM work area prior to the abatement operations in order to establish the airborne asbestos fiber concentration in the work area prior to the commencement of removal operations. This result will establish an airborne fiber concentration in the work area during normal environmental conditions. A minimum of three samples shall be collected on 0.8 micron mixed cellulose ester (MCE) filters loaded in conducting cassettes with extension cowls. Sampling and analysis will be in accordance with the latest edition of NIOSH 7400 protocol, counting rules A. The minimum sample volume will be 1,250 liters. These samples may be analyzed or archived at the Consultant's discretion. The samples shall be preserved for not less than 60 days following achieving clearance.

7.3 Monitoring During Abatement

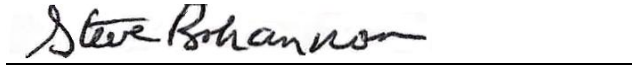
Area, environmental, and personal monitoring shall be performed to provide exposures to airborne fiber concentrations in the working environment. All area samples shall be referenced in the daily log.

7.3.1 Area and Environmental Sampling

Monitoring of the areas surrounding the abatement site shall be performed on a daily basis. Area samples shall be collected inside the abatement area (containment) and environmental samples shall be collected outside the containment. A minimum of two (2) general area samples shall be collected inside the abatement area and three (3) outside the containment. The outside samples shall be located at the negative air exhaust, in the immediate outside adjacent space and at the decontamination unit. The amount of air sampled shall be approximately 1250 liters per sample. Reduction in air sample volumes may be necessary based on work activities and time constraints. If air monitoring outside the abatement area shows air concentrations greater than the action level (0.01 fibers/cc Time Weighted Average), the contractor's supervisor will be immediately notified.

7.3.2 Personal Sampling

Monitoring of workers shall take place as required by *OSHA regulation 29 CFR 1910.1001* and *Texas Department of State Health Services regulations.* This type of monitoring shall be performed as required during different phases of the abatement process. A minimum of 240 liters of air shall be collected on these samples. Personal sampling is the responsibility of the contractor.

PREPARED BY: 

Steve Bohannon
Individual Asbestos Consultant
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7.4 Monitoring After Abatement

Clearance monitoring shall be conducted upon completion of the removal process and the visual walkthrough inspection by the contractor's supervisor and the Consultant, or the delegated Project Manager. A minimum of 1250 liters of air shall be collected for final clearance samples for jobs that can be cleared by PCM. These samples shall be below 0.01 fibers per cubic centimeters Time Weighted Average (TWA), or at the reference TWA. Clearance in schools will be conducted according to AHERA TEM procedures for all large jobs.

7.5 Air Sample Analysis

The air samples shall be analyzed in accordance with the NIOSH 7400 protocol, counting rules A using Phase Contrast Microscopy by an AAR certified laboratory. Collecting and analyzing baseline, area, and environmental samples, as well as inspecting the site, will be the responsibility of Professional Service Industries, Inc. (PSI), Three Burwood Lane, San Antonio, Texas. The laboratory results will be available within 24 hours after completion of the sampling.

Clearance sample analysis shall be performed in accordance with 40 CFR 763, Subpart E, Appendix A. A total of 13 samples will be analyzed by Transmission Electron Microscopy (TEM) and the sample results shall be less than 70 structures/$mm^{2.}$ to meet clearance criteria per AHERA.

END OF SECTION 7.0

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SECTION 8.0 - SUBMITTALS

8.1 Contractor's Construction Schedule

A. Before the start of work, the contractor shall provide a proposed detailed schedule including work dates, work shift time, number of employees, date of start and completion including dates of preparation work, removal and final inspection dates.

B. Submit the following to the Owner's representative for review of project coordination.

1. Contingency Plans for Emergency Action.
2. Telephone Numbers and Location of Emergency Services.
3. Notifications Sent to Emergency Service Agencies.
4. Resume of Supervisor.
5. Accreditation Training Certificate for Asbestos Abatement Supervisor.
6. Copy of Medical Examination for Asbestos Abatement Supervisor.
7. Texas DSHS License for Asbestos Abatement Supervisor.

C. Submittals related to Regulatory Requirements:

1. Notices: Submit notices required by federal, state and local regulations together with proof of timely transmittal to agency requiring the notice.

2. Permits: Submit copies of current valid permits required by state and local regulations.

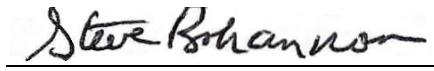
3. Licenses: Submit copies of all state and local licenses and permits necessary to carry out the work of this contract.

D. Before the start of work, submit the following to the Owner's representative for review:

1. Copies of certification from an EPA approved AHERA abatement workers course, Texas Department of State Health Services Asbestos Worker's registration and a current copy of medical examination for each worker.

E. At the completion of the project, submit two (2) copies of all the above referenced items to the Owner's representative as the project close-out documents.

END OF SECTION 8.0

PREPARED BY: 

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Individual Asbestos Consultant
DSHS License No. 10-5652
Expiration Date: March 28, 2021

APPENDICES

APPENDIX A

DRAWINGS

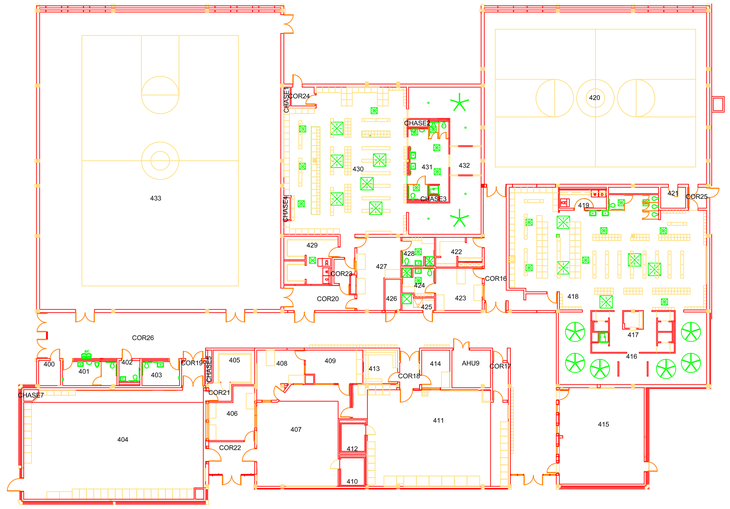
Scope of Work ACM Extents

Remove approximately 48 LF of white A/C ductwork mastic and 35 LF of white mastic from elbows and seams of pipe systems in AHU 3.

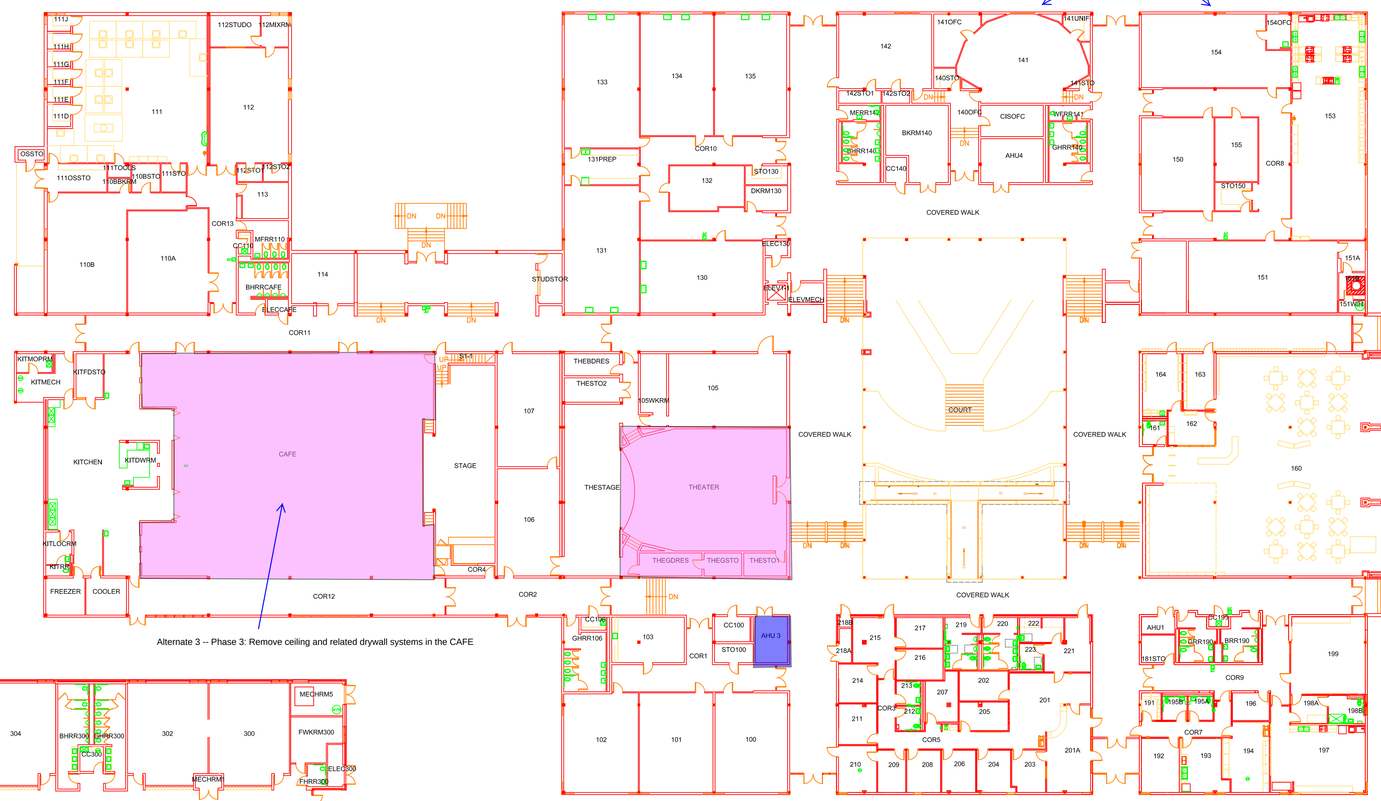
Remove approximately 200 SF of ACM drywall materials consisting of joint compound and texture within the 100 wings (Rooms 100-193), Room 236, Theater and Cafeteria. Removal areas will be spot abatements where the replacement of lighting in the Cafeteria, Classrooms, and Corridors with LED fixtures and emergency lighting --including the replacement of the ceiling grid and tiles--throughout the campus will impinge upon these materials. The areas of spot abatement will be determined by the District. Alternate No. 3 --Phase 3: Remove and install new ceiling in the Cafeteria may result in increased abatement of impacted drywall systems.

B

FLR--054B--01



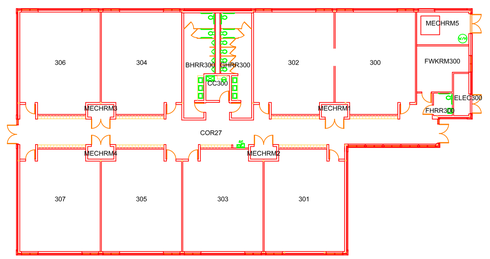
Spot abatements of drywall in the 100 Wing throughout (see above)



Alternate 3 -- Phase 3: Remove ceiling and related drywall systems in the CAFE

C

FLR--054C--01



A

FLR--054A--01

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL

6800 Bill Hughes Rd.
Austin, Texas

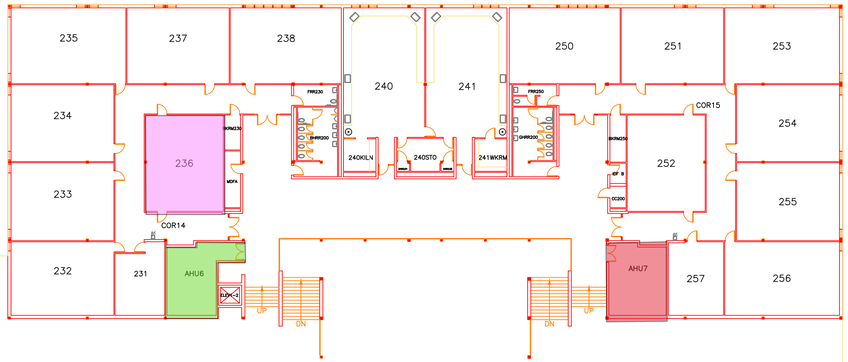
FLOOR PLAN
1ST FLOOR

APPROVALS		
DRAWN	CHECKED	APPROVED
J.R.		
02/11/19		
DWG: 054-FLR-01		SHEET
DRAWING SCALE		1 OF 2
1" = 30'-0"		

Scope of Work
Extents of Asbestos

Remove approximately 96 LF of ACM white A/C ductwork mastic and 60 LF of white mastic from elbows and seams of pipe systems in AHU 7

Remove approximately128 LF of ACM white A/C ductwork mastic and 63 LF of white mastic from elbows and seams of pipe systems in AHU 6



A

FLR-054A-02

AUSTIN I.S.D.

DEPARTMENT OF
CONSTRUCTION MANAGEMENT

BEDICHEK
MIDDLE
SCHOOL

6800 Bill Hughes Rd.
Austin, Texas

FLOOR PLAN
2ND FLOOR

APPROVALS		
DRAWN	CHECKED	APPROVED
J.R.		
02/03/18		
DWG: 054-FLR-02		SHEET
DRAWING SCALE		2 OF 2
1" = 30'		

B

FLR-054B-CS

B1-CRWL

CRAWL SPACE

CRAWL SPACE

CRAWL SPACE

OPEN
COURT

CRAWL SPACE

A1-CRWL

C

FLR-054C-CS

C1-CRWL

A

FLR-054A-CS

AUSTIN I.S.D.

DEPARTMENT OF
CONSTRUCTION MANAGEMENT

BEDICHEK
MIDDLE
SCHOOL

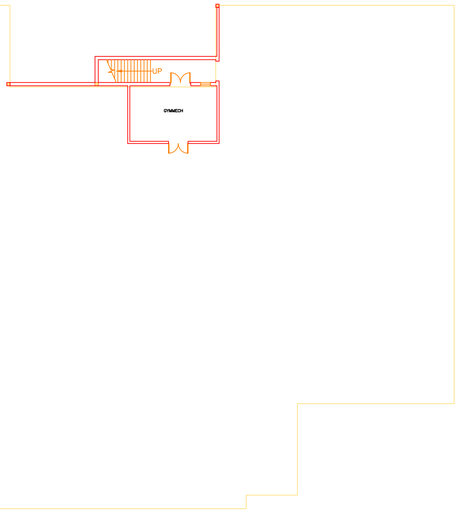
6800 Bill Hughes Rd.
Austin, Texas

CRAWLSPACE

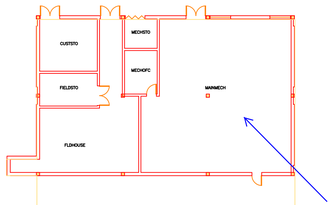
APPROVALS		
DRAWN	CHECKED	APPROVED
J.R.		
02/03/18		
DWG: 054-FLR-CS		SHEET
DRAWING SCALE		
1" = 30'		1 OF 1

B

FLR-054B-G1



See notes below for ACM removals in Building A crawlspace and exterior transite pipe riser associated with chillers.



Approx. location of ACM transite riser associated with exterior chillers.
Remove approx. 5 LF of transite pipe
(not to scale)

Alternate No. 4, Phase 4: Remove approximately 20 each of ACM gaskets associated with pipe systems and connections that will be impinged upon by the removal and replacement of two chillers and pumps.

Within the Bldg A Crawlspace. remove approximately 743 LF of asbestos containing pipe insulation and fittings with white mastic (the only ACM layer)on pipe risers and runs within the crawlspace under the original 1972 'A' Building. Alternate No. 6 - Phase 6

At the discretion of the District, the pipes may be enclosed in plastic prior to the concrete spalling and cracking structural repairs within the crawlspace. If this option is selected by the District, the contractor will enclose the pipes with plastic instead of removing the ACM pipe insulation.

Remove approximately 270 CF of asbestos-containing loose debris within the crawlspace under the original 1972 'A' Building. These debris have intermixed pipe insulation that has delaminated from the pipe systems within the crawlspace.

A

FLR-054A-G1

AUSTIN I.S.D.

DEPARTMENT OF
CONSTRUCTION MANAGEMENT

BEDICHEK
MIDDLE
SCHOOL

6800 Bill Hughes Rd.
Austin, Texas

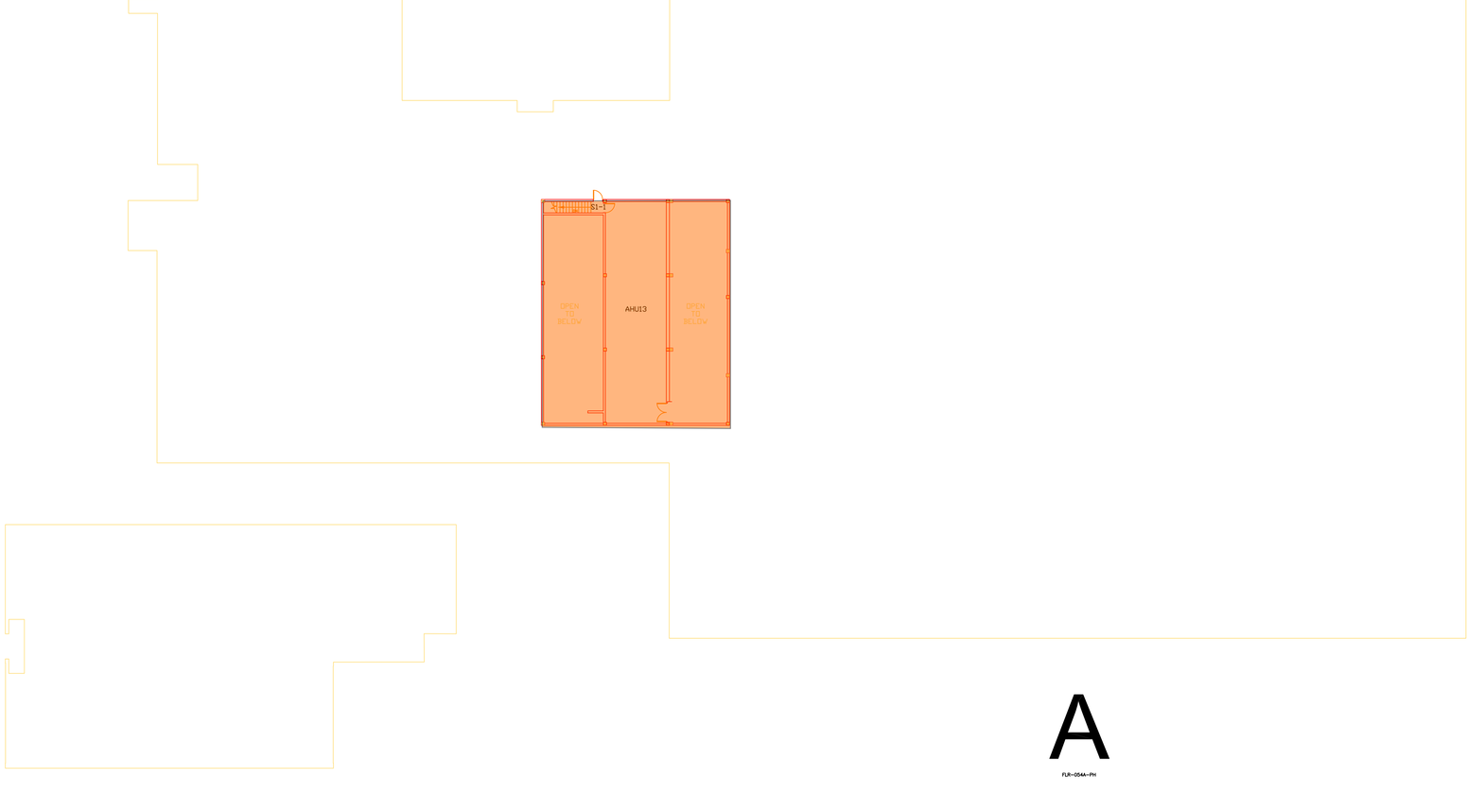
FLOOR PLAN
GROUND FLOOR

APPROVALS		
DRAWN	CHECKED	APPROVED
J.R.		
02/03/18		
DWG: 054-FLR-G1		SHEET
DRAWING SCALE		
1" = 30'		1OF 1

Scope of Work

Extents of Asbestos

Alternate No. 5 - Phase 5: Remove approximately 132 LF of ACM white A/C ductwork mastic and 67 LF of white mastic from elbows and seams of pipe systems in AHU 13 and AHU 14.



A

FLR-054A-PH

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL

6800 Bill Hughes Rd.
Austin, Texas

PENTHOUSE

APPROVALS		
DRAWN	CHECKED	APPROVED
J.R.		
02/03/18		
DWG: 054-FLR-PH		SHEET
DRAWING SCALE		
1" = 30'		10F 1

B

ROOF-054B

B-01
B-11
B-03
B-04
B-02
B-12
B-05
B-14
B-06
B-15
B-16
B-13
B-07
B-08
B-09
B-10

A-01
A-02
A-03
A-04

A-16
A-15
A-17
A-14
A-13
A-10
OPEN
A-05
A-06
A-12
A-11
A-07
A-18
C-01
C-02
C-04
C-03
A-09
A-08

C

ROOF-054C

A

ROOF-054A

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL

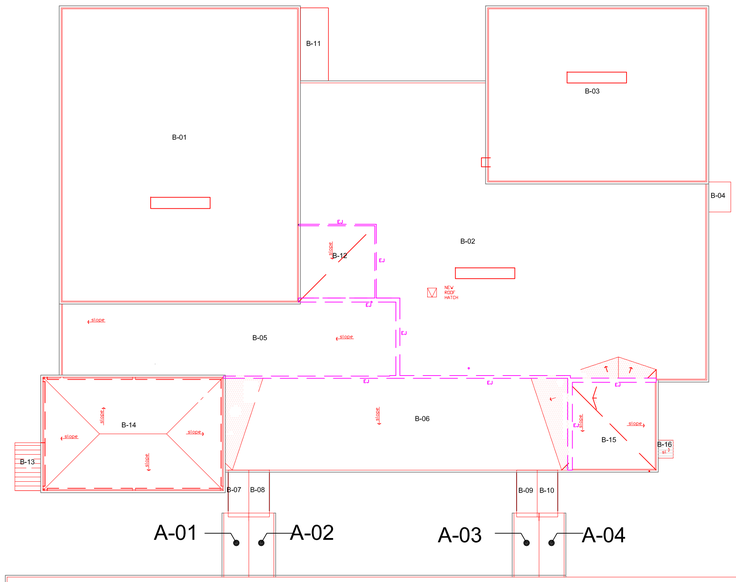
6800 Bill Hughes Rd.
Austin, Texas

ROOF PLAN

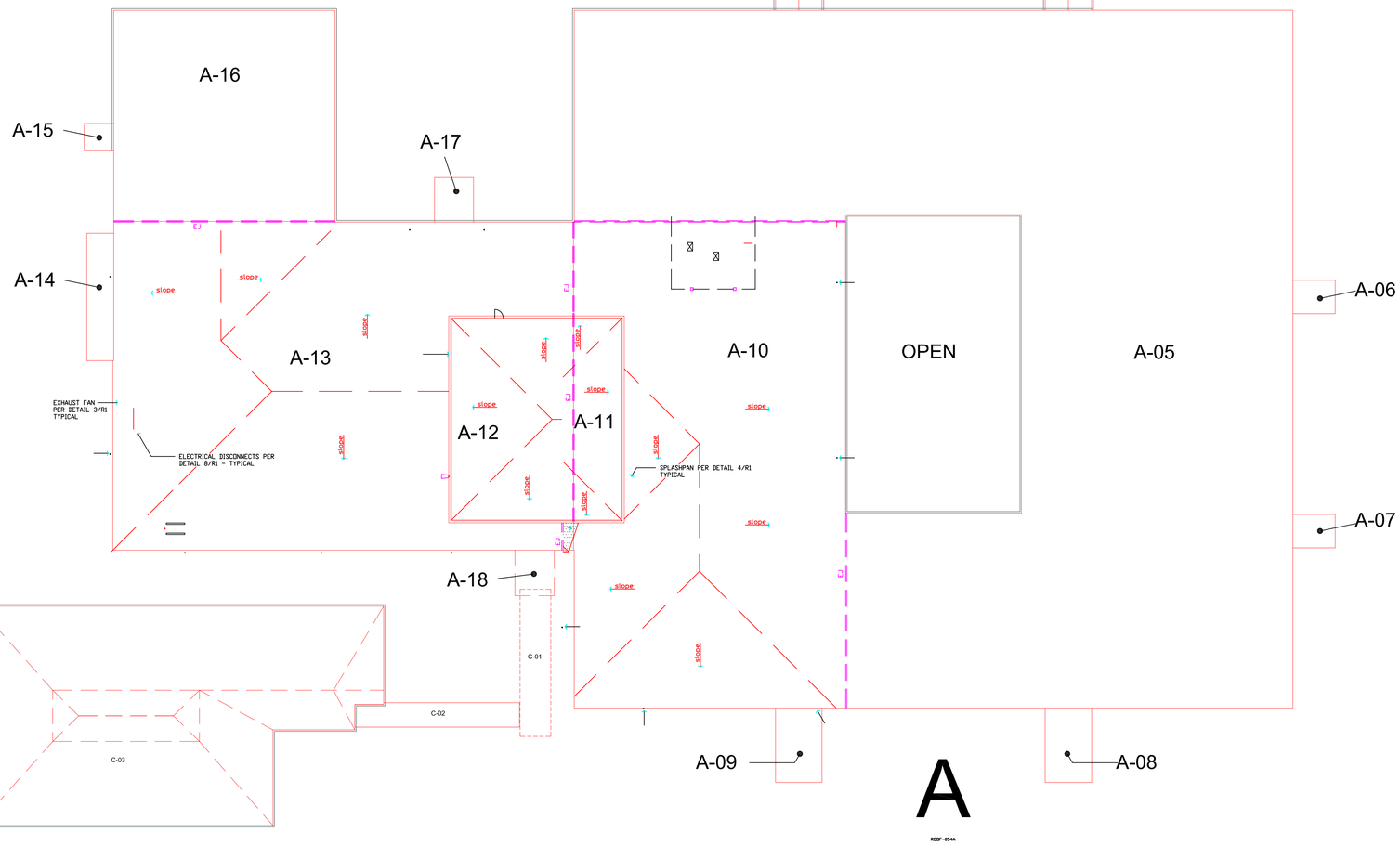
APPROVALS		
DRAWN	CHECKED	APPROVED
J.R.		
05/10/12		
DWG: 054-FLR-RF		SHEET
DRAWING SCALE		1 OF 1
1/32"=1'-0"		

B

ROOF-054B



A-01 A-02 A-03 A-04



C

ROOF-054C

A

ROOF-054A

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL

6800 Bill Hughes Rd.
Austin, Texas

ROOF PLAN

APPROVALS		
DRAWN	CHECKED	APPROVED
J.R.		
05/10/14		
DWG: 054-FLR-RF		SHEET
DRAWING SCALE		10F 1
1/8"= 30'		

APPENDIX B

LICENSES

Texas Department of State Health Services

Asbestos Individual Consultant

STEVEN L BOHANNON
License No. 105652
Control No. 97473
Expiration Date: 28-Mar-2021

Texas Department of State Health Services

Asbestos Project Manager

JASON G TIDWELL

License No. 501673

Control No. 98217

Expiration Date: 3-May-2021

Texas Department of State Health Services

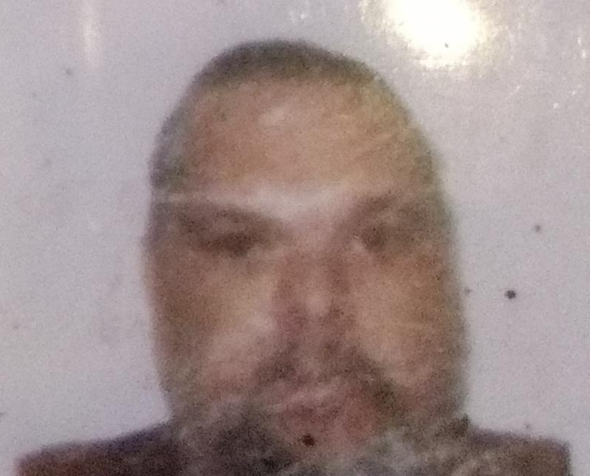
Asbestos Air Monitoring Technician

JASON G TIDWELL

License No. 706813

Control No. 98394

Expiration Date: 20-May-2021



Texas Department of State Health Services

Asbestos Project Manager

JOE LEAL

License No. 500822

Control No. 97914

Expiration Date: 4/13/2020

Texas Department of State Health Services

PROFESSIONAL SERVICE INDUSTRIES, INC

is certified to perform as an

Asbestos Laboratory

PCM, PLM, TEM

in the State of Texas and is hereby governed by the rights, privileges and responsibilities set forth in Texas Occupations Code, Chapter 1954 and Title 12, Texas Administrative Code, Chapter 295 relating to Texas Asbestos Health Protection, as long as this license is not suspended or revoked.

License Number: 300047

Expiration Date: 06/10/2021

John Hellerstedt, M.D.,
Commissioner of Health

Control Number: 96380

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

SEE BACK

TEXAS DEPARTMENT OF STATE HEALTH SERVICES

PROFESSIONAL SERVICE INDUSTRIES INC

is certified to perform as a

Asbestos Consultant Agency

in the State of Texas within the purview of Texas Occupations Code, chapter 1954, so long as this license is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

John Hellerstedt, M.D.
Commissioner of Health

License Number: 100047

Control Number: 97080

Expiration Date: 3/19/2020

(Void After Expiration Date)

VOID IF ALTERED NON-TRANSFERABLE

APPENDIX B

SUPPLEMENTAL INFORMATION

THREE YEAR REINSPECTION PROJECT DIRECTORY

School Name:

BEDICHEK MIDDLE SCHOOL (054)
6800 Bill Hughes Road
Austin, Texas 78745

Prepared by:

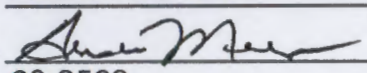
AUSTIN INDEPENDENT SCHOOL DISTRICT
Service Center
5101 East 51st Street
Austin, Texas 78723-6199
Mr. Louis Zachary, LEA Designation Person
(512) 414-3299

Andrew Mendoza
Asbestos Inspector
License Number 60-2568

Chris Papick
Asbestos Management Planner
License Number 205594

INVENTORY OF ACBM

Description: **Floor Tile**

Date: December 5, 2018
School Name/Code: Bedichek Middle School (054)
Inspector's Name: Andrew Mendoza
Inspector's Signature: 
Inspector's License #: 60-2568

Description/Location (Floor Tile 054)	Homogeneous Area	Total (Sq. Ft.)	Comments	Condition	Response Action
100	F09	768 SF		Good	7
101	F09	768 SF		Good	7
102	F09	768 SF		Good	7
103	F09	360 SF		Good	7
105	F09	931 SF		Good	7
106	F09	701 SF		Good	7
107	F09	716 SF		Good	7
112	F17	988 SF	Carpet Overlay	Unknown	7
113	F09	174 SF		Good	7
130	F09	880.75 SF		Good	7
131	F09	935.75 SF		Good	7
132	F09	362.5 SF		Good	7
133	F09	976 SF		Good	7
134	F14	955.5 SF		Good	7
135	F14	897 SF		Good	7
141	F09	500 SF		Good	7
141	F17	396 SF		Good	7
142	F09	741 SF		Good	7
150	F09	373 SF		Good	7
151	F17	1,104 SF		Good	7

153	F21	1,140 SF	**New Construction Need to Sample.**	Good	7
154	F09	1,044 SF		Good	7
155	F09	290 SF		Good	7
156	F09	373.5 SF		Good	7
190	F09	544 SF	**New Construction Need to Sample.**	Good	7
191	F09	535 Sf	**New Construction Need to Sample.**	Good	7
192	F09	779 SF	**New Construction Need to Sample.**	Good	7
193	F09	288 SF	**New Construction Need to Sample.**	Good	7
194	F09	288 SF	**New Construction Need to Sample.**	Good	7
230	F09	301 SF		Good	7
231	F09	263 SF		Good	7
232	F09	736 SF		Good	7
233	F09	780 SF		Good	7
234	F09	800 SF		Good	7
235	F09	828 SF		Good	7
236	F09	360 SF		Good	7
237	F09	724.5 SF		Good	7
238	F09	840 SF		Good	7
241	F14	1,040 SF		Good	7
250	F09	833 SF		Good	7
251	F09	756 SF		Good	7
252	F09	360 SF		Good	7
253	F09	846 SF		Good	7
254	F09	768 SF		Good	7
255	F09	768 SF		Good	7

256	F09	846 Sf		Good	7
257	F09	373 SF		Good	7
258	F09	360 SF		Good	7
110A	F17	837.5 SF	Carpet Overlay	Unknown	7
110B	F17	988 SF		Good	7
112MIXRM	F17	110.25 SF	Carpet Overlay	Unknown	7
112STUDO	F17	150 SF	Carpet Overlay	Unknown	7
140STO/140B	F09	58.5 SF		Good	7
141OFC	F09	232.5 SF		Good	7
141STO	F09	20 SF		Good	7
141UNIF	F09	64 SF		Good	7
142STO1	F09	60.75 SF		Good	7
142STO2	F09	38.25 SF		Good	7
151OFC	F09	144 SF		Good	7
154OFC	F09	96 SF		Good	7
190KIT	F09	119 SF	**New Construction Need to Sample.**	Good	7
190STO	F09	72 SF	**New Construction Need to Sample.**	Good	7
191WKRM	F09	116 SF	**New Construction Need to Sample.**	Good	7
240STO	F09	346 SF		Good	7
241WKRM	F14	100 SF		Good	7
ADMCOPY	F09	58.5 SF	**New Construction Need to Sample.**	Good	7
ADMIN	F09	259 SF	**New Construction Need to Sample.**	Good	7
ADMIN/C14	F09	924 SF	**New Construction Need to Sample.**	Unknown	7
ADMIN1	F09	168 SF	**New Construction Need to Sample.**	Unknown	7

ADMIN2	F09	174 SF	**New Construction Need to Sample.**	Unknown	7
ADMIN3	F09	97.75 SF	**New Construction Need to Sample.**	Unknown	7
ADMIN4	F09	68 SF	**New Construction Need to Sample.**	Unknown	7
ADMIN5	F09	84 SF	**New Construction Need to Sample.**	Unknown	7
ADMIN6	F09	97.5 SF	**New Construction Need to Sample.**	Unknown	7
ADMIN7	F09	72.25 SF	**New Construction Need to Sample.**	Unknown	7
ADMIN8	F09	97.5 SF	**New Construction Need to Sample.**	Unknown	7
ADMIN9	F09	162 SF	**New Construction Need to Sample.**	Unknown	7
ADMSTO2	F09	8.5 SF	**New Construction Need to Sample.**	Good	7
ADMSTO3	F09	8 SF	**New Construction Need to Sample.**	Good	7
BKRM140	F09	423 SF		Good	7
BKRM230	F09	66 SF		Good	7
BKRM250	F09	90 SF		Good	7
C1-1/100 Wing	F09	431 SF		Good	7
C1-2/230 Wing	F09	861 SF		Good	7
C2-2/250 Wing	F09	829.5 SF		Good	7
C3/150 Wing	F09	753 SF		Good	7
C4/190 Wing	F09	406 SF	**New Construction Need to Sample.**	Good	7
C5/130 Wing	F09	691 SF		Good	7

C7/East Side inside Café	F14	636 SF		Good	7
Cafeteria Stage Entrance Left Side	F14	27 SF		Good	7
Cafeteria Stage Entrance Right Side	F14	69 SF		Good	7
CISOFC	F09	190 SF		Good	7
C11/Counselor's Waiting Area	F09	275.5 SF	**New Construction Need to Sample.**	Good	7
DKRM130	F09	117 SF		Good	7
C13/Hallway Between Main Office and Counselor's Area	F09	54 SF	**New Construction Need to Sample.**	Good	7
C15/Hallway Entrance to Nurse's Office	F09	32 SF	**New Construction Need to Sample.**	Good	7
Hallway to Boy's Dressing Room in Theatre	F09	105 SF		Good	7
C9/Hallway to Classrooms 110A-113	F09	478 SF		Good	7
Hallway to Girl's Dressing Room in Theatre	F09	44 SF		Good	7
LOUNGE	F09	97.75 SF	**New Construction Need to Sample.**	Unknown	7
NURSE	F09	312 SF	**New Construction Need to Sample.**	Good	7
C12/Open Area in Attendance Clerk and Interpreter Office Area	F09	145 SF	**New Construction Need to Sample.**	Good	7
Outer Edge of C1-1/100 Wing	F10	105.0 SF		Good	7

Outer Edge of C1-2/230 Wing	F10	255 SF		Good	7
Outer Edge of C2-2/250 Wing	F10	241 SF		Good	7
Outer Edge of C3/150 Wing	F10	241 SF		Good	7
Outer Edge of C4/190 Wing	F18	119 SF	**New Construction Need to Sample.**	Good	7
Outer Edge of C5/130 Wing	F18	220 SF		Good	7
STO100	F09	91 SF		Good	7
131PREP	F09	288 SF		Good	7
STO130	F09	91 SF		Good	7
STO150	F09	108 SF		Good	7
Storage Closet back of Theatre	F09	112 SF		Good	7
THEATER	F11	1,574 SF		Good	7
THEBDRES	F09	133 SF		Good	7
THEGDRES	F09	266 SF		Good	7
Top of Steps in Hallway to Boy's Dressing Room in Theatre	F13	10 SF		Good	7
C10	F09	689 SF		Good	7
VAULT	F09	81 SF	**New Construction Need to Sample.**	Good	7

Response Action 7: e known to all maintenace and custodial personnel who will monitor this non-friable ACM. If removal is required, it will be removed by trained personnel.

INVENTORY OF ACBM (TSI)

Description: **TSI - Mastic (white)**

Date: December 5, 2018
School Name/Code: Bedichek Middle School (054)
Inspector's Name: Andrew Mendoza
Inspector's Signature:
Inspector's License #: 60-2568

Description/Location (054)	Homogeneous Area	Total (Sq. Ft.)	Comments	Condition	Response Action
Boiler #1 and Boiler #2 Main Eguipment Room and Gym Crawlspace - TSI with White Mastic	N/A T005 and T006	275 SF	**New Construction Need to Sample.**	Fair	7
Gym Crawlspace - Hot Water Storage Tank	N/A		**New Construction Need to Sample.**	Fair	7
AHU3	M22	48 LF	A/C Ductwork Mastic (white)	Fair	7
AHU4	M22	48 LF	**New Construction Need to Sample.**	Fair	7
AHU5	M22	80 LF	**New Construction Need to Sample.**	Fair	7
AHU6	M22	128 LF	A/C Ductwork Mastic (white)	Fair	7
AHU7	M22	96 LF	A/C Ductwork Mastic (white)	Fair	7
AHU13	M22	132 LF	A/C Ductwork Mastic (white)	Fair	7

AHU14	M22	132 LF	A/C Ductwork Mastic (white)	Fair	7
AHU3	T01	35 LF	Mastic (white) on Elbows and Seams	Fair	7
AHU4	T01	49 LF	Mastic (white) on Elbows and Seams	Fair	7
AHU5	T01	55 LF	Mastic (white) on Elbows and Seams	Fair	7
AHU6	T01	63 LF	Mastic (white) on Elbows and Seams	Fair	7
AHU7	T01	60 LF	Mastic (white) on Elbows and Seams	Fair	7
AHU13	T01	52 LF	Mastic (white) Café Mezz	Fair	7
AHU14	T01	67 LF	Mastic (white) Café Mezz	Fair	7
Crawlspace	T04	743 LF	Insulation falling off pipe into plastic wrap, sagging in places and falling on ground. Pipe Insulation Mastic (white) on chilled water supply and return lines.	Poor	7

Response Action 7: Location of this material will be made known to all maintenance and custodial personnel who will monitor this non-friable ACM. If removal is required, it will be removed by trained personnel

INVENTORY OF ACBM (Miscellanceous other than Floor Tile)

Description: **Miscellaneous ACBM**

Date: December 5, 2018
School Name/Code: Bedichek Middle School (054)
Inspector's Name: Andrew Mendoza
Inspector's Signature:
Inspector's License #: 60-2568

Description/Location Misc. (054)	Homogeneous Area	Total (Sq. Ft.)	Comments	Condition	Response Action
100	NA	60 SF	(2) - Brown Slate Chalk Boards covered with white boards	Good	7
102	NA	120 SF	(4) - Brown Slate Chalk Boards	Good	7
103	M03	1.5 SF	Sink Coating (pink)	Good	7
105	NA	120 SF	(4) - Brown Slate Chalk Boards	Good	7
110B	NA	40 SF	teachers roll a-way desk w/black slate desk top	Fair	7
111	NA	120 SF	**New Construction Need to Sample.**	Good	7
130	M03	3 SF	Sink Coating (pink)	Good	7
130	M09	112 SF	6 Work tables and 1 teacher's desk with sink. Table Tops, sinks and counters (black slate)	Fair	7

130	NA	60 SF	(2) - Brown Slate Chalk Boards	Good	7
131	M09	118	6 Work tables and 1 teacher's desk with sink. Table Tops, sinks and counters (black slate)	Fair	7
131	NA	60 SF	(2) - Brown Slate Chalk Boards	Good	7
132	NA	60 SF	(2) - Brown Slate Chalk Boards painted green	Good	7
133	M03	3 SF	**New Construction Need to Sample.**	Good	7
133	M09	153 SF	2 black slate tables, 6 work table tops,1 teacher's desk	Fair	7
134	M09	13 SF	1 black Slate Teacher's Desk. Black Slate Desk Top 1 brown slate chalkboard covered with white board	Fair	7
135	M09	13 SF	3 black Slate tables Teacher's Desk. Black Slate Desk Top	Fair	7
141	NA	60 SF	(2) - Brown Slate Chalk Boards	Good	7
142	N/A		3 brown slate chalkboards	Good	7

153	NA	30 SF	**New Construction Need to Sample.**	Fair	7
154OFC	M27	12 LF	Brown Cove base with Black Mastic	Fair	7
190	NA	60 SF	**New Construction Need to Sample.**	Good	7
191	NA	60 SF	**New Construction Need to Sample.**	Good	7
192	NA	120 SF	**New Construction Need to Sample.**	Good	7
193	NA	60 SF	**New Construction Need to Sample.**	Good	7
194	NA	60 SF	**New Construction Need to Sample.**	Good	7
232	NA	210 SF	(7) - Brown Slate Chalk Boards	Good	7
233	NA	120 SF	(4) - Brown Slate Chalk Boards	Good	7
234	NA	120 SF	(4) - Brown Slate Chalk Boards	Good	7
235	M09	186 SF	1 table, counter around classroom. sinks and counters (black slate)	Fair	7
237	M09	186 SF	counter around classroom and roll away teachers desk	Fair	7
238	M09	240 SF	counter around room - Table Tops (black slate)	Fair	7
240	NA	60 SF	6 (black slate tables)	Fair	7

241	NA	240 SF	7 (black slate tables) 1 roll away teacher's desk	Fair	7
241STO	NA	240 SF	Counter w/Black Slate Counter Top	Fair	7
250	NA	60 SF	(2) - Brown Slate Chalk Boards	Good	7
251	NA	120 SF	(4) - Brown Slate Chalk Boards covered with white boards	Good	7
252	NA	60 SF	(2) - Brown Slate Chalk Boards	Good	7
253	NA	120 SF	White boards over chalkboards. (4) - Brown Slate Chalk Boards	Good	7
254	NA	120 SF	(4) - Brown Slate Chalk Boards	Good	7
255	NA	120 SF	(4) - Brown Slate Chalk Boards	Good	7
258	NA	120 SF	White board over portion of chalkboard. (4) - Brown Slate Chalk Boards	Good	7
110A	NA	90 SF	Two Boards covered with White Boards. (3) - Brown Slate Chalk Boards	Good	7
131PREP	M03	3 SF	Sink Coating (pink)	Good	7

191WKRM	M03	1.5 SF	**New Construction Need to Sample.**	Good	7
DKRM130	M03	3 SF	Sink Coating (pink)	Good	7
LIBWKRM	M03	1.5 SF	**New Construction Need to Sample.**	Good	7
Lounge	M03	1.5 SF	**New Construction Need to Sample.**	Good	7
Nurse	M03	1.5 SF	**New Construction Need to Sample.**	Good	7
THEBDRES	M03	2 SF	Sink Coating (pink)	Good	7
THEGDRES	M03	2 SF	Sink Coating (pink)	Good	7
Transite moisture barrier around school	N/A		Not able to see barrier	Poor	7
Black Vapor Barrier Mastic located behind Exterior Brick	M035		Not able to see barrier	Unknown	7
Transite panels under window and above door - all entrances to Bldg. And around entire Bldg.	M06	2,134 SF		Good	7

Response Action 7: Location of this material will be made known to all maintenance and custodial personnel who will monitor this non-friable ACM. If removal is required, it will be removed by trained personnel.

INVENTORY OF ACBM

Description: **Surfacing**

Date: December 5, 2018
School Name/Code: Bedichek Middle School (054)
Inspector's Name: Andrew Mendoza
Inspector's Signature:
Inspector's License #: 60-2568

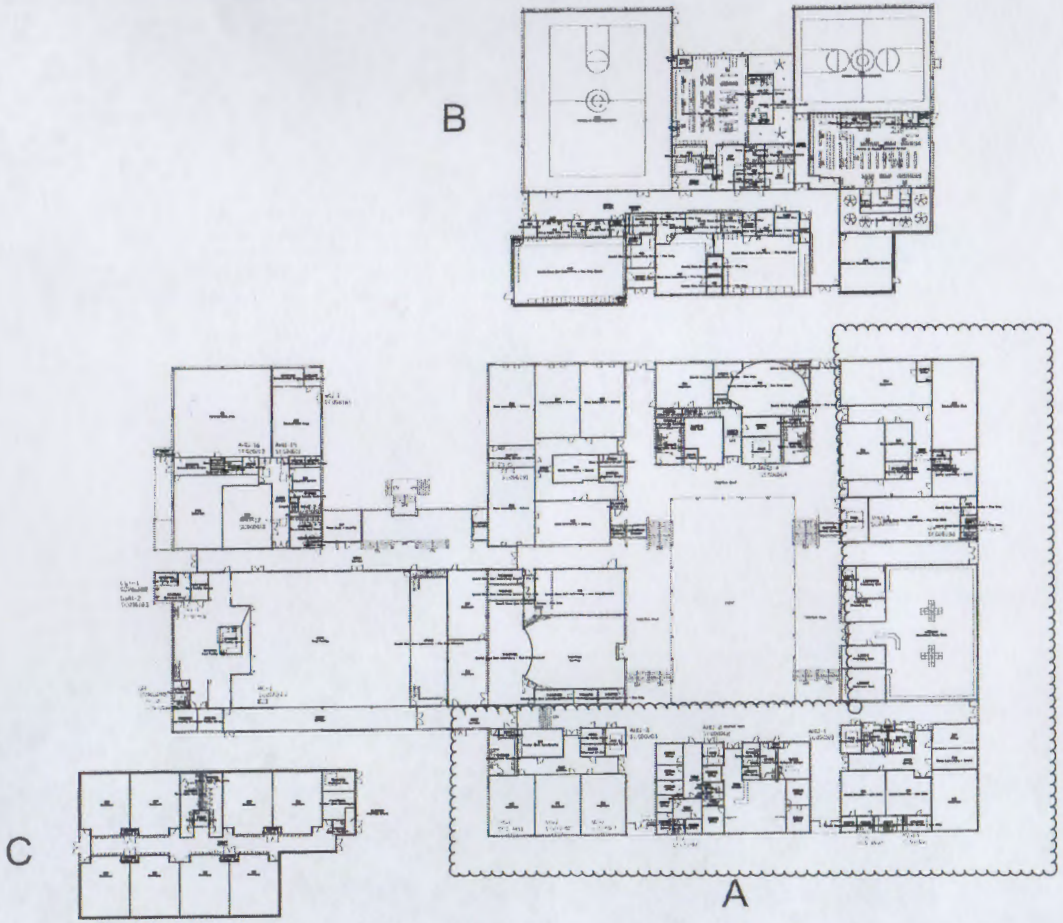
Description/Location Surfacing (054)	Homogeneous Area	Total (Sq. Ft.)	Comments	Condition	Response Action
100	M30/M31		Wall Texture and Joint Compound	Good	7
101	M30/M31		Wall Texture and Joint Compound	Good	7
130	M30/M31		Wall Texture and Joint Compound	Good	7
131	M30/M31		Wall Texture and Joint Compound	Good	7
134	M30/M31		Wall Texture and Joint Compound	Good	7
135	M30/M31		Wall Texture and Joint Compound	Good	7
150	W25		Wall Texture and Joint Compound	Fair	7
150STO	W25		Wall Texture and Joint Compound	Fair	7
151	W25/M30/M31		Wall Texture and Joint Compound	Fair	7

151OFC	W25		Wall Texture and Joint Compound	Fair	7
152	W25		**New Construction Need to Sample.**	Fair	7
152STO	W25		**New Construction Need to Sample.**	Fair	7
152CLO	W25		**New Construction Need to Sample.**	Fair	7
153	W24		**New Construction Need to Sample.**	Fair	7
154	W25		**New Construction Need to Sample.**	Fair	7
154OFC	W25		**New Construction Need to Sample.**	Fair	7
155	W25		Wall Texture and Joint Compound	Fair	7
C3/150 Wing	W25		Wall Texture and Joint Compound	Fair	7
190 Wall Texture (Medium) White in color	W13	250 sq.ft.	**New Construction Need to Sample.**	Good	7
191 Wall Texture (Medium) White in color	W13	524 sq.ft.	**New Construction Need to Sample.**	Good	7
192 Wall Texture (Medium) White in color	W13	510 sq.ft.	**New Construction Need to Sample.**	Good	7
193 Wall Texture (Medium) White in color	W13	320 sq.ft.	**New Construction Need to Sample.**	Good	7
190KIT Wall Texture (Medium) White in color	W13	93 sq.ft.	**New Construction Need to Sample.**	Good	7

236 Wall Texture (Medium) White in color	W13	1,080 SF	Color is white - Shadows make paint seem grey. North Wall has been painted lime Green	Good	7
Theatre Wall Texture (Medium) White in color	W13	1,760 SF	Color is white - Shadows make paint seem grey. Posters stapled/taped onto wall above theater seating area	Good	7
Cafeteria Wall Texture (Medium) White in color	W13	1,005 SF	Color is white - Shadows make paint seem grey. Posters screwed into wall above café eating area.	Good	7

Response Action 7: Location of this material will be made known to all maintenance and custodial personnel who will monitor this non-friable ACM. If removal is required, it will be removed by trained personnel.

Bedichek Middle School 11/18/2015



AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL

6800 Dll Hughes Road
Austin, Texas

FLOOR PLAN 1ST FLOOR

DRAWN	CHECKED	APPROVED
SLB	MH	S.M.
03/07/13	03/07/13	03/07/13
DWG: 154-FLR-01		SHEET
DRAWING SCALE: 1" = 16'		2 OF 4

1. G. ASSESSMENT OF MATERIALS SAMPLED DURING RE-INSPECTION

The following suspect materials were sampled during this re-inspection.

A. Carpet mastics (2) located throughout the campus in carpeted areas.

All of these materials were found to be Non-ACBM.

B. Floor tiles/mastics (5) located throughout the campus.

All of these materials were found to be Non-ACBM.

C. Rolled flooring located in the faculty visitor restroom.

This material was found to be Non-ACBM.

D. Cove bases/mastics (4) located throughout the campus.

All of these materials were found to be Non-ACBM.

E. Wall/ceiling Textures/plasters/coverings (26) located throughout the campus.

Of all these materials, one (1) wall texture was found to be ACBM. This texture is located in the theater, cafeteria and rooms 190, 191, 192, 193, 194, 236. All other textures/plasters/coverings were found to be Non-ACBM.

F. Sink Coatings (3) located throughout the campus.

Of these materials, (2) were found to be ACBM. A (pink) coating located in the library, nurse's office, theater dressing rooms, and rooms 103, 130, 131, 133, 191, and 240. And a (gray) coating located in rooms 134, 135 and 241.

G. Stage/dividing curtains located in the Theatre, Cafeteria and some 100-wing classrooms.

All of these materials were found to be Non-ACBM.

H. Table tops, sinks and countertops (black slate) located rooms 130, 131, 133, 235, 237 and 238.

All of these materials were found to be ACBM.

I. Wall panels (under windows and above doors) at all entrances and throughout campus.

This material was found to be ACBM.

J. Sound panels located in the Band Hall #1.

This material was found to be Non-ACBM.

K. Window and Door Caulking located throughout the campus.

All of these materials were found to be Non-ACBM.

L. Thermal systems mastics (2) located throughout the campus.
Of these materials, one (1) was found to be ACBM. This mastic (white) is located on HVAC ducts in Gym, Gym basement and air handling units (AHU's) #1, 2, 3, 4, 5, 6, 7, 8, 9.

M. Thermal system insulation covering located in the main equipment room on boiler flues for boilers #1 & #2. Also found in gym basement boiler room on boiler # flue and the hot water storage tank. hot water storage tank.

This material was found to be ACBM.

N. Ceiling tiles (2x4) located in the main hallway, classrooms 300, 301, 302, 303, 304, 305, 306, 307.

These materials were found to be Non-ACBM.

See Section 2.B. of this report for the sampled material descriptions, sample locations, PLM Laboratory Analyses Results and Sample Location Map.

BUILDING DESCRIPTION

School or Building Bedichek Number 054 Date April 23, 1988

Addition or Portable No. Original Date built 1972 Phases

Address 6800 Bill Hughes Road (Street) Austin (City) TX (State) 78745 (Zip) Phone

Location

Size

Square Feet		Ceiling Height		Distance	
Main Bldg.	133527	Hall		Between decks	
Addition		Atrium		Between columns	
		Room		Crawl space	
				To roof	

Description/notes:

Construction

Roof		Outside Wall		Inside Wall		Floor		Ceiling	
Tar and felt	X	Concrete		Plaster		Cement	X	Lath/plaster	X
Shingle		Block	X	Brick		Wood		Dry Wall	
Metal		Brick	X	Dry-Wall	X	Terrazzo		Tile Size	2'x4'
Other		Metal	X	Metal		Other		Lights	
		Stone		Block	X	Tile Size	12 x 12	Other	Mina-board
		Other		Other	Paneling	Carpet			

Shape of Deck		Deck		Column		Description & notes:
Flat	X	Cement		I-beam		
Dome		Metal	X	Concrete	X	
Corrugated		Wood		Bar Joists	X	
Barrel		Gyp		Wood		
Other		Other	Petiole	Other		

Mechanical

Heating				Cooling			
Types		Suspect		Types		Suspect	
Individual		Tanks		Individual		Compressor	
Heat Pumps		Flues	X	Heat Pumps		Re-circ pumps	
Boiler	X	AHU		Central	X	Vibration gasket	
Steam		Runs				Expansion tank	
FF		Re-circ pmp				Cooling tower	
Elect.	X	Radiators				Ductwork	
Water		EJT				AHU	

Description & quantities
Main Building has 840 sq. ft. of flues and 56 sq. ft. on gym boiler.

Description & quantities
Potable Water – FF – Flue – Storage Tank.
Gym shower boiler and storage tank have 246 sq. ft.

Comments/diagrams:

BUILDING DESCRIPTION

School or Building Bedichek Number 054 Date August 30, 2001

Addition or Portable No. Addition Date built 1999 Phases

Address 6800 Bill Hughes Road (Street) Austin (City) TX (State) 78745 (Zip) Phone

Location

Size

Square Feet		Ceiling Height		Distance	
Main Bldg.		Hall		Between decks	
Addition	10,315	Atrium		Between columns	
		Room		Crawl space	
				To roof	

Description/notes: This construction added 8 classrooms.

Construction

Roof		Outside Wall		Inside Wall		Floor		Ceiling	
Tar and felt		Concrete		Plaster		Cement		Lath/plaster	
Shingle		Block		Brick		Wood		Dry Wall	
Metal		Brick		Dry-Wall		Terrazzo		Tile Size	
Other		Metal		Metal		Other		Lights	
		Stone		Block		Tile Size		Other	
		Other		Other		Carpet			

Shape of Deck		Deck		Column		Description & notes:
Flat		Cement		I-beam		
Dome		Metal		Concrete		
Corrugated		Wood		Bar Joists		
Barrel		Gyp		Wood		
Other		Other		Other		

Mechanical

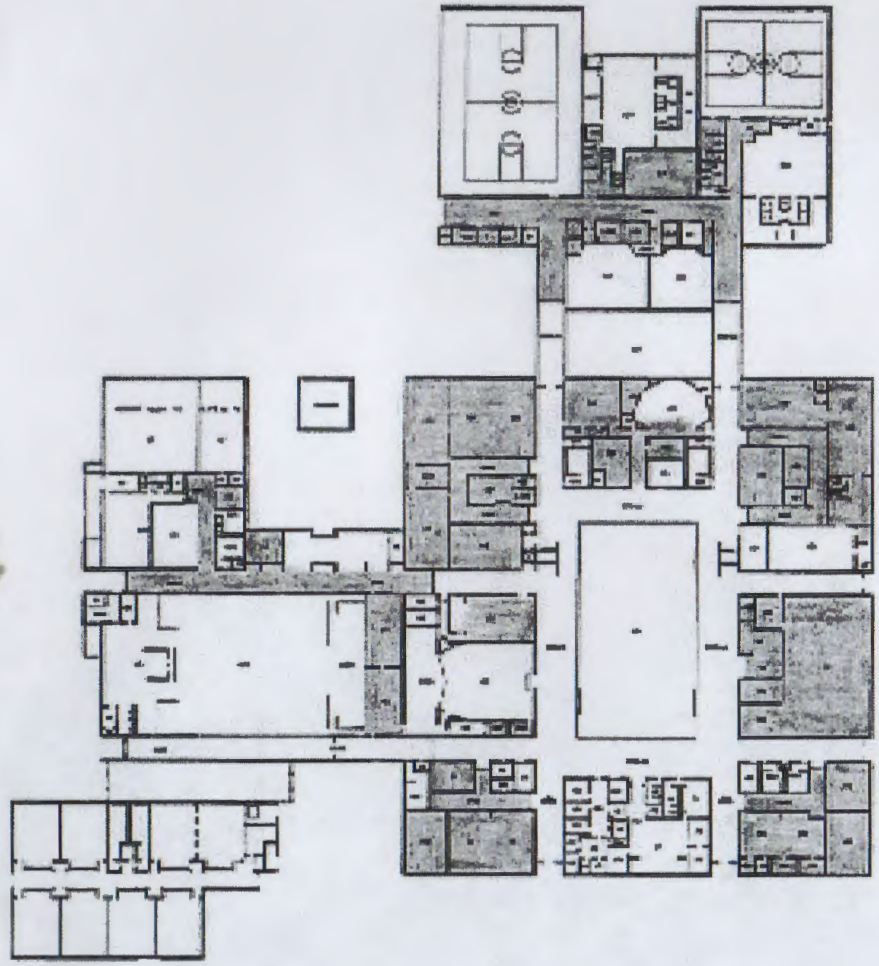
Heating				Cooling			
Types		Suspect		Types		Suspect	
Individual		Tanks		Individual		Compressor	
Heat Pumps		Flues		Heat Pumps		Re-circ pumps	
Boiler		AHU		Central		Vibration gasket	
Steam		Runs				Expansion tank	
FF		Re-circ pmp				Cooling tower	
Elect.		Radiators				Ductwork	
Water		EJT				AHU	
Description & quantities						Description & quantities	

Comments/diagrams:

Bedichek Middle School (054)

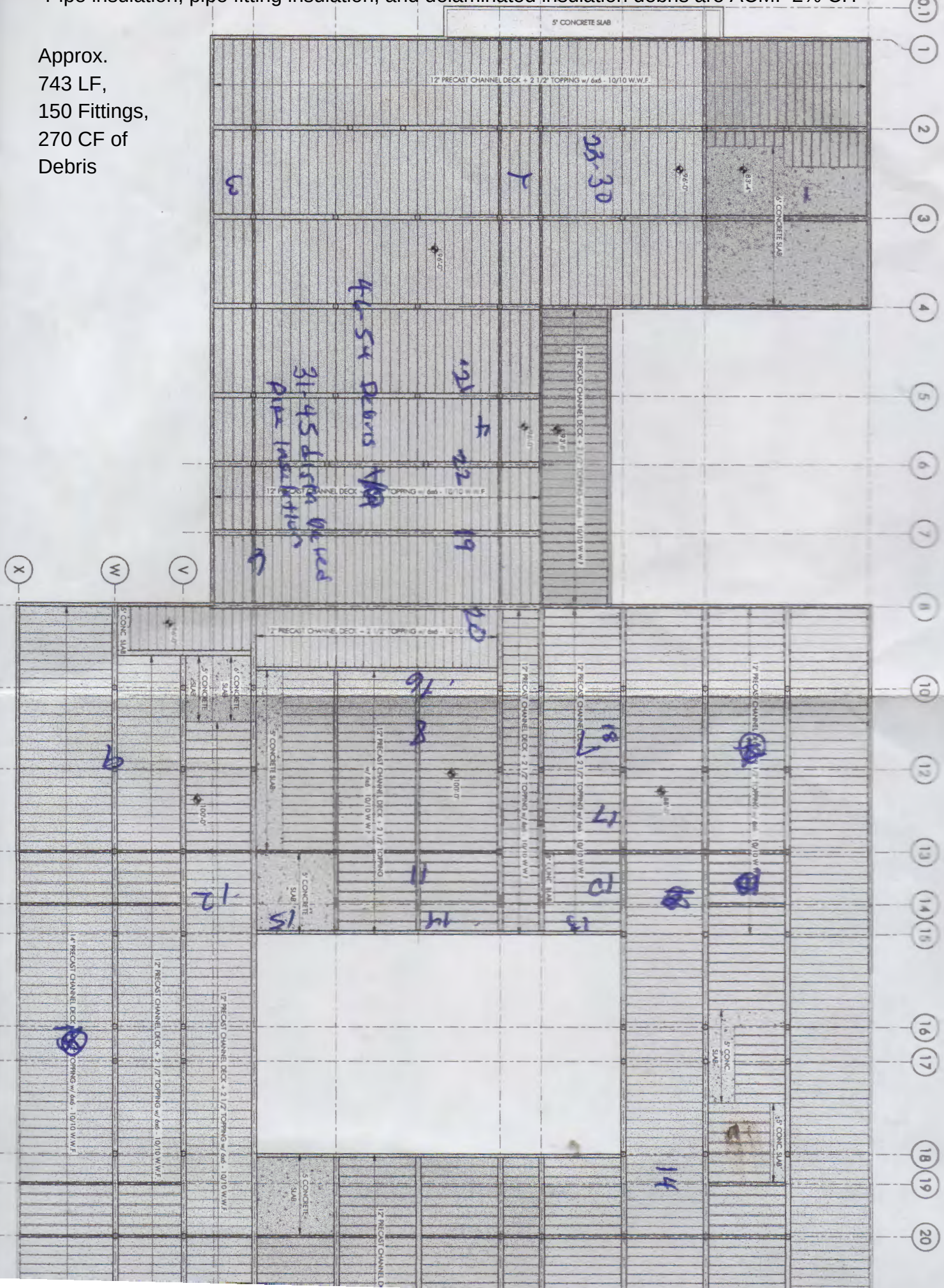
This school contains asbestos containing building material.

Confirmed ACBM
- Floor Tile
- Heat Shields (Shop Area)
- Hot Water Tank, Boiler
- Boilers
- Transite Vapor Barrier (Building Perimeter
- TSI, Mastics (White) All Mechanical Rooms
- Sink Coating (Pink)
- Tabletops and Sinks (Black Slate)
- Wall Texture (Medium) Gray in Color



Pipe insulation, pipe fitting insulation, and delaminated insulation debris are ACM. 2% CH

Approx.
743 LF,
150 Fittings,
270 CF of
Debris



Texas Association of School Boards
P.O. Box 400
Austin, TX 78767-0400
512-467-0222

June 11, 2014

Angela Kizzee
Austin ISD
1111 W 6th St
Austin, TX 78703-5300

Dear Angela Kizzee:

On 5/27/2014, a TASB Asbestos Inspector/Management Planner, (TDH license No.205622, enclosed) conducted a limited sample survey of the Bedichek Middle School and Portables. These laboratory results should be included in your asbestos management plan. **During the limited survey asbestos materials were found. Please see below.**

Bedichek Middle School (054)

Sample	Location	Material	Asbestos Type
Gym Building			
A	Large Gym	Dark grey CMU and grey mortar	None
B	**Large Gym**	**Yellow Pipe insulation on wall with white mastic (Run) Whtie mastic is hot**	**4% Chrysotile**
C	**Large Gym**	**Yellow Pipe insulation on wall with white mastic (elbow) White mastic is hot**	**5% Chrysotile**
Main Building			
A	Elevator Mechanical Room	Brown brick and grey mortar	None
B	Elevator Mechanical Room	Grey CMU and mortar	None

[redacted]

All of the identified asbestos containing materials should be monitored during six-month periodic surveillance activities until renovation or damage condition warrants removal.

If you have any questions or need additional information, please call me at 800-580-8272.

Sincerely,

Jason Buster
Sr. Environmental Specialist

The known and assumed non-friable ACBMs consists of:

A. Boiler flue insulation located in the gym boiler room.

B. Hot water tank insulation located in the gym boiler room.

C. Various flooring/mastic located in:

Drama – boys dressing room/hallway	Drama – girls dressing room/hallway	Room 105	Drama – Auditorium
Room 106	Room 107	Stage hallway/stairway	Cafeteria
Room 100	Room 101	Room 102	Work room
Hallway	Storeroom	Shop hallway	100 wing hallway
Custodial closet	Room 130	Room 131	Room 133
Storeroom 130 area			Storeroom
Bookroom			Room 142
Room 141	Room 140	Room 155	Closet by room 141
Room 150	Room 151	Room 154	Room 152-153
Storeroom	Hallway 150 area	Hallway 190 area	Library
Theater storeroom	Room 190	Room 191	Room 192
Room 193	Room 194	Band-Orchestra room	Gym hallway
Equipment storage room	Girls gym hallway	Women coaches office	Boys gym hallway
Men coaches office	200 wing hallway	Room 238	Bookroom
Room 237	Room 230/236	Room 235	Room 234
Room 233	Room 232	Room 231	200 wing hallway

Room 240		Room 257	Room 256
Room 255	Room 254	Room 253	Room 252
Bookroom	Room 251	Room 250	Weight room

D. Heat shield panel located in room 110B (Metal Working Shop).

Note: An internal work request (#001875) indicated removal of this material was to take place prior to the start of school year 93-94. No further documentation is provided in this plan but, the material is not included in any re-inspections since that time.

E. Exterior moisture barrier (transite) panels located along the perimeter of the main building.

F. Two boilers located in the gym boiler room.

G. All thermal gaskets on boilers, chillers and associated pumps and pipe joints may contain asbestos. Samples could not be taken without causing material damage, which would destroy their functional effectiveness. Thermal insulation gaskets are well sandwiched in their metallic enclosures and can become friable only during demolition or disassembly of their parent mechanical system. Thermal gaskets will be replaced only during mechanical system overhauls or replacements. All future disassembly of suspected mechanical systems will be performed by qualified asbestos workers.

** It should be noted that in April of 2000, all ceiling tiles throughout the campus were sampled and tested for asbestos content. No asbestos was detected in any of those samples.

Baer Engineering
and Environmental Consulting, Inc.

May 18, 2007

Austin Independent School District
Service Center
5101 East 51st Street
Austin, TX 78723-6199

Attention: Ms. Angela Earls

Reference: **Limited Asbestos Survey Report**
Bedichek Middle School, Austin, Texas
AISD Project No. P07-0011-BEDCK
Baer Engineering Document No. 071004-8i.040

Dear Ms Earls:

The Austin Independent School District (AISD) has initiated a roof renovation project at Bedichek School in Austin, Texas. O'Connell Robertson, the project architect selected by AISD, provided Baer Engineering with the roof renovation plans dated April 23, 2007. Ms. Debra James, the Project Manager from the AISD Bond 2004 program office, requested Baer Engineering to evaluate these areas to determine if any asbestos-containing materials (ACMs) would be disturbed during this renovation.

Baer Engineering visited the site on May 15, 2007. Our site-visit consisted of visually surveying the roof renovation areas identified on O'Connell Robertson roof renovation diagrams. Our survey included the following roof areas: D, E1, E2, and F. All suspect roofing materials not included in this survey should be treated as ACM until sampling proves otherwise. We reviewed the AISD Operations and Maintenance Plan and determined that a roof survey for Bedichek Middle School had not been performed. We collected material samples of suspect roofing materials. ***Asbestos was not present in any of the material samples we collected from the roof renovation areas.***

It has been a pleasure assisting you with this project. Please contact me at 453-3733 if you have any questions about the abatement report.

Sincerely,

BAER ENGINEERING AND ENVIRONMENTAL CONSULTING, INC.

Geoff Dupree
Project Consultant
DSHS License No. 10-5606

Enclosure: DSHS Licenses
AISD Forms
Laboratory Analytical Report
Sample Location Diagram

071004-8i.040 Bedichek Roof Survey Ltr.doc

Texas Association of School Boards
P.O. Box 400
Austin, TX 78767-0400
512-467-0222

November 30, 2015

Mr. Marc Brewster
Austin ISD
1111 W 6th St
Austin, TX 78703-5300

Dear Mr. Brewster:

On 11/18/2015, a TASB Asbestos Inspector/Management Planner, (TDH license No.205668, enclosed) conducted a sample survey of the Bedichek Middle School. These laboratory results should be included in your asbestos management plan. **No asbestos was found during a limited survey, please see below.**

Bedichek Middle School (054)

Sample	Location	Material	Asbestos Type
Main Building-Building A			
	Exterior ADMIN 1, ADMIN 2, ADMIN 3, FRR, and LOUNGE	Grey rubber caulking on outside of window frame-Sample 1-11182015	None
	Exterior ADMIN 1, ADMIN 2, ADMIN 3, FRR, and LOUNGE	Silicone glaze along metal sheet frame-Sample 2-11182015	None
	Exterior ADMIN 1, ADMIN 2, ADMIN 3, FRR, and LOUNGE	Silicone glaze along window edges-Sample 3-11182015	None
	Exterior 190 STO, 190 FRR, 190 KIT, 191 WKRM, 192 Classroom, 193 Study Laboratory, 194 Office	Grey rubber caulking on outside of window frame-Sample 4-11182015	None
	Exterior 190 STO, 190 FRR, 190 KIT, 191 WKRM, 192 Classroom, 193 Study Laboratory, 194 Office	Silicone glaze along metal sheet frame-Sample 5-11182015	None

	Exterior 190 STO, 190 FRR, 190 KIT, 191 WKRM, 192 Classroom, 193 Study Laboratory, 194 Office	Silicone glaze along window edges-Sample 6-11182015	None
	LIBRARY, 151 W/H, 151 B, 151 A, 152, 153, 154, 154 OFC Exterior	Grey rubber caulking on outside of window frame-Sample 7-11182015	None
	LIBRARY, 151 W/H, 151 B, 151 A, 152, 153, 154, 154 OFC Exterior	Silicone glaze along metal sheet frame-Sample 8-11182015	None

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Main Building-Building A			
	LIBRARY, 151 W/H, 151 B, 151 A, 152, 153, 154, 154 OFC Exterior	Silicone glaze along window edges-Sample 9-11182015	None
	Interior LIBRARY	White caulking on interior window frame-Sample 10-11182015	None
	Interior 153	White window caulking-Sample 11-11182015	None
	Interior 153, 154, and 152	Silicone glaze along window frames-Sample 12-11182015	None
	Interior 192 Classroom	Silicone glaze along window frame-Sample 13-11182015	None
	Interior 190 STO	White caulking along window frame-Sample 14-11182015	None
	Interior ADMIN 1, LOUNGE, and ADMIN 3	Silicone glaze along window frame-Sample 15-11182015	None
	Interior ADMIN 1	Black caulking-Sample 16-11182015	None
	Interior ADMIN 1	White caulking on metal frame-Sample 17-11182015	None

Texas Association of School Boards
P.O. Box 400
Austin, TX 78767-0400
512-467-0222

October 6, 2014

Angela Kizzee
Austin ISD
1111 W 6th St
Austin, TX 78703-5300

Dear Angela Kizzee:

On 9/12/2014, a TASB Asbestos Inspector/Management Planner, (TDH license No.205622, enclosed) conducted a limited sample survey of the Bedichek Middle School. These laboratory results should be included in your asbestos management plan.

Bedichek Middle School (054)

Sample	Location	Material	Asbestos Type
Bldg B			
A	Exterior	AHU-9 Roof core sample	None
B	Exterior	Roof-black caulking around flue pipes	None
C	Exterior	Roof- Throughout expansions and units Silver square flashing with mastic	None
CQ	**Exterior**	**AHU-9- Pipe insulation elbow with white mastic white mastic is hot**	**5% Chrysotile**
CR	Exterior	AHU-9- Yellow pipe insulation RUN	None
CS	Exterior	AHU-9- Concrete	None
CT	Exterior	AHU-9- Yellow HVAC insulation with white mastic	None
CU	**Exterior**	**AHU-9- Yellow HVAC insulation with white mastic**	**5% Chrysotile**

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Bldg B			
CV	Exterior	AHU-9- Black vibration boot	None
CW	Exterior	AHU-9- CMU	None
D	Exterior	Roof-Standing platform pole at base of unit- Black roofing material	None
E	Exterior	Roof Throughout-Flashing with mastic	None
F	**Exterior**	**Roof-Beige mastic around unit against wall**	**8% Chrysotile**
G	**Exterior**	**Roof-Insulation with white mastic on units white mastic is hot**	**8% Chrysotile**
H	Exterior	Along wall beams-white plaster	None
I	Exterior	Tan brick with grey mortar	None
J	Exterior	East side of roof top of AHU 9- Black roofing material with white paint	None
Main Building-Building A			
AA	Consumer Sciences	Grey HVAC mastic	None
AB	Consumer Sciences	Biege Ceramic wall tile with grout and yellow mastic	None
AC	Consumer Sciences	Beige Ceramic tile square with yellow mastic	None
AD	Field House/Mechanical Room	CMU with grout	None
AE	Field House/Mechanical Room	Brick and mortar	None
AF	Consumer Sciences	Homemaking Area-Sheetrock from wall next to Hallway	None
AG	Consumer Sciences	Homemaking Area-Plaster above stove vents	None

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Main Building-Building A			
AH	**Consumer Sciences**	**Homemaking Area-Joint Compound texture and compound are both hot**	**2% Chrysotile**
AI	Consumer Sciences	Homemaking Area-Grey sink damper	None
AJ	**Consumer Sciences**	**12" Floor tile under 1st layer of tile with black mastic tile is hot at 2%. black mastic hot at 5%**	**5% Chrysotile**
AK	**Consumer Sciences**	**Along Hallway and Wall-12" multi colored green floor tile with clear yellow mastic tile is hot**	**2% Chrysotile**
AL	Administration Offices	4" Greyish brown shiny Cove base with beige mastic	None
AM	Administration Offices	4" Brown cove base with beige mastic	None
AN	Administration Offices	Green and blue carpet with yellow mastic	None
AO	Administration Offices	2 x 4 Drop ceiling tile with fissures in 2ft direction wtih pin holes	None
AP	Administration Offices	2 x 4 Drop ceiling tile with fissures in the 4ft direction with large pin holes	None
AQ	Administration Offices	2 x 2 Drop ceiling tile with fissures in the 2ft direction with pin holes	None
AR	**Administration Offices**	**12" Floor tile beige with tan marble pattern with black mastic both tile and mastic is hot tile is at 2% and mastic is at 5%**	**5% Chrysotile**
AS	Administration Offices	Pink lay in insulation	None
AT	Administration Offices	Grey CMU with grey mortar	None

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Main Building-Building A			
AU	**Administration Offices**	**Joint compound both texture and joint compound contain asbestos**	**2% Chrysotile**
AV	Administration Offices	Restrooms-Ceramic floor tile with yellow mastic	None
AW	Administration Offices	Restrooms-beige ceramic wall tile with yellow mastic	None
AX	**Administration Offices**	**Conference Room-beige painted Sheetrock with texture and compound**	**2% Chrysotile**
AY	Life Skills & Staff Workroom	Staff Workroom-4" Brown cove base with brown mastic	None
AZ	**Life Skills & Staff Workroom**	**12" Beige floor tile with brown specs with black and yellow mastic Black mastic is hot**	**5% Chrysotile**
BA	Life Skills & Staff Workroom	White plaster	None
BB	Life Skills & Staff Workroom	Plaster behind plaster	None
BC	Life Skills & Staff Workroom	2 x 4 Drop ceiling tile with fissures in the 4 ft direction	None
BD	Life Skills & Staff Workroom	2 x 4 Drop ceiling tile with 2 size pin holes	None
BE	Life Skills & Staff Workroom	Pink ceiling insulation	None
BF	**Life Skills & Staff Workroom**	**12" Floortile brown with black and white specs with black mastic both floor tile and mastic are hot**	**5% Chrysotile**
BG	Life Skills & Staff Workroom	12" Dark brown floor tile with grey specs with yellow mastic (patch tile)	None
BH	Life Skills & Staff Workroom	2 x 4 Drop ceiling tile plain white gypsum	None

BI	**Life Skills & Staff Workroom**	**Joint compound from Restroom**	**2% Chrysotile**

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Main Building-Building A			
BJ	**Life Skills & Staff Workroom**	**Joint Compound from kitchen area**	**2% Chrysotile**
BK	Life Skills & Staff Workroom	Beige wall tile	None
BL	Life Skills & Staff Workroom	Green ceramic small tile	None
BM	Life Skills & Staff Workroom	CMU and mortar	None
BN	Life Skills & Staff Workroom	Wall divider with insulation	None
BO	Construction & Technology	Sheetrock-between wood walls Room 111	None
BP	Construction & Technology	CMU with beige paint	None
BQ	Construction & Technology	4" Brown cove base with brown mastic	None
BR	Construction & Technology	Pink ceiling insulation	None
BS	Construction & Technology	2 x 4 Ceiling tile with yellow insulation	None
BT	Construction & Technology	2 x 4 Drop ceiling tile with small random fissures	None
BU	Construction & Technology	2 x 4 Drop ceiling tile with large random fissures	None
BV	Construction & Technology	Exterior-Tan brick with grey mortar	None
BW	**Construction & Technology**	**Hallway and Room 113-12" White floor tile with grey spec with black mastic both tile and black mastic are hot**	**6% Chrysotile**
BX	Construction & Technology	Room 112-Joint compound	None
BY	Construction & Technology	Sheetrock with white texture	None

BZ	Construction & Technology	Multi colored carpet with yellow mastic	None

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Main Building-Building A			
C	Library	12" Floor tile beige with clear yellow mastic Front Entrance, AV Room and Storage Closet	None
CA	Construction & Technology	4" black cove base with beige mastic	None
CB	Construction & Technology	Room 110-12" Beige floor tile with yellow mastic	None
CC	Exterior & Mechanical Rooms	AHU-1,2,6 and 7- Roof Core Sample	None
CD	Exterior & Mechanical Rooms	AHU-17,3- Roof core sample	None
CE	Exterior & Mechanical Rooms	Flue pipes by AHU1 and 2-mastic with backing	None
CF	Exterior & Mechanical Rooms	Throughout expansions and around AHU's-Black mastic with silver foil	None
CG	Exterior & Mechanical Rooms	AHU-5- yellow insulation with black mastic	None
CH	Exterior & Mechanical Rooms	AHU-3 around flue pipes-Black mastic with beige caulking	None
CI	Exterior & Mechanical Rooms	Construction Technology Roof core sample	None
CJ	**Exterior & Mechanical Rooms**	**Black mastic around flue pipes AHU-15 and AHU-16 side of roof**	**4% Chrysotile**
CK	Exterior & Mechanical Rooms	Grey caulking AHU-15 and AHU-16	None
CL	Exterior & Mechanical Rooms	Black mastic with silver backing AHU-15 and AHU-16	None
CM	Exterior & Mechanical Rooms	AHU-13 and AHU-14-Black vibration boot on HVAC	None
CN	Exterior & Mechanical Rooms	AHU-13 and AHU-14- Beige brick with grey mortar	None

CO	Exterior & Mechanical Rooms	AHU-13 and AHU-14- Grey CMU and mortar	None

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Main Building-Building A			
CP	**Exterior & Mechanical Rooms**	**AHU-13 and AHU-14- White mastic with orange insulation white mastic is hot**	**5% Chrysotile**
CQ	Exterior & Mechanical Rooms	AHU-5,7- Black vibration boot	None
CR	**Exterior & Mechanical Rooms**	**AHU-5,7- Yellow pipe insulation Elbow with white mastic white mastic is hot**	**5% Chrysotile**
CS	Exterior & Mechanical Rooms	AHU-5,7- Yellow pipe insulation RUN	None
CT	**Exterior & Mechanical Rooms**	**AHU-5,7- HVAC insulation with beige mastic**	**5% Chrysotile**
CU	Exterior & Mechanical Rooms	AHU-5,7- Grey CMU and mortar	None
CV	Exterior & Mechanical Rooms	AHU-5,7- Concrete slab	None
CW	**Exterior & Mechanical Rooms**	**AHU-4,6-Yellow HVAC insulation with white mastic**	**5% Chrysotile**
CX	Exterior & Mechanical Rooms	AHU-4,6- Concrete slab	None
CY	Exterior & Mechanical Rooms	AHU-4,6- Black vibration boot on HVAC	None
CZ	Exterior & Mechanical Rooms	AHU-4,6- CMU and mortar	None
D	Library	Multi colored carpet	None
DA	Exterior & Mechanical Rooms	AHU-7- Yellow HVAC insulation	None
DB	Exterior & Mechanical Rooms	AHU-6- Pink HVAC insulation	None
DC	Exterior & Mechanical Rooms	AHU-15,16,17-Sheetrock	None
DD	Exterior & Mechanical Rooms	AHU-15,16,17-2 x 4 Drop ceiling tile with fissures in the 4ft direction	None

DE	Exterior & Mechanical Rooms	AHU-15,16,17- 2 x 4 Drop ceiling tile with fissures in the 2ft direction	None

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Main Building-Building A			
DF	Exterior & Mechanical Rooms	AHU-15,16,17-2 x 4 Drop ceiling tile with 2 size pin holes	None
DG	**Exterior & Mechanical Rooms**	**AHU-1,2,3- Pipe insulation elbow yellow with white mastic**	**5% Chrysotile**
DH	**Exterior & Mechanical Rooms**	**AHU-1,2,3- Pipe insulation yellow Run with white mastic**	**5% Chrysotile**
DI	Exterior & Mechanical Rooms	AHU-1,2,3- Black vibration boot	None
DJ	Exterior & Mechanical Rooms	AHU-1,2,3- Grey concrete	None
DK	Exterior & Mechanical Rooms	AHU-1,2,3- CMU and mortar	None
E	Library	4" Beige cove base with beige and brown mastic	None
F	Library	2 x 2 Ceiling tile with random fissures	None
G	Library	2 x 4 Drop ceiling tile with random fissures located in library Office and Conference	None
H	Library	Pink ceiling insulation	None
I	**Library**	**Sheetrock with white texture with beige paint**	**2% Chrysotile**
J	**Library**	**Joint Compound texture and compound both contain asbestos**	**2% Chrysotile**
K	Library	CMU with mortar	None
L	**Library**	**Window caulking brown**	**2% Chrysotile**
M	Cafeteria Hallway by water fountains	12" Floor tile white with brown and black specs and clear yellow mastic	None

N	Cafeteria Hallway by water fountains	4" Cove base dark brown with yellow mastic	None

Bedichek Middle School

Sample	Location	Material	Asbestos Type
Main Building-Building A			
O	Cafeteria Hallway by water fountains	CMU with grout	None
P	Cafeteria Hallway by water fountains	Tan Brick with tan mortar	None
Q	Cafeteria Stage	CMU and mortar	None
R	Cafeteria Stage	4" Cove base dark brown with yellow mastic	None
S	Cafeteria Stage	12" Beige floor tile with brown streaks with yellow mastic	None
T	Consumer Sciences	12" Floor tile white with brown specs and yellow mastic	None
U	Consumer Sciences	4" Cove base black with yellow mastic	None
V	Consumer Sciences	CMU with mortar	None
W	**Consumer Sciences**	**Joint Compound**	**2% Chrysotile**
X	**Consumer Sciences**	**Sheetrock with texture texture is hot**	**2% Chrysotile**
Y	Consumer Sciences	2 x 4 Ceiling tile with random fissures	None
Z	Consumer Sciences	2 x 4 Ceiling tile with 2 size pin holes	None

All of the identified asbestos containing materials should be monitored during six-month periodic surveillance activities until renovation or damage condition warrants removal.

If you have any questions or need additional information, please call me at 800-580-8272.

Sincerely,

D. Jason Buster

D. Jason Buster
Facility Consultant II

6. PREVIOUSLY SAMPLED MATERIALS AND ADDITIONAL SAMPLING DOCUMENTATION

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6. 1. PREVIOUSLY SAMPLED MATERIALS AND ADDITIONAL SAMPLING DOCUMENTATION

The following suspect materials were sampled prior to this inspection and/or after this survey. The lab results of materials sampled prior to this survey are located in this schools original management plan and /or previous inspections.

A. Boiler Flue on boilers in main boiler room was sampled on 4/23/88.

All of these materials were found to be Non-ACBM.

B. Chilled water lines and hot water lines underneath the building were found to be fiberglass insulation.

This material was found to be Non-ACBM.

C. Air handler rooms thermal insulation in pipes were found to be fiberglass.

All of these materials were found to be Non-ACBM.

D. Gym Boiler Room main heater boiler flue heater riser was sampled on 4/23/88.

This material was found to contain ACBM.

E. Heat shield in Rm 110 thru 113, located behind metal worktables was sampled on 4/23/88.

These materials were found to contain ACBM.

F. Bifold Curtain dividers in Room 254 and 252 were sampled on 4/23/88.

These materials were found to be Non-ACBM.

G. Spot light wiring located in the theatre was assumed ACBM on 4/23/88.

H. Water tower transite panels were assumed ACBM on 4/23/88.

I. Curtain on Cafeteria Stage was sampled on 4/23/88.

This material was found to be Non-ACBM.

J. Ceiling tiles located by the stage were sampled on 4/23/88.

This material was found to be Non-ACBM.

K. Boilers (thermal gasket inside unit) were assumed to be ACBM on 3/2/92.

L. Soil moisture barrier along perimeter of building was assumed ACBM 3/2/92.

M. Floor tile (12x12) located throughout the building was sampled on 3/2/92.

All of these materials were found to contain ACBM.

N. Linoleum flooring in the weight room was sampled on 3/2/92.

This material was found to contain ACBM.

O. Ceiling Tiles located throughout the building were sampled on 4/3/00.

All of these materials were found to be Non-ACBM.

P. Boiler (firewall insulation) located in the small gym boiler room was sampled on 6/11/02.

This material was found to contain ACBM.

Q. 12 x 12 Floor tile and mastic located in Room 151 (which was replaced in the year 2003) and 12 x 12 floor tile and mastic located in the Theatre Stairway (right side) were sampled on 11/13/2004.

All of these materials were found to contain ACBM.

R. A/C ductwork mastic (white) located on air handler units (AHU) numbers 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, and 14 was sampled on 4/30/2005.

All of these materials were found to contain ACBM.

S. Pipe insulation mastic (white) located on chilled water supply and return lines, hot water supply and return, domestic water line, elbows, tees and valve connection in the crawlspace to main building.

All of these materials were found to be ACBM.

T. 12 x 12 Floor Tile and Mastic (F12, F19, F22, and F24) were sampled on 7-11-05

All of these materials were found to be Non-ACBM.

U. Carpet with mastic (f15, F16, F20, and F26) was all sampled on 7-11-05.

All of these materials were found to be Non-ACBM.

V. 12 x 12 Floor Tile and Mastic (F09, F10, F11, F13, F14, F17, F18, F21, F23, and F25) were sampled on 7-11-05.

All of these materials were found to be ACBM.

W. Built-up Roofing (Tar and Gravel) and Gray Granular Flashing located on roofs D, F, E, and E1 were sampled on 5/15/2007.

These materials were found to be Non-ACBM.

X. (M24) Brown fibrous window panel insulation located in room 153 was sampled on June 23, 2009.

This material was found to be Non-ACBM.

Y. (M25) loose debris under gym wooden flooring, (M26) black tar paper under debris under gym wooden flooring located in Big Gym was sampled on July 16, 2009.

These materials were found to be Non-ACBM.

Z. (W24) Medium/Rough Drywall Texture, Tape and Float located in room 153 was sampled on June 8, 2011.

This material was found to be ACBM.

AA. (W25) Sheetrock with Texture/Joint Compound located in Rooms 150, 150STO, 151, 151OFC, 152, 152STO, 152CLO, 154, 154OFC, 155, and C3, (M27) located in 154OFC was sampled on June 14, 2011.

All of these materials were found to be ACBM.

BB. (M28) Gypsum Wallboard and (M29) Joint Compound located in Room 112 was sampled on May 11, 2012.

All of these materials were found to be Non-ACBM.

CC. (M30) Gypsum Wallboard and (M31) Joint Compound located in Rooms 100, 101, 130, 131, 134, 135 and 151 was sampled on June 1, 2012.

All of these materials were found to be ACBM.

DD. (M32) Gypsum Wallboard and (M33) Joint Compound located in Rooms 301, 303, 304, 305, 306, 307 and FWKRM300 was sampled on June 1, 2012.

All of these materials were found to be Non-ACBM.

EE. (F27) 12 x 12 Multicolor Floor Tile and Yellow Mastic located in BAND2 was sampled on April 23, 2014.

This material was found to be Non-ACBM.

FF. (M034) Soil below 130's Wing was sampled on April 6, 2016.

This material was found to be Non-ACBM.

GG. (T005) Boiler Firebrick located on Boiler # 1 (T006) Boiler Firebrick located on Boiler # 2 was sampled on June 7, 2016.

These materials were found to be ACBM.

HH. (S001) Dens-glass Sheetrock with tape, float and Texture located in Room 415 was sampled on June 7, 2016.

This material was found to be Non-ACBM.

II. (S002) Sheetrock/Joint Compound/Light Texture located in Library was sampled on 8-16-16.

This material was found to be Non-ACBM.

JJ. (M035) Black Vapor Barrier Mastic located behind Exterior Brick was sampled on 8-16-16.

This material was found to be ACBM.

KK. On May 27, 2014 TASB performed a Survey in various areas. See survey for exact locations and materials sampled.

Some of the materials were found to be ACBM and others were found to be Non- ACBM.

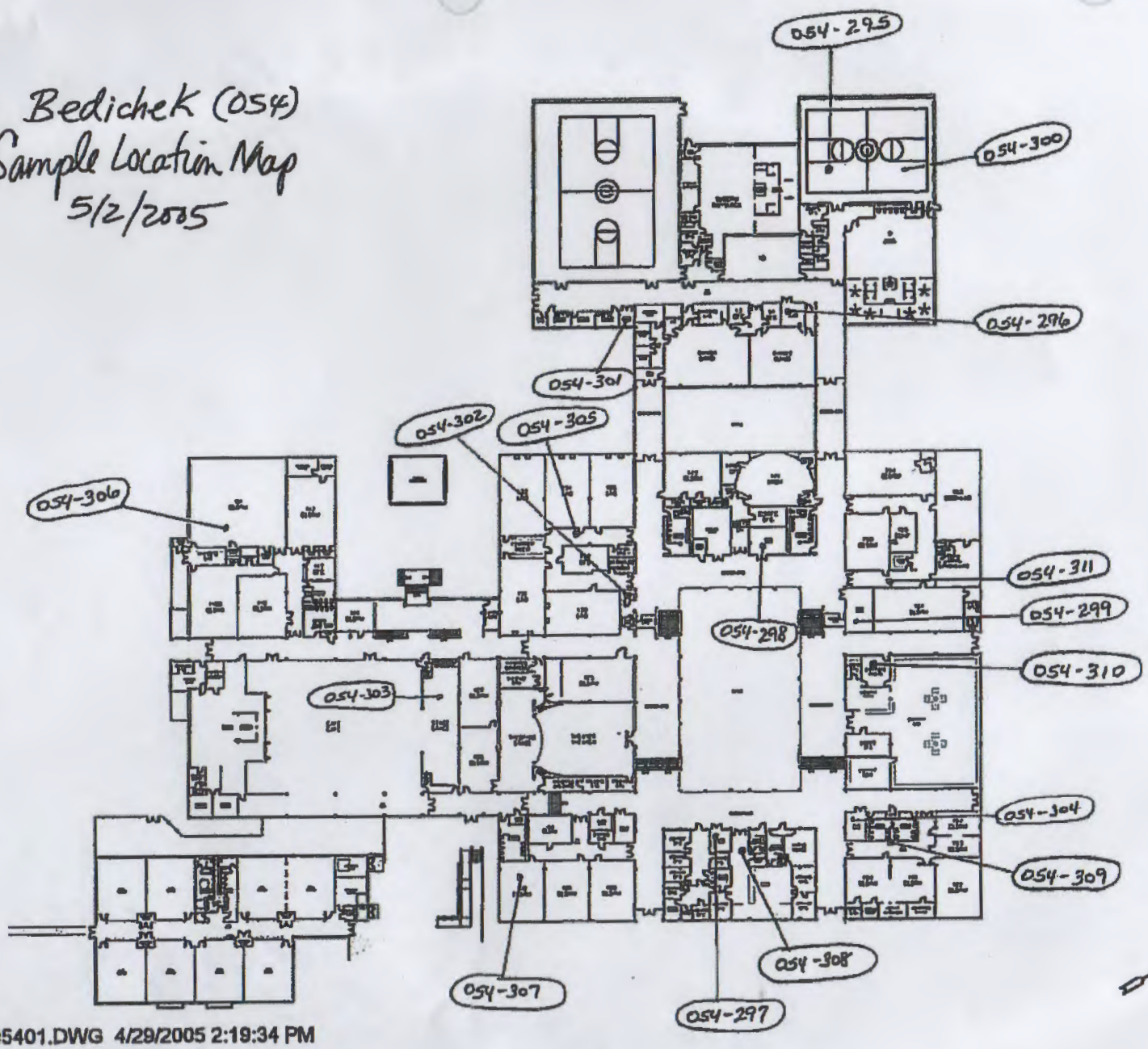
LL. On September 12, 2014 TASB performed a Survey in various areas. See survey for exact locations and materials sampled.

Some of the materials were found to be ACBM and others were found to be Non- ACBM.

MM. On November 18, 2015 TASB performed a Survey in various areas. See survey for exact locations and materials sampled.

All materials were found to be Non- ACBM.

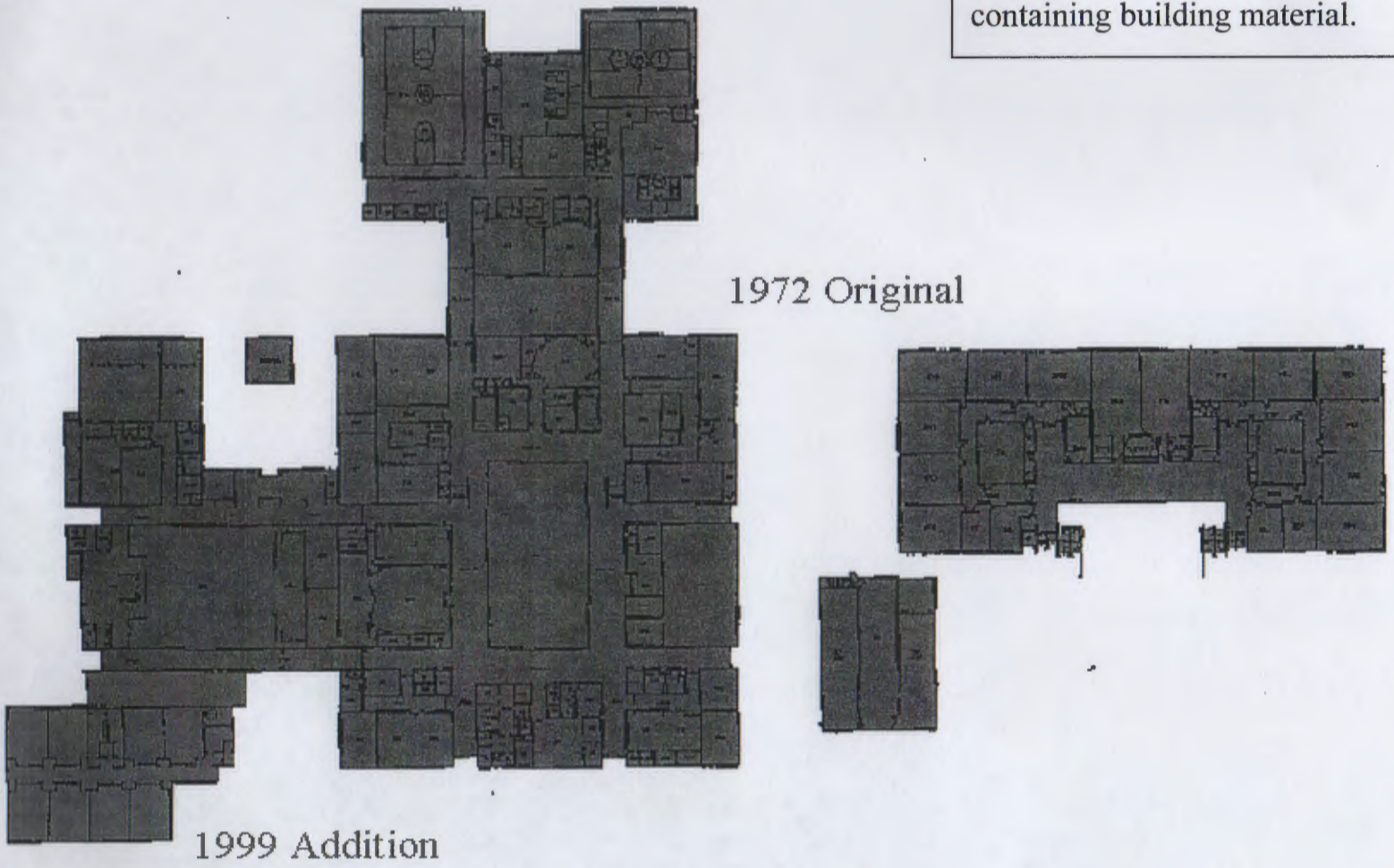
Bedichek (054)
Sample Location Map
5/2/2005



...\Bedichek MS\Drawings\05401.DWG 4/29/2005 2:19:34 PM

Bedichek Middle School (054)

This school contains asbestos containing building material.



1972 Original

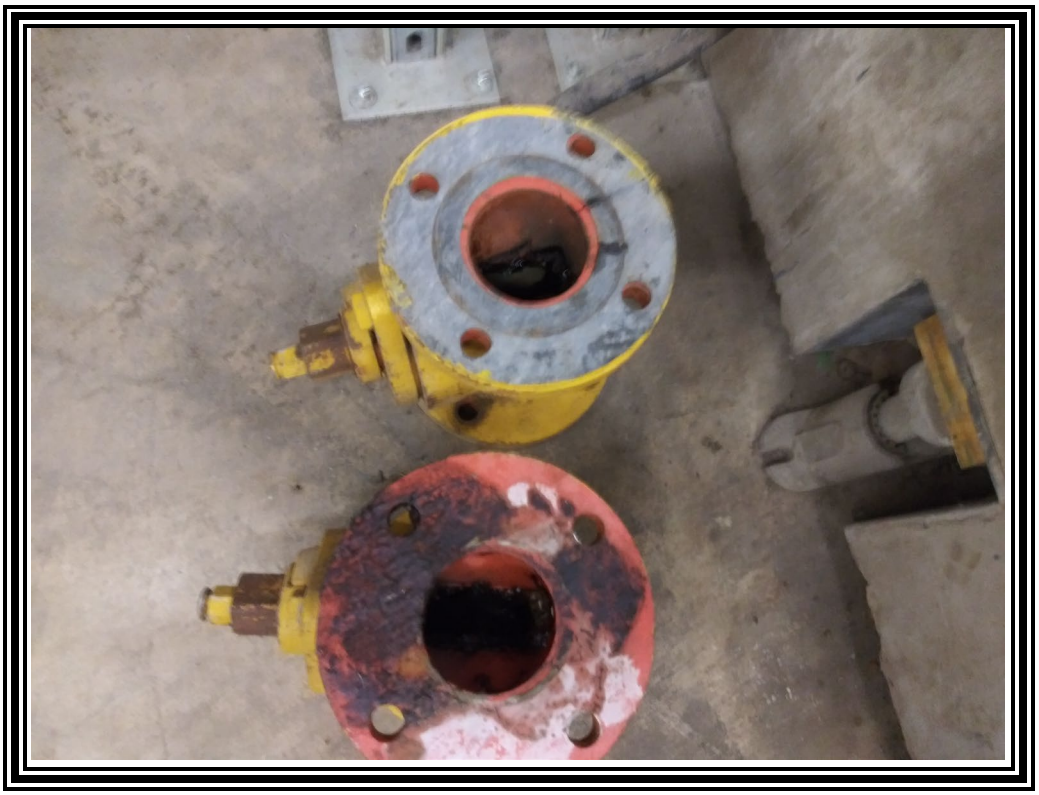
1999 Addition

1. Pipe insulation inside the crawlspace was found to contain up to 2% chrysotile asbestos.

2. Pipe fitting insulation in the crawlspace was found to contain up to 2% chrysotile asbestos.

3. Soil inside the crawlspace did not contain detectable asbestos in the sampled locations.

4. Debris, primarily delaminated pipe insulation, in the crawlspace were found to contain up to 2% chrysotile asbestos.



5. Gaskets inside pipe system flanges associated with the two hydronic pumps and two chillers inside the main mechanical room that will be removed were found to contain up to 70% chrysotile asbestos.

6. Pipe insulation mastic and duct insulation mastic were found to contain 2% chrysotile asbestos in the AHU 7 on the second floor.

7. Ground riser Transite pipe to the exterior chiller to be removed was found to contain 25% chrysotile asbestos.

HADDON+COWAN ARCHITECTS

Addendum No. 4

TO:	Prospective Bidders	**DATE:**	September 30, 2020
FROM:	Haddon+Cowan Architects	**HCA PROJ. NO:**	19-1013
SUBJECT:	AISD Bedichek Middle School Renovations	**AISD PROJ. NO:**	20-0029 BEDCHK

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents dated September 04, 2020. Addendum Number 4 issued September 30, 2020 with amendments and additions noted below. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

ADDENDUM SUMMARY:

This Addendum consists of:

1. New and Revised 24 x 36 Drawings
2. Revised specification sections

SPECIAL INSTRUCTIONS:

None at this time

DRAWINGS:

1. Sheet C300 – Revised and Reissued
   a. Extended area of vegetation and debris removal near main entry.
2. Sheet C400 – Revised and Reissued
   a. Added notes for Civil Alternate No. 1 to clean and flush existing storm water lines.
3. Sheet C401 – Revised and Reissued
   a. Added notes for Civil Alternate No. 1 to clean and flush existing storm water lines.
4. Sheet G0.00 – Revised and Reissued
   a. Austin ISD Board of Trustees and personnel section updated.
   b. Scope Outline updated to include item #8 regarding drains and areaways.
   c. Scope Outline updated to include item #9 regarding lab station abatement and removal.
   d. Phase 3 updated to include Cafeteria ceiling replacement.
   e. Updated sheet list.
5. Sheet G0.01 – Revised and Reissued
   a. Scope Outline updated to include item #8 regarding drains and areaways.
   b. Scope Outline updated to include item #9 regarding lab station abatement and removal.
6. Sheet A2.01 – Revised and Reissued
   a. Typo corrected.
7. Sheet A2.02 – Revised and Reissued

a. Removed note to reference MEP for Phase #3 scope.

8. Sheet A2.04 – Revised and Reissued
   a. Added RTU equipment designation.
9. Sheet 2.05 – Revised and Reissued.
   a. Revised demo plan and new work plans.
10. Sheet 2.06 – Revised and Reissued
    a. Added note to salvage demolished brick for put-back.
    b. Revised 3/A2.06 to show removal of additional built-in epoxy desks.
11. Sheet 3.01 – Revised and Reissued
    a. Revised plan legend.
    b. Revised to show Cafeteria ceiling replacement as part of Phase #3.
12. Sheet 3.02 – Revised and Reissued
    a. Revised plan legend.
    b. Revised plan drawing scales.
    c. Revised sheet to show Cafeteria ceiling replacement as part of Phase #3.
13. Sheet A4.01 – Revised and Reissued.
    a. Revised partition types detail.
14. Sheet M0.2 – Revised and Reissued
    a. Revised schedules per AISD review comments.
15. Sheet M0.2.1 – Revised and Reissued
    a. Revised schedules per AISD review comments.
16. Sheet M0.3 – Revised and Reissued
    a. Sheet title revised.
    b. Revised details per AISD review comments.
17. Sheet M0.4 – Revised and Reissued
    a. Revised details per AISD review comments.
18. Sheet M0.5 – Revised and Reissued
    a. Revised details per AISD review comments.
19. Sheet M0.6 – Revised and Reissued
    a. Sheet title revised.
    b. Revised details per AISD review comments.
20. Sheet M0.7 – Revised and Reissued
    a. Revised central plant schematics per AISD review comments.
21. Sheet M0.7.1 – Revised and Reissued
    a. Revised central plant schematics per AISD review comments.
22. Sheet M0.8 – Revised and Reissued
    a. Revised controls diagrams/sequences/points lists per AISD review comments.

23. Sheet M0.8.1 – Revised and Reissued
    a. Revised controls diagrams/sequences/points lists per AISD review comments.
24. Sheet M0.8.2 – Revised and Reissued
    a. Revised controls diagrams/sequences/points lists per AISD review comments.
25. Sheet M0.8.3 – Revised and Reissued
    a. Revised controls diagrams/sequences/points lists per AISD review comments.
26. Sheet M0.8.4 –
    a. Sheet added.
    b. Revised controls diagrams/sequences/points lists per AISD review comments.
27. Sheet M0.8.5 –
    a. Sheet added.
    b. Revised controls diagrams/sequences/points lists per AISD review comments.
28. Sheet M0.8.6 –
    a. Sheet added.
    b. Revised controls diagrams/sequences/points lists per AISD review comments.
29. Sheet M0.8.7 –
    a. Sheet added.
    b. Revised controls diagrams/sequences/points lists per AISD review comments.
30. Sheet M0.8.8 –
    a. Sheet added.
    b. Revised controls diagrams/sequences/points lists per AISD review comments.
31. Sheet M0.9 – Revised and Reissued
    a. Revised chilled and hot water piping schematics per AISD review comments.
32. Sheet M0.9.1 – Revised and Reissued
    a. Revised chilled and hot water piping schematics per AISD review comments.
33. Sheet M0.10 – Revised and Reissued
    a. Revised equipment drawings per AISD review comments.
34. Sheet M0.12 – Revised and Reissued
    a. Revised equipment drawings per AISD review comments.
35. Sheet M0.13 – Revised and Reissued
    a. Revised equipment drawings per AISD review comments.
36. Sheet M1.1 – Revised and Reissued
    a. Revised demolition drawings per AISD review comments.
37. Sheet M1.1.1 – Revised and Reissued
    a. Revised demolition drawings per AISD review comments.
38. Sheet M1.3 – Revised and Reissued
    a. Revised demolition drawings per AISD review comments.

39. Sheet M1.4 – Revised and Reissued
    a. Revised demolition drawings per AISD review comments.
40. Sheet M1.6 – Revised and Reissued
    a. Revised demolition drawings per AISD review comments.
41. Sheet M1.7 – Revised and Reissued
    a. Revised demolition drawings per AISD review comments.
42. Sheet M2.1 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
43. Sheet M2.1.1 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
44. Sheet M2.2 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
45. Sheet M2.2.1 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
46. Sheet M2.3 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
47. Sheet M2.4 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
48. Sheet M2.5 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
49. Sheet M2.6 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
50. Sheet M2.7 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
51. Sheet M2.8 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
52. Sheet M2.9 – Revised and Reissued
    a. Revised new work drawings per AISD review comments.
53. Sheet E1.1 – Revised and Reissued
    a. Sheet renamed.
    b. Revised lighting demolition plans to show revised scope areas.
54. Sheet E2.1 – Revised and Reissued
    a. Revised lighting plans to show revised scope areas and update approved lighting manufacturers per AISD review comments.
55. Sheet E2.2 – Revised and Reissued
    a. Revised lighting plans to show revised scope areas and update approved lighting manufacturers per AISD review comments.

56. Sheet E3.1 – Revised and Reissued
    a. Revised electrical power drawings per AISD review comments.
57. Sheet E3.1.2 – Revised and Reissued
    a. Revised electrical power drawings per AISD review comments.
58. Sheet E3.2 – Revised and Reissued
    a. Revised electrical power drawings per AISD review comments.
59. Sheet E3.3 – Revised and Reissued
    a. Revised electrical power drawings per AISD review comments.
60. Sheet E3.3.1 – Revised and Reissued
    a. Revised electrical power drawings per AISD review comments.
61. Sheet P1.2 – Revised and Reissued
    a. Revised plumbing fixture schedule per AISD review comments.

SPECIFICATIONS:

1. Specification 00 01 10 – Revised and Reissued.
    a. Revised to include added specification sections.
2. Specification 00 01 15 – Revised and Reissued.
    a. Revised to include added sheets.
3. Specification 01 35 46 – Revised and Reissued
    a. Replaced in its entirety.
4. Specification 01 65 00 – Revised and Reissued
    a. Section replaced in its entirety.
5. Specification 01 74 19 – Revised and Reissued
    a. Section replaced in its entirety.
6. Specification 01 81 13 – Revised and Reissued
    a. Section replaced in its entirety.
7. Specification 09 51 00 – Revised and Reissued
    a. Section revised to include ACT-2.
8. Specification 22 01 00 – Revised and Reissued
    a. Section replaced in its entirety.
9. Specification 22 02 00 – Revised and Reissued
    a. Section replaced in its entirety.
10. Specification 22 07 19 – Revised and Reissued
    a. Section replaced in its entirety.
11. Specification 22 10 00 – Revised and Reissued
    a. Section replaced in its entirety.

12. Specification 22 40 00 – Revised and Reissued
    a. Section replaced in its entirety.
13. Specification 23 01 00 – Revised and Reissued
    a. Section replaced in its entirety.
14. Specification 23 02 00 – Revised and Reissued
    a. Section replaced in its entirety.
15. Specification 23 05 26 – Revised and Reissued
    a. Section replaced in its entirety.
16. Specification 23 05 53 – Revised and Reissued
    a. Section replaced in its entirety.
17. Specification 23 05 93 – Revised and Reissued
    a. Section replaced in its entirety.
18. Specification 23 07 13 – Revised and Reissued
    a. Section replaced in its entirety.
19. Specification 23 07 16 – Revised and Reissued
    a. Section replaced in its entirety.
20. Specification 23 07 19 – Revised and Reissued
    a. Section replaced in its entirety.
21. Specification 23 09 26a – Revised and Reissued
    a. Section replaced in its entirety.
22. Specification 23 09 26c – Revised and Reissued
    a. Section replaced in its entirety.
23. Specification 23 21 13 – Revised and Reissued
    a. Section replaced in its entirety.
24. Specification 23 21 23 – Revised and Reissued
    a. Section replaced in its entirety.
25. Specification 23 25 16 – Revised and Reissued
    a. Section replaced in its entirety.
26. Specification 23 31 13 – Revised and Reissued
    a. Section replaced in its entirety.
27. Specification 23 64 16 –
    a. Section added.
28. Specification 23 73 13 – Revised and Reissued
    a. Section replaced in its entirety.
29. Specification 23 81 33 –
    a. Section added.

30. Specification 26 01 00 – Revised and Reissued
    a. Section replaced in its entirety.
31. Specification 26 05 19 – Revised and Reissued
    a. Section replaced in its entirety.
32. Specification 26 05 26 – Revised and Reissued
    a. Section replaced in its entirety.
33. Specification 26 24 16 – Revised and Reissued
    a. Section replaced in its entirety.
34. Specification 26 29 13 – Revised and Reissued
    a. Section replaced in its entirety.
35. Specification 26 51 00.13 – Revised and Reissued
    a. Section replaced in its entirety.

END OF ADDENDUM NUMBER 4

SECTION 00 01 10

TABLE OF CONTENTS

END OF SECTION

SECTION 00 01 15
LIST OF DRAWING SHEETS

GENERAL

G0.00	**COVER SHEET**
G0.01	**SCOPE OUTLINE**

CIVIL

C100	**CIVIL GENERAL NOTES**
C200	**CIVIL EROSION & SEDIMENT CONTROL PLAN**
C201	**CIVIL EROSION & SEDIMENT CONTROL DETAILS**
C300	**CIVIL DEMOLITION PLAN**
C400	**CIVIL ENLARGED GRADING, DRAINAGE & MAINT. PLAN - NORTH**
C401	**CIVIL ENLARGED GRADING, DRAINAGE & MAINT. PLAN - SOUTH**
C500	**CIVIL DETAILS**
C501	**CIVIL DETAILS**

ARCHITECTURAL

A2.01	**SUBFLOOR PLAN**
A2.02	**FLOOR PLANS**
A2.04	**ROOF PLAN - OVERALL**
A2.05	**ENLARGED PLANS**
A2.06	**ENLARGED PLANS**
A3.01	**OVERALL RCP**
A3.02	**ENLARGED RCP**
A4.01	**DOOR SCHEDULE & DETAILS**

STRUCTURAL

S001	**STRUCTURAL NOTES**
S100	**FOUNDATION PLAN BUILDING A**
S200	**ENLARGED FRAMING PLAN BUILDING A**
S300	**FOUNDATION DETAILS**
S301	**FOUNDATION PHOTOS**
S400	**FRAMING DETAILS**

MECHANICAL

M0.1	**MECHANICAL GENERAL NOTES & OUTSIDE AIR CALCS**
M0.1.1	**MECHANICAL CALCS FOR PHASE 5**
M0.2	**NEW MECHANICAL EQUIPMENT SCHEDULES**
M0.2.1	**MECHANICAL SCHEDULES FOR PHASE 2,4,5**
M0.3	**NEW MECHANICAL EQUIPMENT SCHEDULES & DETAILS**
M0.4	**MECHANICAL DETAILS**
M0.5	**MECHANICAL DETAILS**

M0.6 MECHANICAL DETAILS - PHASE 4
M0.7 CONDENSER & CHILLED WATER PIPING SCHEMATIC
M0.7.1 CONDENSER & CHILLED WATER PIPING SCHEMATIC - PHASE 4
M0.8 MECHANICAL CONTROLS
M0.8.1 MECHANICAL CONTROLS
M0.8.1.1 MECHANICAL CONTROLS - PHASE 5
M0.8.2 MECHANICAL CONTROLS
M0.8.3 MECHANICAL CONTROLS
M0.8.4 MECHANICAL DETAILS
M0.8.5 MECHANICAL CONTROLS
M0.8.6 MECHANICAL CONTROLS - PHASE 5
M0.8.7 MECHANICAL CONTROLS
M0.8.8 MECHANICAL CONTROLS
M0.9 CHILLED & HOT WATER PIPING SCHEMATIC
M0.9.1 CHILLED & HOT WATER PIPING SCHEMATIC - PHASE 5
M0.10 NEW RTU & AHU'S - PLANS & ELEVATIONS
M0.11 CENTRAL PLANT NEW EQUIPMENT ELEVATIONS
M0.12 CENTRAL PLANT NEW EQUIPMENT PLANS - PHASE 4
M0.13 NEW AHU'S - PLANS & ELEVATIONS - PHASE 5
M1.1 MECHANICAL DEMO PLAN CENTRAL PLANT
M1.1.1 MECHANICAL DEMO PLAN CENTRAL PLANT - PHASE 4
M1.2 MECHANICAL DEMO PLAN CRAWL SPACE
M1.3 MECHANICAL DEMO PLAN FIRST FLOOR & KITCHEN
M1.4 MECHANICAL DEMO PLAN FIRST FLOOR
M1.5 MECHANICAL DEMO PLAN SECOND FLOOR
M1.6 MECHANICAL DEMO PLAN ROOF
M1.7 MECHANICAL DEMO PLAN PENTHOUSE
M2.1 MECHANICAL PLAN CENTRAL PLANT
M2.1.1 MECHANICAL PLAN CENTRAL PLANT - PHASE 4
M2.2 MECHANICAL PLAN CRAWL SPACE
M2.2.1 MECHANICAL PLAN CRAWL SPACE - PHASE 1 & 2
M2.3 MECHANICAL PLAN FIRST FLOOR
M2.4 MECHANICAL PLAN FIRST FLOOR
M2.5 MECHANICAL PLAN FIRST FLOOR
M2.6 MECHANICAL PLAN SECOND FLOOR
M2.7 MECHANICAL PLAN SECOND FLOOR
M2.8 MECHANICAL ROOF PLAN
M2.9 MECHANICAL PLAN PENTHOUSE - PHASE 5

ELECTRICAL

E1.1 LIGHTING DEMO PLAN FIRST FLOOR PHASE 1 & PHASE 3

E1.2 LIGHTING DEMO PLAN SECOND FLOOR PHASE 1
E2.1 LIGHTING PLAN FIRST FLOOR - PHASE 1
E2.2 LIGHTING PLAN SECOND FLOOR - PHASE 1
E3.1 POWER PLAN FIRST FLOOR - INITIAL PHASE
E3.1.1 POWER PLAN FIRST FLOOR - PHASE 2
E3.1.2 POWER PLAN FIRST FLOOR - PHASE 5
E3.2 POWER PLAN SECOND FLOOR - INITIAL PHASE
E3.3 POWER PLAN CENTRAL PLANT INITIAL PHASE
E3.3.1 POWER PLAN CENTRAL PLANT - PHASE 4

PLUMBING
P1.1 PLUMBING PLAN FIRST FLOOR
P1.2 PLUMBING PLAN SECOND FLOOR

ROOFING
R1 ROOFING DETAILS
R2 ROOFING DETAILS

END OF SECTION

INDOOR AIR QUALITY MANAGEMENT

SECTION 01 35 46

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protection of heating, ventilating, and air conditioning systems.
2. Reducing emissions through source control.
3. Pathway interruption.
4. Housekeeping.
5. Scheduling.
6. Indoor Air Quality Management Plan.

B. Related Sections:

1. 01 81 13 Sustainable Construction Requirements

1.2 REFERENCES

A. American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) 52.2-2007, with errata - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

B. Sheet Metal and Air Conditioning Manufacturer's Association International (SMACNA) - IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition, 2007, ANSI/SMACNA 008-2008, Chapter 3.

1.3 SUBMITTALS

A. Indoor Air Quality Management Plan:

1. Submit Indoor Air Quality Management Plan for review within ten days after date of Notice to Proceed. Plan should address key issues for IAQ protections such as scheduling, source control, HVAC protection pathway interruption, and housekeeping. Include:

a. Procedures for implementing requirements of SMACNA IAQ

Guideline.

b. Substitution procedures for products that are responsibility of Contractor and proposed source control implementation measures to minimize building contamination.

c. Construction sequencing and storage plans for protection of stored on-site or installed absorptive materials against moisture absorption and contamination.

d. Filter media change schedule. Minimum MERV filtration media per Section 3.1.

e. Contact Information including name, phone number, and email address of Contractor's personnel responsible for instructing workers and overseeing and documenting results of Indoor Air Quality Management Plan.

2. If required, revise and resubmit plan within ten days after receipt of comments.

3. Distribute copies of approved Indoor Air Quality Management Plan to concerned parties.

B. Photographs: Document indoor air quality management measures implemented, including protection of ducts, on-site storage, source control including use of low-VOC products, pathway interruption, green housekeeping, scheduling, and protection of installed absorptive materials. Provide date stamped and annotated photographs during construction and pre-occupancy. Highlight materials stored or installed on-site.

1.4 QUALITY ASSURANCE

A. Review and discuss Indoor Air Quality Management Plan implementation and progress at Preconstruction Conference and Progress Meetings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Designate specific storage areas to facilitate protection of stored absorptive materials.

B. Clearly identify storage areas. Keep clean and orderly; prevent contamination of materials.

C. Monitor storage areas for contamination; correct problems and implement preventative measures.

D. Store materials off ground on pallets or skids. Keep materials covered and protected until ready for installation.

1.6 TRAINING

A. Provide training of indoor air quality management methods to be used at appropriate stages of Project.

B. Include Indoor Air Quality Management plan and implementation as an agenda item to Pre-Construction meeting as well as Pre-Installation meetings.

C. Require participation of all subcontractors and include as agenda item to subcontractor meetings.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. During construction, meet or exceed SMACNA minimum requirements for heating, ventilating, and air conditioning system protection, source control, pathway interruption, housekeeping, and scheduling.

B. Protect stored on-site or installed absorptive materials from moisture damage and volatile organic compound contamination through construction sequencing and proper storage.

C. If air handlers are used during construction, use filtration media with minimum MERV of 8.

D. Replace filtration media with minimum MERV of 13 just prior to occupancy.

E. Heating, Ventilating, and Air Conditioning System Protection:

1. Keep duct systems including supply air, return air, and exhaust air and associated equipment including air handlers, variable air volume boxes, silencers, fans, and filter boxes, clean and uncontaminated.

2. Seal taps and open ends of duct systems not actively being worked on with plastic and tape.

3. Provide 1-inch polyester filter media over return and exhaust air inlets during construction and until Substantial Completion.

4. Ensure that temporary and permanent filters are in place at openings before running fans.

F. Source Control:

1. For temporary and ancillary materials used in construction, follow requirements of similar products in Divisions 2 through 49 to minimize adverse indoor air quality impacts.

2. Use nontoxic and no- and low-VOC formulations and implement other source control measures to minimize building contamination.

3. Prohibit use of tobacco products inside the building and within 30 feet of the building entrance during construction.

G. Pathway Interruption: Isolate areas where work is being performed to prevent contamination of clean spaces.

H. Housekeeping:

1. Implement cleaning activities concentrating on heating, ventilating, and air conditioning systems and building space to remove contaminants prior to occupancy.

2. Comply with AISD Green Housekeeping policy.

3. Protect materials from weather and store in clean area prior to unpacking.

4. Clean coils, air filters, and fans before performing testing and balancing.

I. Scheduling:

1. Sequence construction activities to reduce absorption of any volatile organic compounds by materials.

2. Complete applications of wet and odorous materials before installing absorptive materials.

J. Documentation/Recordkeeping:

1. Photograph each IAQ measure and annotate images for documentation.

2. Photograph the methods employed to protect stored and installed

absorptive materials from moisture damage during construction and preoccupancy.

3 Record the filtration media used in HVAC equipment and date(s) media was replaced.

END OF SECTION 013546

SECTION 016500 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Sections:
   1. Division 22 Section “Commissioning of Plumbing Systems” for commissioning process activities for plumbing systems, assemblies, equipment and components.
   2. Division 23 Section "Commissioning of Mechanical Systems" for commissioning process activities for mechanical systems, assemblies, equipment, and components.
   3. Division 26 Section "Commissioning of Electrical Systems" for commissioning process activities for electrical systems, assemblies, equipment, and components.

1.3 DEFINITIONS

A. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in tested modes according to Contract Documents.

B. Basis of Design (**BoD**): A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process. Describes systems, components, conditions, and methods chosen to meet design intent.

C. Building Commissioning: A joint team effort to ensure that all mechanical equipment, controls, and systems function together properly to meet the design intent, to document system performance parameters for fine-tuning of control sequences and operational procedures, and to ensure that personnel are adequately trained to operate systems.

D. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

E. Commissioning Authority (**CxA**): Independent agent hired by Owner and not associated with Contractor or its subcontractors, Architect or its sub-consultants, or Owner’s Contracting Officer Technical Representative or its staff or consultants. Under Owner’s direction, and not Contractor’s direction, CA will direct and coordinate day-to-day commissioning activities without assuming oversight responsibilities.

F. Commissioning (**Cx**) Process: A process that encompasses and coordinates the traditionally separate functions of system documentation, equipment start-up, control system calibration, testing and balancing, training and performance testing. Commissioning requirements do not supersede other requirements of the specifications, but may expand on some of them.

G. Commissioning Team: Consists of a Commissioning Authority retained by the Owner, Owner's Representative, major equipment suppliers and Contractors/subcontractors.

H. Contractor (**CONTRACTOR**): Representatives from the Contractor, with whom Owner is contractually obligated to carry out overall planning, coordination, and control of project from inception to completion in accordance with contract documents.

I. Deferred Functional Tests: Functional tests performed later, after Substantial Completion, due to partial occupancy, equipment, seasonal requirements, design, or other Site conditions that disallow test from being performed.

J. Design Intent: Dynamic document that provides explanation of ideas, concepts, and criteria that are considered to be important to Owner. Initially, outcome of programming and conceptual design phases.

K. Functional Test: Test of dynamic function of systems, as opposed to components, under full operation in various modes through all control system's sequences of operation using manual (direct observation) or monitoring methods following prescribed test procedures in sequential written form.

L. Owner's Project Requirements (**OPR**): A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

M. Pre-functional Checklist: List, provided by Commissioning Authority to installer, of items to inspect and elementary component tests to conduct to verify proper installation of equipment prior to functional testing.

N. Sampling: Functionally testing only a fraction of total number of identical or near identical pieces of equipment.

O. Seasonal Commissioning: Testing of equipment that can be done only during periods of peak heating or cooling, when HVAC equipment is operating at full-load or heavy-load conditions.

P. Simulated Condition: Condition created for purpose of testing response of system.

Q. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

R. Trending: Monitoring using building control system.

1.4 COMMISSIONING TEAM

A. Members Appointed by CONTRACTOR: Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of CONTRACTOR, including Project superintendent and all subcontractors, installers, suppliers, specialists, etc. who are responsible for installing systems under this project.

B. Members Appointed by Owner:

1. Owner:
   Austin Independent School District
   812 San Antonio St
   Austin, Texas 78701
   Contact: Bob Cervi, Executive Director of Construction Management and Facilities
   Phone (office): 512-414-8948
   E-mail: robert.cervi@austinisd.org

2. Commissioning Authority (CxA):
   ACR Engineering
   3001 South Lamar, Ste. 210
   Austin, Texas 78704
   Contact: Ricardo Troncoso, P.E.
   Phone (office): 512-440-8333
   Phone (mobile): 512-563-3493
   E-mail: rtroncoso@acreng.com

3. Architect:
   Haddon + Cowan Architects
   2301 East Riverside Drive, Bldg. A, Ste. 80
   Austin, Texas 78741
   Contact: Michael Cowan AIA
   Phone (office): 512-228-4389
   Email: mcowan@haddoncowan.com

4. MEP Engineer:
   Wilson Girgenti
   13785 Research Blvd., Ste. 125
   Austin, Texas 78750
   Contact: Melissa Coad
   Phone (office): 813-855-3330
   E-mail: mcoad@wilsongirgenti.com

1.5 RESPONSIBILITIES

A. Responsibilities of the CxA during the Construction Phase include, but are not limited to the following:

1. Coordinate and direct each step of the total Commissioning Process for systems being installed as part of this contract. Coordinate commissioning work schedule with Owner and CONTRACTOR.
2. Provide commissioning plan.
3. Attend planning and job-site meetings as required to obtain information relating to Commissioning Process. Convene commissioning team meetings as required.
4. Plan and conduct Commissioning scoping and coordination meetings. Provide notice to all Team members to attend scheduled commissioning meetings.
5. Request all information required for Commissioning Process from manufacturers, CONTRACTOR, and Design Professionals.
6. Review Design Professionals' design documents to gain clear understanding of design intent.
7. Review CONTRACTOR submittals for compliance with commissioning needs.
8. Verify that systems and equipment have been installed and started in accordance with manufacturer's recommendations and with generally recognized construction standards, and that documentation of such has been provided.
9. Assist in resolving discrepancies.
10. Conduct periodic site observations during constructions and issue Cx Field Reports to documents findings and issues requiring Owner or Architect attention.
11. Prepare Pre-Functional Checklists to ensure systems have been installed according to project specifications. Verify that Pre-Functional Checklists have been addressed by CONTRACTOR and are accurate. Deliver final Pre-Functional Checklists to Owner.
12. Prepare Functional Test procedures to demonstrate performance of systems according to project specifications. Observe and document performance of systems, as per process detailed in Functional Test procedures.
13. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
14. Prepare and maintain an Issues Log.
15. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.
16. Review testing and balancing (TAB) reports; notify Owner of deficiencies.
17. Recommend acceptance or non-acceptance of systems to Owner.
18. Verify that Operations and Maintenance (O&M) documentation is acceptable. Operations and Maintenance manuals shall be submitted simultaneously to CxA and to Design Professionals for review.
19. Prepare and maintain a current facilities requirements and operations and maintenance plan that contains the information necessary to operate the space efficiently.
20. Verify that training has taken place by collecting training documentation from CONTRACTOR.
21. Compile and maintain commissioning record.
22. Provide pre-final and final commissioning reports to all commissioning team members. The report shall include:

a. Communications between Owner, CxA, Design Professionals, Vendors, and/or CONTRACTOR and Subcontractors related to Commissioning Process.
b. Minutes of Commissioning meetings.
c. Findings and pertinent observations.
d. A listing of any deficiencies, unresolved issues, and compromises in the environmentally responsive features of the project.
e. Manufacturer's start-up reports.
f. An Issues Log which will:

1) List design, installation, and performance issues that are at variance with the Owner's project requirements and Contract Documents.
2) Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.
3) Document corrective modifications made.

g. Pre-Functional Checklists.
h. Testing plans and Functional Test reports.
i. Listing of off-season test(s) not performed and a schedule for their completion.

23. Conduct an inspection of the building and its systems within 10 months after substantial completion and prior to the expiration of warranties. Prepare a report documenting findings that should be addressed prior to expiration of warranties. (Not in scope)

B. Contractor: Responsibilities of the Contractor as related to Commissioning Process include, but are not limited to the following:

1. Facilitate coordination of Commissioning work by CxA.
2. Attend Commissioning meetings or other meetings called by CxA to facilitate the Commissioning Process.
3. Integrate and coordinate commissioning process activities with construction schedule.
4. Provide CxA with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be provided directly to the CxA as a digital PDF file at the same time that the submittals are made to the architect and/or engineer.
5. Review and accept Pre-Functional/Construction checklists provided by the CxA.
6. Review CxA's Functional Test procedures for feasibility, safety, and impact on warranty, and provide CxA with written comment on same.
7. Provide all documentation relating to manufacturer's recommended performance testing of equipment and systems.
8. Provide Operations and Maintenance Data to CxA for preparation of checklists and training manuals.
9. Provide testing and balancing report.
10. Provide As-built drawings and documentation to facilitate Functional Testing.
11. Assure and facilitate participation and cooperation of specialty subcontractors (electrical, mechanical, controls, etc.) and equipment suppliers as required for the Commissioning Process.
12. Install systems and equipment in strict conformance with project specifications, manufacturer's recommended installation procedures, and Pre-Functional Checklists, as prepared by CxA.
13. Require subcontractors to inspect systems installed and fill out Pre-functional Checklists (provided by CxA) to verify installation has taken place in accordance with manufacturer's

instructions, and in a workmanlike manner in accordance with project documents and generally accepted construction practices. Certify to CxA that installation work listed in Pre-functional Checklists has been completed and accompany CxA during verification of completed Pre-functional Checklists.

14. Provide data concerning performance, installation, and start-up of systems.
15. Provide copy of manufacturer's filled-out start-up forms for equipment and systems.
16. Ensure systems have been started and fully checked for proper operation prior to arranging for Functional Testing with CxA. Prepare and submit to CxA written certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.

    a. CONTRACTOR shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in CxA's Functional Test procedures.
    b. CONTRACTOR is not relieved of obligation for systems / equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by CxA.

17. Coordinate with CxA to determine mutually acceptable date for Functional Performance Tests.
18. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.
19. Complete commissioning process test procedures.
20. Provide qualified personnel to assist and participate in Commissioning.
21. Provide test instruments and communications devices, as prescribed by CxA and where identified in this specifications manual, as required for carrying out Functional Testing of systems.
22. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
23. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
24. Ensure deficiencies found in the Commissioning Process are corrected within the time schedule shown in the Cx report.
25. Prepare and submit to CxA proposed Training Program outline for each system.
26. Coordinate and provide training of Owner's personnel. Provide CxA with proposed training agenda no less than 14 days prior to proposed training sessions. Provide documentation that training took place (including system being trained, trainer's name and contact information, sign-in sheet verifying who attended training, length of training, and signature of owner's authorized person certifying training took place satisfactorily).
27. Provide a tracking method to ensure that all required positions or person received training.
28. Prepare Operation and Maintenance manuals and As-Built drawings in accordance with specifications; submit copy to CxA in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and CxA's comments.
29. All costs associated with the participation of CONTRACTOR, Sub-Contractors, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

C. Subcontractors and vendors shall prepare and submit to Commissioning Authority Manufacturer's installation and performance test procedures to demonstrate performance of systems according to these specifications and checklists prepared by Commissioning Authority.

D. Owner's Representative: Responsibilities of the Owner's Representative as related to the Commissioning Process include, but are not limited to the following:

1. Provide the OPR documentation to the CxA and CONTRACTOR for information and use.
2. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
3. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and CONTRACTOR for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.
4. Manage contracts of Architect, CONTRACTOR and CxA.
5. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
6. Provide final approval for completion of commissioning Work.
7. Warranty Period: Ensure that seasonal or deferred testing and deficiency issues are addressed.

E. Architect: Responsibilities of the Architect as relate to Commissioning Process include, but are not limited to the following:

1. Attend commissioning scoping meeting and other commissioning team meetings as requested by Commissioning Authority and as selected by Architect.
2. Perform normal submittal review, construction observation, record drawing preparation, and operations and maintenance data preparation, as required by Contract Documents.
3. Review Commissioning Authority's submittal review comments and issue directive to CONTRACTOR and/or Design Professionals as deemed applicable.
4. Coordinate resolution of system deficiencies identified during commissioning, as required by Contract Documents. Review Commissioning Issues Logs and issue directives to CONTRACTOR and/or Design Professionals as applicable.
5. Prepare and submit final as-built design intent documentation for inclusion in Operation and Maintenance Data Manual, and review and approve Operation and Maintenance Data Manual.
6. Review Commissioning Report and issue directive to resolve all outstanding deficiencies prior to project close-out.
7. Warranty Period: Coordinate resolution of design non-conformance and design deficiencies identified during warranty period commissioning.

F. Design Professionals Responsible for Design of Each Portion of Work Being Commissioned:

1. Perform normal submittal review, construction observations, and record drawing preparation, as required by Contract Documents. Perform site observation immediately preceding system startup.
2. Respond to deficiencies identified by Commissioning Authority as directed by Architect.
3. Provide design narrative and sequence documentation requested by Commissioning Authority. Assist, along with CONTRACTOR, in clarifying operation and control of commissioned equipment in areas where specifications, control drawings, or equipment documentation are not sufficient for writing detailed testing procedures.
4. Attend commissioning scoping meetings and other commissioning team meetings as requested by Commissioning Authority and as directed by Architect or responsible design professional.

5. Participate in resolution of system deficiencies identified during commissioning, as required by Contract Documents.
6. Prepare and submit final as-built design intent and operating parameters documentation for inclusion in Operation and Maintenance Manual, and review and approve Operation and Maintenance Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Authority

1. The Commissioning Authority carries out his responsibilities as the Owner's authorized agent in accordance with plans, specifications, and contractual requirements.
2. CxA reports deficiencies found to the CONTRACTOR, Architect and Owner.
3. The Architect evaluates deficiencies and issues directive to CONTRACTOR to remedy CxA's deficiencies lists, in accordance with contract documents.
4. No change in scope work is to take place without express written consent of Owner. Any deficiencies identified by CxA that are deemed by Architect to be outside of the scope of work shall be discussed with Owner for consideration.
5. CONTRACTOR and CxA are to copy Architect on all correspondence related to the commissioning process.

B. CONTRACTOR Participation In The Commissioning Process

1. Attend meetings related to Commissioning process and arrange for attendance by subcontractors and vendors prior to commissioning of their systems, at the discretion of CxA.
2. Provide skilled technicians to start and test all systems, and place systems in complete and fully functioning service in accordance with contract documents and design intent.
3. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist CxA in commissioning process.
4. Attend initial commissioning team scoping meeting, pre-commissioning meetings specific to each system, and other meetings requested by CxA as required to discuss resolution of deficiencies.
5. Coordinate with sub-Contractors and equipment vendors/representatives to set aside adequate time to address Pre-Functional Checklists, Functional Testing, Operations and Maintenance Training, and associated coordination meetings.

C. Work Prior To Testing

1. A commissioning team scoping meeting shall be held at a time and place designated by Commissioning Authority. Owner, Architect, Commissioning Authority, Contractor, and Mechanical, Electrical, and Controls Contractors, shall be present at this meeting. The main objectives of the meeting are to familiarize all parties with the requirements of the commissioning process; to ensure that the responsibilities of each party are clearly

understood; and obtain information to develop the preliminary commissioning plan, including:

a. Personnel representing the various entities participating in the process (CONTRACTOR, subcontractors, Owner, Architect, Engineer, CxA)
b. Lines of communications;
c. Assignment of responsibilities;
d. Review pre-functional checklists;
e. Submittal schedule;
f. Preliminary construction schedule

2. Following the initial commissioning team scoping meeting, and upon reviewing submittals, CxA shall prepare a Preliminary Commissioning Plan outlining procedures and responsibilities, including names and contact information of responsible parties, tentative dates for commissioning activities, and pre-functional checklists. Preliminary Commissioning Plan shall be distributed to CONTRACTOR and Owner electronically for review and comment. CxA shall modify the Commissioning Plan based on feedback from CONTRACTOR and Owner and will generate a final Cx Plan.
3. Prior to pre-functional and functional testing, CxA will conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate
4. CONTRACTOR shall complete all phases of the work so the systems can be started, tested, adjusted, balanced, and otherwise commissioned.
5. CONTRACTOR shall verify requirements of Divisions 22, 23 and 26 outlining responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.
6. Convene system-specific pre-commissioning meetings prior to start of pre-functional testing of each system. The CONTRACTOR shall hold a pre-commissioning meeting with all Team members in attendance. The purpose of the meeting is to review the pre-functional checklists, and equipment start-up procedures for each system to be commissioned, confirm that systems are ready for testing, and define a schedule for testing activities.
7. A minimum of seven (7) days prior to any verification by CxA (Pre-functional Checklists or Functional Testing) submit to Commissioning Authority for review copies of all required completed checklists, start-up forms, and test procedures CONTRACTOR proposes to perform to demonstrate conformance of systems to specifications and commissioning checklists.

D. Pre-functional checks and functional performance tests

1. The CONTRACTOR shall provide all materials, services, and labor required to operate equipment and/or system in order to perform the pre-functional checks and functional performance tests. A pre-functional check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating commissioning team member of which participation is specified is not present for the test. The CONTRACTOR shall reimburse the Owner and A/E for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable).
2. Functional performance tests may sometimes duplicate the checking, testing, and inspection methods established in related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide required information. Testing and verification required by this section shall be performed during the

Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section without the approval of CxA.

3. Follow start-up and initial checkout procedures listed in article titled "RESPONSIBILITIES" in Part 1, and additional requirements specified in this Section. Divisions 22, 23 and 26 have startup responsibilities and are required to complete systems and sub-systems so systems are fully functional, meeting design requirements of Contract Documents. Commissioning procedures and functional testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

E. Work To Resolve Deficiencies

1. Complete corrective work in a timely manner to allow expeditious completion of commissioning process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be CONTRACTOR's responsibility.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. General

1. Pre-functional checklists are important to ensure that equipment and systems are properly installed and connected in accordance with specifications, drawings, manufacturer's requirements, and all applicable codes.
2. Checklists ensure that system start-up and functional performance testing (in-depth checkout) may proceed without unnecessary delays.
3. Completion of pre-functional checklists, startup, and checkout shall be directed and executed by authorized subcontractors or vendors. Only individuals that have direct knowledge and who witnessed that line item task on pre-functional checklist was performed shall initial or check item off.
4. Each piece of equipment and major distribution system receives full pre-functional checkout. No sampling strategies are used.
5. Pre-functional checkout for given system must be successfully completed prior to requesting verification by CxA and to formal functional performance testing of equipment or subsystems of given system.

B. Pre-functional Checklists

1. Pre-functional performance tests shall be documented in a checklist format, as prepared and provided by CxA, for each piece of equipment. Each checklist shall be initialed by CONTRACTOR, verifying that all items on checklist have been addressed and completed.
2. Commissioning Pre-functional checklists are not to preclude CONTRACTOR or its subcontractor or vendors from applying their own construction inspection checklists.
3. All system elements shall be checked to verify that they have been installed, adjusted, and calibrated properly, that all connections have been made correctly, and that it is ready to be started-up and function as specified. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, control sequence, and other conditions which may cause damage.

4. Verify that tests, meter readings and specific electrical characteristics agree with those required by equipment or system manufacturer.
5. All discrete elements and sub-systems shall be adjusted and shall be checked for proper operation.
6. Verify wiring and support components for equipment are complete and tested.
7. Do not conduct start-up procedure recommended by equipment/system manufacturer prior to pre-functional testing.
8. When filling-out Pre-Functional Checklists, subcontractors shall clearly list outstanding items that were not successfully verified by noting them at bottom of procedures form or on separate sheet attached to form. Installing subcontractor or vendor shall correct deficient or incomplete areas in timely manner and shall submit updated pre-functional checklist and startup report with statement of correction on original non-compliance report.
9. Upon completion of pre-functional checklists for a particular system or subsystems CONTRACTOR will request verification by CxA.
10. Completed forms and attached start-up and documentation sheets shall be provided to Commissioning Authority seven (7) days prior to requested verification date.
11. CONTRACTOR and subcontractors shall accompany CxA during pre-functional checklist verification.
12. If during pre-functional checklist verification, CxA finds a significant number of deficiencies, CONTRACTOR shall have all the checklists associated with similar system redone.

3.3 SYSTEM START-UP

A. CONTRACTOR will arrange for start-up of operating equipment and systems after completion of pre-functional checklists and prior to requesting CxA verification. In some cases (at CxA's discretion and when in the best interest of the project schedule), equipment start-up by specialized vendors may take place at the same time as CxA verification of pre-functional checklists.

B. Start-up of equipment and systems shall be performed only by a manufacturer's representative, or person(s) who are specifically manufacturer-approved. All start-up personnel shall be trained and authorized, experienced and knowledgeable in the operations of such equipment and systems.

C. Coordinate schedule for start-up of various equipment and systems so that subsystems required for major systems operation are tested first.

D. Manufacturer's start-up reports must be submitted to CxA prior to scheduling Functional Testing.

3.4 FUNCTIONAL TESTING

A. The objective of Functional Testing is to demonstrate that each system is operating according to documented design intent and Contract Documents, through all possible modes of operation.

B. CONTRACTOR and sub-Contractors shall include in his bid proposal all costs associated with preparation and execution of Testing Procedures for all systems to be commissioned in accordance with requirements specified under Divisions 22, 23 and 26

C. Functional testing is intended to begin after pre-functional checklists have been completed and verified for all related systems. Functional testing for some systems/subsystems may proceed prior to pre-functional verification of all systems at discretion of Commissioning Authority. Beginning system testing before completion does not relieve CONTRACTOR from fully completing all work, including pre-functional checklists as early as possible.

D. CONTRACTOR and sub-Contractors shall provide detailed Testing Procedures and resources that will allow all items to be verified.

E. Testing shall be conducted under specified operating conditions as recommended or approved by Commissioning Authority.

F. A Functional Performance Test shall be performed on each complete system. Each function shall be demonstrated to the satisfaction of Commissioning Authority in accordance with proposed test procedures developed to demonstrate compliance with specifications.

G. Each Functional Test shall be witnessed and signed off by Commissioning Authority upon satisfactory completion. Functional Test is not to be considered complete until Owner accepts Commissioning Authority's recommendation for completion.

H. All elements of system shall be tested to demonstrate that total systems satisfy all requirements of these specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each subsystem, followed by the entire system, followed by any inter-ties to other major systems.

I. Notification, Scheduling Of Functional Testing and Re-Testing

1. Notify CxA and Owner, in writing, of request for scheduling Functional Testing. Submit request no fewer than seven (7) days prior to desired date for beginning functional testing.

    a. CONTRACTOR must certify that systems and equipment are functioning satisfactorily, according to specifications and design intent, prior to requesting Functional Testing. Upon receipt of such certification, CxA will schedule with CONTRACTOR a time for the particular system test.

        1) CxA will attempt to schedule Functional Testing when convenient for CONTRACTOR and his vendors, and to minimize lost time to CONTRACTOR.

    b. CONTRACTOR will resolve all deficiencies identified during initial test prior to submitting request, in writing, for re-testing. Such request for re-testing shall certify that CONTRACTOR has resolved all deficiencies, or list reason why any deficiencies remain which cannot be resolved.

    c. CxA will witness re-test to ensure that all deficiencies have been resolved.

        1) Deficiencies that were not detected in first Functional Test, but are discovered in subsequent re-testing, are to be resolved by CONTRACTOR as if they had been discovered in initial testing.

J. Functional Testing Requirements and Procedures:

1. CONTRACTOR and sub-Contractors shall perform tests in the presence of CxA. Tests not witnessed by CxA shall not be considered complete.
2. To facilitate Functional Testing, CONTRACTOR shall provide services of personnel to accompany CxA for the duration of Functional Testing, including any follow-up testing. Such personnel must be experienced, qualified, and intimately familiar with the system being tested.

    a. Participation by representative(s) of direct digital controls (DDC) systems is of particular importance in Functional Testing. All systems which are controlled and/or monitored by DDC are to be thoroughly tested, point by point, through all modes of operation, with the assistance of manufacturer's representative. DDC graphics, setpoints, and programming are to be included as a part of Functional Testing as well.
    b. CONTRACTOR's or subcontractor's assigned personnel shall be responsible for subjecting systems to test procedures. Should these personnel suspect that a given test condition may be detrimental to the system or equipment, he/she shall notify CxA and test shall be aborted.
    c. CONTRACTOR continues to bear full responsibility for equipment warranty throughout the Commissioning process. Owner and CxA will not be held responsible for damage to equipment, or other actions which might impact warranty, when performing Functional Testing of systems.

3. Each system shall be operated through all modes of operation including, but not limited to seasonal, occupied, unoccupied, warm-up, cool-down, part-load, and full-load, where system response is specified.

    a. For multiple units, sampling strategy established by Commissioning Authority and subject to approval of Owner may be used.
    b. Verification of each sequence in sequences of operation is required.
    c. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, and the like, shall also be tested.

4. Where possible, inspections carried out on systems by local Authorities Having Jurisdiction (AHJ) may serve as Functional Testing for purposes of Commissioning.

    a. CxA will accompany AHJ during testing procedures required by AHJ.
    b. It is responsibility of CONTRACTOR to arrange for testing by AHJ and to coordinate with CxA to find mutually convenient times for testing. Provide CxA a minimum of four days in advance of intent to schedule testing by AHJ.
    c. CxA will issue a separate report with results of testing.
    d. CxA reserves the right to require additional testing, should testing by AHJ not adequately cover all system components in all modes of operation.

5. Functional Testing is to be dedicated solely to testing of equipment and systems, and not to resolution of deficiencies. Deficiencies identified during testing process must be corrected by CONTRACTOR at a time other than during Functional Testing.
6. Within six days of performing functional test, CxA will issue test report with findings and a list of deficiencies that must be addressed by CONTRACTOR or sub-Contractors.
7. Commissioning Authority shall submit a Final Report to Owner recommending acceptance or non-acceptance of individual system components as well as the systems as a whole.

K. Re-Testing and Failure To Remedy Deficiencies:

1. Despite CONTRACTOR's best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is CONTRACTOR's responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is CONTRACTOR's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.

    a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond CONTRACTOR's control to resolve expeditiously.
    b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)

4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving CONTRACTOR's request.

    a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, CONTRACTOR will be back-charged for CxA's expenses, and time at a rate of $120 per hour, for a third and any subsequent re-inspections and re-tests.

3.5 DEFERRED TESTING

A. "Seasonal Commissioning" pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by CONTRACTOR and CxA.

1. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.
2. CONTRACTOR is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
3. Until off-season commissioning can be accomplished, Owner may retain an amount from CONTRACTOR's payment sufficient to cover the cost of off-season testing.

B. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.

1. CONTRACTOR is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.
2. Until deferred testing can be accomplished, Owner may retain an amount from CONTRACTOR's payment sufficient to cover the cost of deferred testing.

3.6 TRAINING

A. The following requirements are in addition to operation and maintenance requirements specified elsewhere in this specifications manual. CONTRACTOR shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

B. Scheduling

1. Organize training to fit Owner's schedule and to optimize the learning experience. Limit continuous sessions to no more than four hours, or otherwise only as approved by Owner and/or Architect.
2. Provide an outline of the proposed training agenda for review by Owner and CxA a minimum of 10 days prior to proposed date for training session.
3. Provide CxA a minimum 5 days advance notice of intent to carry out a training session.
4. The CxA will not be required to attend all training sessions for building personnel, but will attend selected sessions and monitor progress and content.
5. No training will take place prior to successful completion of Functional Testing.

C. Training Materials

1. Develop Training Manuals to meet requirements of individual equipment specification sections.
2. Operating and Maintenance Manuals alone are NOT considered training manuals. O&M Manuals may be used as reference, but shall not be considered to meet requirements for training materials.
3. Develop a detailed outline showing how training program will be organized, including classroom and hands-on training as required by individual specifications sections.
4. Provide with training materials, a quick-reference "how-to" index which will allow operators to easily access information included in Training Manuals and/or O&M Manuals. This reference will include, as a minimum; routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions.
5. Refer to individual equipment or system specifications and paragraph 3.10 of this specification for minimum requirements.

D. Documentation

1. All training sessions are to be fully documented. Document:

    a. Basic information on training session (name of system, time, date, and location of training, name of presenter, length of training session, etc.).
    b. Names of persons who attended the training session (provide a sign-in sheet).
    c. Signature from authorized Owner's representative indicating that training took place and was satisfactory.

2. Provide CxA copy of sign-in sheet with training session documentation.

E. System-Specific Training Requirements:
   1. General:
      a. Participants that will receive training on the systems will be determined by Owner.
      b. The minimum level of instruction and topics to be covered for each system are as follows:
         1) Emergency instructions and procedures.
         2) Operation instructions and procedures.
         3) Troubleshooting procedures.
         4) Maintenance and inspection procedures.
         5) Repair procedures.
         6) Upkeep the system manual and associated maintenance documentation logs.

3.7 SPECIAL WARRANTY

A. Provide special warranty in accordance with equipment specifications. Refer to the tables in paragraph 3.10 for a summary.

3.8 O&M MANUALS

A. Provide operation and maintenance manuals as specified in section 017700 Closeout Submittals, and as outlined in individual sections of Divisions 22, 23 and 26.

B. Provide CxA with a single copy of Operation and Maintenance Manuals for review. CxA's copy of O&M manuals shall be submitted through Architect.

C. CxA shall review O&M Manuals and submit comments through the Architect.

3.9 SYSTEMS TO BE COMMISSIONED

A. Plumbing Systems

B. HVAC Systems

C. Electrical Systems

Refer to Div. 22, 23, and 26 for specific tasks associated with each system.

END OF SECTION

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

SECTION 01 74 19

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Construction and demolition waste management goals, plan, and records.

2. General requirements for compliance with certain LEED and AEGB prerequisites and credits

B. Related Sections:

1. 01 81 13 Sustainable Construction Requirements

1.2 REFERENCES

A. City of Austin Construction and Demolition Ordinance, 20151119-098
http://www.austintexas.gov/edims/document.cfm?id=244998
Austin Resource Recovery, Online Construction Recycling Report,
https://connect.re-trac.com/registration/austin-cdordinance

1.3 WASTE MANAGEMENT REQUIREMENTS

A. Reuse, salvage, or recycle non-hazardous waste materials.

B. Maximize diversion of non-hazardous construction and demolition debris from landfill.

C. Prioritize non-hazardous construction waste management in following order:

1. Reduce amount of waste generated.

2. Reuse materials through on-site reuse or off-site salvaging, including sale or donation.

3. Recycle materials including diverting materials for secondary uses whenever economically feasible.

4. Properly dispose of materials with no practical use or economic benefit at permitted landfill.

D. Divert minimum 75 percent of non-hazardous construction and demolition waste by weight (in tons) from landfills through reuse, recycling and composting. Land clearing debris and excavated soil and rocks do not contribute to the calculation.

E. Comply with the provisions of City of Austin No. 20151119-098 “Construction and Demolition Ordinance”.

1.4 CONSTRUCTION WASTE MANAGEMENT

A. Take proactive role in management of construction and demolition waste:

1. Practice efficient waste management when sizing, cutting, and installing products.

2. Facilitate reuse and recycling and utilize all reasonable means to divert construction and demolition waste from landfills.

3. Return unused products and overages to supplier, or donate to non-profit group.

4. Carefully install products; avoid removal of ill-timed and poorly installed products.

5. Use centralized cutting areas to facilitate waste collection.

6. Deliver, store, and handle products to prevent damage.

7. Specify delivery of product and materials with minimum packaging; all packaging shall be specified as reusable and returned to manufacturer, or recyclable.

B. Require subcontractors and suppliers to implement the Construction Waste Management Plan by prioritizing waste reduction, reuse, and recycling.

C. Construction waste includes:

1. Products from demolition and removal.

2. Excess and unusable construction products.

3. Packaging materials for construction products.

4. Other materials generated during construction process but not incorporated into the work.

D. Give consideration to:

1. Availability of viable recycling markets.

2. Condition of materials.

3. Ability to provide material in suitable condition and in quantities acceptable to available markets.

4. Time constraints imposed by internal project completion mandates.

E. Be responsible for implementation of special programs involving rebates and similar incentives related to recycling of waste.

F. Revenues and other savings obtained for salvage and recycling accrue to Contractor.

G. Ensure that firms and facilities used for recycling, reuse, and disposal have legal permits for intended uses.

1.5 SUBMITTALS

A. Construction Waste Management Plan:

1. Submit Construction Waste Management Plan within ten days after Notice to Proceed and prior to initiating site preparation.

2. Include:

a. Name and contact information of individual on Contractor's staff responsible for waste prevention and management.

b. Actions proposed to reduce solid waste generation and achieve waste diversion goal.

c. Description of proposed methods for recycling and reuse of materials generated, including areas and equipment for processing, sorting, and temporary storage.

d. Identification of at least 5 material streams and estimated quantities, in tons, of waste to be generated.

e. Name of construction debris haulers and landfills to be used.

f. Name of recycling service providers and recycling collection facilities to be used.

g. Identification of local and regional reuse programs that will accept waste materials.

h. List of waste materials to be salvaged for resale, donation, salvaged and reused, or recycled. Identify recycling facilities to be used.

i. Identification of materials that cannot be recycled or reused, with justification.

3. If required, revise and resubmit Construction Waste Management Plan within ten days after receipt of comments.

4. Distribute copies of approved Construction Waste Management Plan. Update Construction Waste Management Plan periodically through duration of Project to reflect changed conditions.

B. Construction Waste Management Documents:

1. Maintain records to document:

a. Quantities of waste generated, in tons.

b. Quantities of waste diverted through sale, donation, reuse, or recycling, in tons, and diversion location.

c. Quantities of waste sent to landfill in tons

2. Submit monthly summary of waste disposal and diversion to date in conjunction with each request for payment.

3. Keep records of manifests, weight tickets, receipts, or invoices, identifying Project and waste material(s), to be available upon request.

4. Deliver final summary of solid waste disposal and diversion to Architect upon completion of project. If commingled, provide evidence of facility's average recycling rates, or project-specific recycling rates.

5. Use the following solid waste conversion factors when weight tickets are not available:

Asphalt	**1,380 lbs/CY**
Wood Pallets	**300 lbs/CY**
Concrete	**1,400 lbs/CY**
Concrete Washout	**1,400 lbs/CY**
Clean Wood	**300 lbs/CY**
Miscellaneous Wood Scraps	**300 lbs/CY**
Wood Chips	**500 lbs/CY**
Steel	**1,000 lbs/CY**
Miscellaneous Metals	**100 lbs/CY**
Gypsum Wallboard/Sheetrock	**500 lbs/CY**
Plastics/Plastic Bottles	**76 lbs/CY**
Cardboard	**100 lbs/CY**
Glass Bottles	**600lbs/CY**
Aluminum Cans	**175 lbs/CY**
Miscellaneous Waste	**350 lbs/CY**
Job Trailer Paper	**150 lbs/CY**

1.6 QUALITY ASSURANCE

A. Review and discuss Construction Waste Management Plan implementation and progress at Preconstruction Conference and Progress Meetings.

1.7 DELIVERY, STORAGE AND HANDLING

A. Designate separate areas to facilitate separation of materials for potential recycling, salvage, reuse and return.

B. Identify areas and receptacles with signage clearly written in both English and Spanish.

C. Keep storage areas and receptacles clean and orderly; prevent contamination of materials.

D. Monitor storage areas; correct problems and implement preventative measures.

1.8 TRAINING

A. Provide training of construction waste management methods to be used at appropriate stages of Project.

B. Include Construction Waste Management as an agenda item for Pre-Construction meeting, at each Pre-Installation meeting, and at weekly site meetings.

B. Require participation of all subcontractors.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 CONSTRUCTION AND DEMOLITION RECYCLABLES COLLECTION

A. Designate and clearly label containers and storage areas to facilitate construction waste management. Provide signage written in both English and Spanish.

B. Separate recyclable materials from other waste materials to prevent contamination by incompatible products and materials.

C. Separate recyclable materials by:

1. Placing into marked separate containers, then transporting to recycling facility.

2. Placing into single container, then transporting to commingled recycling facility for separation.

D. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

3.2 DISPOSAL

A. Dispose of nonhazardous waste materials that cannot be reused,

recycled, or salvaged at permitted landfill.

B. Handle, store, and dispose of hazardous wastes in accordance with applicable codes, ordinances, rules, and regulations.

C. Do not burn or incinerate waste materials.

3.3 REPORTING

A. Upon request of Final Building Inspection, prepare and submit City of Austin Construction Recycling report (https://connect.re-trac.com/registration/austin-cdordinance) providing the following information:

a. Contact information for general contractor and owner
b. Permit numbers, floor area, location address
c. Tons of materials landfilled
d. Tons of materials diverted form landfilling
e. Weight ticket summary or Qualified Processor report

END OF SECTION 01 74 19

SUSTAINABLE CONSTRUCTION REQUIREMENTS

SECTION 01 81 13

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. General requirements and procedures for sustainable construction practices.

2. General guidelines for AEGB, LEED v4 with recommended v41 Beta credit substitutions, and AISD Sustainability Scorecard. Documentation requirements needed to verify compliance may not be specifically identified in this section.

B. Related Sections:

1. General Conditions – Payment Procedures

2. Section 01 35 46 – Indoor Air Quality Management

3. Section 01 74 19 – Construction Waste Management and Disposal

4. Section 01 65 00 – Commissioning Requirements

5. Divisions 1 through 33 Sections for sustainability requirements specific to the work of each of those sections.

1.02 DEFINITIONS

A. Austin Energy Green Building (AEGB) Commercial Program: Local green building rating system. Source for AEGB commercial rating packet with materials calculators: https://www.greenbuildingsystem.austinenergy.com/Login/Help.aspx (choose 'commercial' option).

B. Austin ISD Sustainability Scorecard: Criteria for projects with limited scope that are not whole building or major renovation projects, and not suited for AEGB or LEED.

C. Bio-Based Materials: Materials that are tested using ASTM D 6866 and are legally harvested, as defined by the exporting and receiving country. Meetings

the Sustainable Agriculture Network's Sustainable Agriculture Standard is required for projects pursuing LEED v4 MRc BPDO-Sourcing of Raw Materials; voluntary for LEED v4.1.

D. California Department of Public Health (CDPH) Standard Method v1.1-2010 and v1.2-2017: General VOC emissions testing protocol. https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx#material

E. Carpet and Rug Institute: Green Label Plus testing program for low VOC carpet; Green Label certification for low VOC carpet cushion: www.carpet-rug.com

F. Chain-of-Custody: A document that tracks movement of wood from the forest to a vendor and is used to verify compliance with Forest Stewardship Council (FSC) guidelines.

G. City of Austin Lands Development Code Chapter 25-2 Subchapter E: Design Standards and Mixed Use, Article 2.5 Exterior Lighting: https://library.municode.com/tx/austin/codes/code_of_ordinances?nodeId=TIT25LADE_CH25-2ZO_SUBCHAPTER_EDESTMIUS_ART2SIDEST_S2.5EXLI

H. Composite Wood and Agrifiber: Product manufactured from wood particles or agricultural-based fiber, pressed and bonded with adhesive, resin and/or heat, included, but not limited to, particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.

I. Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer's product and the product's supply chain.

J. Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common product category rules and peer-reviewed. Resources:

1. EPD Database
2. UL's SPOT database (product specific)
3. UL's SPOT database (industry wide)
4. ICC-ES Website
5. NSF Website

K. Extended Producer Responsibility (EPR): Measures undertaken by a product manufacturer to accepts its own and sometimes other manufacturers' products as post-consumer waste at the end of the product's useful life.

L. Forest Stewardship Council (FSC): Chain-of-custody product certification for wood and wood products. ttps://us.fsc.org/

M. Green Seal Standard GS-11: VOC thresholds for paints, primers and anti-corrosive coatings; reference standard in AEGB Commercial Rating: www.greenseal.org

N. GREENGUARD: Product certification for low emitting interior building materials, furnishings, and finish systems; Gold level certification used as a basis to verify compliance with CDPH v1.1 and v1.2 emissions testing. http://greenguard.org/en/CertificationPrograms/CertificationPrograms_ChildrenSchools.aspx

O. Health Product Declaration (HPD): A standard specification format to report chemical content and associated health information for building products and materials.

P. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) “IAQ Guidelines for Occupied Buildings Under Construction.”

Q. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC certified wood products; materials reuse; recycled content; and other USGBC approved programs.

R. LEED v4: Building Design and Construction (BD+C) rating system: http://www.usgbc.org/resources/leed-v4-building-design-and-construction-current-version

S. LEED v4.1 Beta: Building Design and Construction (BD+C) rating system: https://new.usgbc.org/leed-v41#bdc

T. Material Ingredient Reporting: Document disclosing product content and associated health information for building products and materials Resources:
   1. HPD Public Repository
   2. Cradle to Cradle Registry
   3. Declare Label Search
   4. BIFMA search

U. Materials Reuse: Implementation strategies including salvaged, refurbished, or reused products.

V. Multi-Attribute Optimization: Third-party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication, tropospheric ozone creation; nonrenewable resource depletion.

W. Noise Reduction Coefficient (NRC): A scalar representation of how well a material reflects or absorbs sound. An NRC of 0 indicates perfect reflection; an NRC or 1 indicates perfect absorption.

X. Recycled Content Materials: The percentage of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer use (post-consumer).
    1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
    2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

Y. Regionally Sourced Materials: Materials that are sourced/harvested, manufactured and purchased within a 100-mile radius of the project site (LEED), or sourced and/or manufactured within Texas (AEGB). Manufacturing refers to the final assembly of components into the building product that are installed at the Project site.

Z. Safety Data Sheet (SDS): A standard format that contains information about occupational exposure to hazardous chemicals and risks, and recommended procedures for treating exposure. SDS' area used to verify chemical composition, including VOCs, of construction materials and products. They are federally required to be in workplaces where chemicals are present that meet Occupational Safety and Health Administration's (OSHA) definition of "hazardous": https://www.osha.gov/Publications/OSHA3514.html

AA. Scientific Certification Systems Global Services Indoor Advantage Gold: Certification for furniture, finishes and interior building materials used as a basis to verify compliance with CDPH v1.1 and v1.2 emissions testing: www.scsglobalservices.com

BB. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) "IAQ Guidelines for Occupied Buildings Under Construction," 2nd edition, Chapter 3 – Indoor air quality measures during construction: www.smacna.org

CC. South Coast Air Quality Management District (SCAQMD) Rule 1113: VOC limits for architectural coatings, asper most recent amendment: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1113.pdf

DD. South Coast Air Quality Management District (SCAQMD) Rule 1168: VOC limits for adhesives, sealants and sealant primers, as per most recent

amendment: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1168.pdf?sfvrsn=4

EE. Volatile Organic Compound (VOC): A chemical compound or mixture, derived from a vegetable or animal source (including certain minerals such as coal or petroleum that originally came from vegetable or animal sources), contained in a solid or liquid that volatilizes or evaporates at room temperature or an elevated temperature and, therefore, becomes present in the air or in discharge as vapor or smoke. For acceptable testing protocols, refer to California Department of Public Health (CDPH) Standard Method definition.

1.03 SUSTAINABLE CONSTRUCTION REQUIREMENTS

A. Adhere to requirements established by AISD and developed for project to advance sustainability and green building objectives using tools such as LEED, Austin Energy Green Building, as applicable to each project.

B. Construction Activity Pollution Prevention: Implement Erosion and Sedimentation Control Plan for all construction activities associated with this project. Monitor control measures periodically through site inspections and record maintenance activities taken during construction. Inspections must be recorded regularly via date-stamped photographs, inspection reports, or other recording processes.

C. Indoor Air Quality Management: Comply with requirements set forth in 01 35 46 Indoor Air Quality Management.

D. Construction and Demolition Waste Management: Comply with requirements set forth in 01 74 19 Construction Waste Management and Disposal.

E. Integrated Pest Management: Comply with the requirements of AISD Integrated Pest Management Plan, including specific alignment with termite control requirements.

F. For new construction projects, prior to commencement of construction, conduct a Phase I Environmental Site Assessment as described in ASTM E1527-05.

1. If contamination is suspected, conduct a Phase II Environmental Site Assessment as described in ASTM E1903-11.

2. If site is confirmed to be contaminated, remediate site to meet local, state or national environmental protection agency residential (unrestricted) standards, whichever are most stringent.

G. For renovation projects: adhere to requirements to achieve the goals and guidelines as established by AISD and developed for project to advance sustainability and green building objectives using tools such as LEED, AEGB, and/or AISD Sustainability Scorecard, as applicable to each project.

H. Obtain Architect's approval of substitution, change, or alteration of sustainable materials and systems and installation procedures prior to incorporation into Project.

I. Assist Architect in providing project sustainability documentation.

J. Provide submittals required to verify compliance with LEED, AEGB, and/or AISD Sustainability Scorecard criteria on a scheduled basis as requested by Architect, Contractor, or other authorized party. For each submitted material and product requiring sustainability documentation, provide completed AISD Sustainability Submittal Sheet (Appendix E).

1.04 SUBMITTALS

A. For all projects, provide the following:

1. Rating System Compliance Tracking:

a. Use one or more of the following documents as appropriate / relevant to individual project scope. Assist Architect in completing and keeping current through project design and construction:

i. Appendix A for LEED v4 for Schools Checklist
ii. Appendix B for LEED v4 New Construction and Major Renovations Checklist
iii. Appendix C for AEGB Scorecard
iv. Appendix D for AISD Sustainability Scorecard

2. Use AISD Sustainability Submittal Sheet (Appendix E) for subcontractors to complete, coordinated with submittal process.

a. Materials and Products Cost Documentation: Submit documentation for each material and product submitted as follows:

i. Identify materials by specification section number.

ii. Provide separate line item for each material submitted.

iii. Cost data: include materials cost data, excluding labor and equipment, for each line item submitted.

3. Environmental Reports:

    a. Phase I Environmental Site Assessment (ESA), to be completed preferably 180 days prior to construction commencement, or within a time period within which no substantive activities that could affect the ESA have occurred.

    b. Other reports as determined necessary per Phase I Environmental Assessment findings.

4. Project Materials Cost Data: Submit documentation necessary for calculating materials-related credits.

    a. Schedule of Values: Submit a schedule of materials costs, excluding labor and equipment, for Divisions 3-10, 31 (Section 31.60.00 Foundations) and 32 (Sections 32.10.00 Paving, 32,30.00 Site Improvements, and 32.90.00 Planting).

5. Construction Management Plans:

    a. Indoor Air Quality Management Plan: Complying with Division 1 Section 01 35 46 “Indoor Air Quality Management.”

    b. Construction and Demolition Waste Management Plan: Complying with Division 1 Section 01 74 19 “Construction Waste Management and Disposal.”

6. Progress Reports:

    a. Indoor Air Quality Management Reports: Verifying compliance with Division 1 Section 01 35 46 “Indoor Air Quality Management.”

    b. Construction and Demolition Waste Management Reports: Monthly progress reports verifying diversion of waste from the landfill to comply with Division 1, Section 01 74 19 “Construction Waste Management and Disposal.”

    c. Construction Activity Pollution Prevention Reports: Verifying compliance with Erosion and Sedimentation Control Plan and Stormwater Pollution Prevention Plan (SWPPP).

7. Documentation:

a. Native and Non-Invasive Adapted Species: Submit documentation verifying all plants are native or non-invasive adapted species. Refer to Landscape section of Project Design Manual.

b. Light Pollution Reduction:

   i. Submit backlight / uplight / glare (BUG) ratings and cut sheets for all exterior light fixtures.
   ii. Provide maximum illuminance data for internally illuminated exterior signage (daytime / nighttime).

c. Indoor Water Use Reduction: Submit cut sheets for all faucets, showerheads, toilets and urinals indicating flow rates (gallons/minute) and flush volumes (gallons/flush), and for appliances and equipment including for clothes washers, dishwashers, pre-rinse spray valves, ice machines, cooling towers, food steamers, combination ovens as applicable to project.

d. Building Systems Commissioning – Mechanical, Electrical, Plumbing: Comply with Division 1 Section 01 65 00 “Commissioning Requirements” and prepare Owner’s Project Requirements and Basis of Design.

e. Refrigerant Management: Verify no CFCs in HVAC and refrigeration systems, and provide global warming potential, ozone depletion and leakage data for HVAC and refrigerant systems containing >0.5 lb of refrigerants.

f. Construction Waste Management: Comply with Division 1 Section 01 74 19 “Construction Waste Management and Disposal.” Document implementation of Construction and Demolition Waste Management Plan; verify minimum 75% diversion of non-hazardous construction waste by weight.

g. Building Product Disclosure and Optimization (required as relevant to certification strategy pursued):

   i. Submit Environmental Product Declarations and Material Ingredient Reporting documents disclosing product content and associated health information for building projects and materials.
   ii. Submit product data indicating leadership extraction practices which include: extended producer responsibility; bio-based materials; FSC certified wood products;

materials reuse; recycled content; and other USGBC approved programs.

h. Low-Emitting Materials:

i. Submit product data, indicating compliance with VOC content, CDPH emissions testing certification, formaldehyde emissions and/or furniture evaluation.
ii. Submit low-emitting materials calculator listing all relevant products used on the project.

i. Construction Indoor Air Quality Management Plan: Comply with Division 1 Section 01 35 46 “Indoor Air Quality Management” and document implementation of IAQ Management Plan during construction.

j. Acoustical Performance: Select acoustic wall panels, ceiling finishes, and other sound-absorbent finishes with an NRC or 0.70 or higher.

1.05 QUALITY ASSURANCE

A. Designate personnel on Contractor’s staff responsible for instructing workers and overseeing and documenting compliance with sustainable design and construction requirements for Project. Provide contact name and information.

B. Require compliance with sustainability requirements through design and construction by subcontractors and suppliers.

C. Include sustainability goals and status updates as agenda items for Pre-Construction conference, Pre-Installation meeting and weekly subcontractor meetings.

PART 2 – PRODUCTS

2.1 GENERAL

A. Provide products and procedures necessary to comply with the requirements of LEED, AEGB, IASD Sustainability Scorecard credits, as relevant to project scope, required in this Section. Although other Sections may specify some requirements that contribute to these credits, the Contractor shall determine additional products and procedures necessary to comply.

1. Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit

calculations. Also excluded are products purchased for temporary use on the project, like formwork for concrete.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION (BPDO)

A. Environmental Product Declarations (EPDs) (LEED MRc BPDO – EPD, Option 1): Provide at least 20 permanently installed products (sourced form at least 5 different manufacturers) which have at least a cradle-to-gate scope and meet one of the disclosure criteria:

1. Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment (LCA) conforming to ISO 14044. Valued as ¼ product in v4; one whole product in v4.1.

2. Product-Specific Type III EPD (internally reviewed): A product with an internally critically reviewed LCA in accordance with ISO 14071. EPDs which conform to ISO 14025, and EN 15804 or ISO 21930. Valued as one whole product in v4.1.

3. Industry-Wide (Generic) EPD: A product with third-party certification (type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. Must conform to ISO 14025, and EN 15804 or ISO 21930. Valued as ½ of a product in v4; one whole product in v4.1.

4. Product-Specific Type III EPD (externally verified): A product with a third-party certification (type III, including external verification, in which the manufacturer is explicitly recognized by the program operator. Valued as one whole product in v4; 1 ½ products in v4.1.

B. Responsible Sourcing of Raw Materials (LEED MRc BPDO Leadership Extraction Practices / Responsible Sourcing of Raw Materials): Provide products that meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project. (Note: Option 1: Raw Material Source and Extraction Reporting was removed in v4.1):

1. Extended producer responsibility program

2. Bio-based materials

3. Certified Wood: New wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products certified by the Forest Stewardship Council:

i. Rough carpentry.
ii. Miscellaneous carpentry.
iii. Heavy timber construction.
iv. Wood decking.
v. Metal-plate-connected wood trusses.
vi. Structural glued-laminated timber.
vii. Finish carpentry.
viii. Architectural woodwork.
ix. Wood paneling.
x. Wood veneer wall covering.
xi. Wood flooring.
xii. Wood cabinets.
xiii. Furniture (may be included, provided consistently included in all MR credits).

4. Materials Reuse.

    i. Salvaged, refurbished or reused products.

5. Recycled Content.

    i. Post-consumer and pre-consumer (valued at ½).

C. Material Ingredients

1. Material Ingredient Reporting (MRc BPDO Material Ingredients: Option 1 – Material Ingredient Reporting):

    a. Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:

        i. Manufacturer Inventory: GreenScreen / Globally Harmonized System (GHS)
        ii. Health Product Declaration (HPD)
        iii. Cradle to Cradle (C2C) Certified / Material Health Certificate
        iv. Declare product label
        v. Living Product Challenge (v4.1 only)
        vi. ANSI / BIFMA e3 Furniture Sustainability Standard
        vii. UL Product Lens Certification
        viii. FACTS: NSF / ANSI 336

2. Material Ingredient Optimization (MRc BPDO Materials Ingredient: Option 2 – Material Ingredient Optimization, restructured in v4.1).

(Note: Option 3: Product Manufacturer Supply Chain Optimization was removed in v4.1):

a. Use permanently installed products from at least three different manufacturers that document their material ingredient optimization using the paths below. Choose either 10 compliant products, or select products that constitute at least 10% by cost, of the total value of permanently installed products in the project, aligned with one of the following criteria:

   i. Material Screening and Optimization Action Plan
   ii. Advanced Inventory and Assessment
   iii. Material Ingredient and Optimization

2.3 LOW-EMITTING MATERIALS STANDARDS

A. Low-Emitting Material Categories

1. Paints and Coatings

a. For field applications inside the weatherproofing membrane, use paints and coatings that comply with VOC content limits when calculated according to California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the current South Coast Air Quality Management District (SCAQMD) Rule #1113.

b. Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health (CDPH), Standard Method v1.1-2010 or v1.2-2017 using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (TVOC) as follows:

   i. 0.5mg/m3 or less
   ii. Between 0.5 and 5.0 mg/m3, or
   iii. 5.0 mg/m3 or more

c. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

SCAQMD Rule 1113 PAINTS AND COATINGS CATEGORIES	VOC Limit (g/L) Effective Date 1/1/19
Bond Breakers	350
Building Envelope Coatings	50
Concrete-Curing Compounds	100
Concrete-Curing Compounds For Roadways and Bridges	350
Concrete Surface Retarder	50
Default	50
Driveway Sealer	50
Dry-Fog Coatings	50
Faux Finishing Coatings	
Clear Topcoat	100
Decorative Coatings	350
Glazes	350
Japan	350
Trowel Applied Coatings	50
Fire-Proofing Coatings	150
Flats	50
Floor Coatings	50
Form Release Compound	100
Graphic Arts (Sign) Coatings	200
Industrial Maintenance (IM) Coatings	100
Color Indicating Safety Coatings	480
High Temperature IM Coatings	420
Non-Sacrificial Anti-Graffiti Coatings	100
Zinc-Rich IM Primers	100
Magnesite Cement Coatings	450
Mastic Coatings	100
Metallic Pigmented Coatings	150
Multi-Color Coatings	250
Nonflat Coatings	50
Pre-Treatment Wash Primers	420
Primers, Sealers, and Undercoaters	100
Reactive Penetrating Sealers	350
Recycled Coatings	150
Roof Coatings	50
Roof Coatings, Aluminum	100
Roof Primers, Bituminous	350
Rust Preventative Coatings	100
Sacrificial Anti-Graffiti Coatings	50
Shellac	
Clear	730
Pigmented	550

Specialty Primers	100
Stains	100
Stains, Interior	250
Stone Consolidants	450
Swimming Pool Coatings	
Repair	340
Other	340
Tile and Stone Sealers	100
Traffic Coatings	100
Tub and Tile Refinishing Coatings	420
Waterproofing Sealers	100
Waterproofing Concrete/Masonry Sealers	100
Wood Coatings	275
Varnish	275
Sanding Sealers	275
Lacquer	275
Wood Conditioners	100
Wood Preservatives	
Below-Ground	350
Other	350

2. Adhesives and Sealants

   a. For field applications inside the waterproofing membrane, use adhesives and sealants that comply with VOC content limits when calculated according to current South Coast Air Quality Management District (SCAQMD) Rule #1168.

   b. Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health (CDPH), Standard Method v1.1-2010 or v1.2-2017 using the applicable exposure scenario. Manufacturer's documentation demonstrating compliance must state the range of total VOCs (TVOC) as follows:

      i. 0.5mg/m3 or less
      ii. Between 0.5 and 5.0 mg/m3, or
      iii. 5.0 mg/m3 or more

   c. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

SCAQMD Rule 1168 ADHESIVES AND SEALANTS CATEGORIES	VOC Limit (g/L) Effective Date 1/1/2019
Adhesives	
Architectural Applications	
Building Envelope Membrane Adhesive	250
Carpet pad adhesives	50
Ceramic Glass, Porcelain & Stone Tile	65
Cove base adhesives	50
Dry wall and panel adhesives	50
Multipurpose construction adhesives	70
Roofing	
Single ply roof membrane adhesive	250
All other roof adhesives	250
Rubber floor adhesive	60
Structural glazing adhesive	100
Structural wood member adhesive	140
Subfloor adhesive	50
VCT and asphalt tile adhesive	50
Wood flooring adhesive	100
All other indoor floor covering adhesives	50
All other outdoor floor covering adhesives	50
Computer diskette manufacturing	350
Contact adhesive	80
Edge glue adhesive	250
Plastic welding cement	
ABS welding cement	325
ABS to PVC transition cement	510
CPVC welding cement	490
All other plastic welding cements	100
Rubber vulcanization adhesive	850
Special purpose contact adhesive	250
Thin metal laminating adhesive	780
Tire tread adhesive	100
Top and trim adhesive	540
Waterproof resorcinol glue	170
All other adhesives	250
Substrate specific adhesives	
Metal	30
Plastic foams	50
Porous material (except wood)	50
Wood	30
Fiberglass	80
Reinforced plastic composite	200
Sealants	

Architectural applications	
Clear, paintable and immediately water-resistant sealant	380
Foam insulation	250
Foam sealant	250
Grout	65
Roadway sealant	250
Non-staining plumbing putty	150
Potable water sealant	100
Roofing	
Single ply roof membrane sealant	450
All other roof sealants	300
All other architectural sealants	50
Marine deck sealant	760
All other sealants	420
Adhesive Primers	
Plastic	550
Pressure sensitive	785
Traffic marking tape	150
Vehicle grass	700
All other adhesive primers	250
Sealant Primers	
Architectural applications	
Non porous	250
Porous	775
Marine deck	760
Modified bituminous	500
All other sealant primers	750

3. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v1.1-2010 or v1.2-2017." Wet-applied flooring-related paints, coatings, adhesives and sealants must comply with requirements as described above, as applicable.

4. Composite Wood: Composite wood, agrifiber products, and adhesives shall be made with no added formaldehyde or shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products."

5. Walls: Wall panels shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and

Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v1.1-2010 or v1.2-2017."

6. Ceilings: Ceilings shall comply with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v1.1-2010 or v1.2-2017."

7. Insulation:

    a. LEED only: Thermal and acoustic insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v1.1-2010 or v1.2-2017." Insulation for HVAC ducts and plumbing pipe are excluded.

    b. LEED v4 only: Thermal and acoustic batt insulation shall be manufactured with no added formaldehyde.

    c. AEGB only: All insulation, including for HVAC and plumbing installations, must contain no added formaldehyde resins, including urea-, phenol, and urea-extended phenol formaldehyde.

8. Furniture:

    a. Furniture and furnishings shall be tested in accordance with ANSI / BIFMA Standard Method M7.1-2011; comply with ANSI / BIFMA e3-2011 Furniture Sustainability Standard, Sections 7.6.1 and 7.6.2, using either the concentration modeling approach or the emissions factor approach; model the test results using the open plan, private office, or seating scenario in ANSI / BIFMA M7.1, as appropriate.

    b. Classroom furniture shall use the standard school classroom model in CDPH v1.1 / v1.2.

    c. Salvaged / reused furniture more than one year old is considered compliant, provided it meets requirements for field-applied paints, coatings, adhesives, and sealants.

9. Exterior Applied Materials: (Note – this category has been removed in LEED v4.1) Adhesives, sealants, coatings, roofing and waterproofing materials applied on site must meet the VOC limits of CARB 2007 SCM for Architectural Coatings and SCAQMD Rule 1168.

a. The following materials are prohibited and do not count toward total percentage compliance:

i. Hot-mopped asphalt for roofing.
ii. Coal tar sealants for parking lots and other paved surfaces.

10. Additional Low-Emitting Materials Requirements:

a. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% by weight by mass (total exempt compounds) must be disclosed.

b. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.

2.4 INDOOR WATER USE REDUCTION

A. Appliances: Provide ENERGY STAR or performance equivalent appliances.

B. Plumbing Fixtures: Do not exceed water flush/flow requirements indicated in Division 22 – PLUMBING.

C. Equipment: Comply with LEED / AEGB indoor and process water use standards / maximum allowable water use per unit.

PART 3 – EXECUTION

3.1 INDOOR AIR QUALITY MANAGEMENT

A. Indoor Air Quality Management – Comply with Division 1 Section 01 35 46 “Indoor Air Quality Management.”

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Construction and Demolition Waste Management – Comply with Division 1 Section 01 74 19 “Construction Waste Management and Disposal.”

3.3 COMMISSIONING

A. Commissioning (Mechanical, Electrical, Plumbing) – Comply with Division 1 Section 01 65 00.

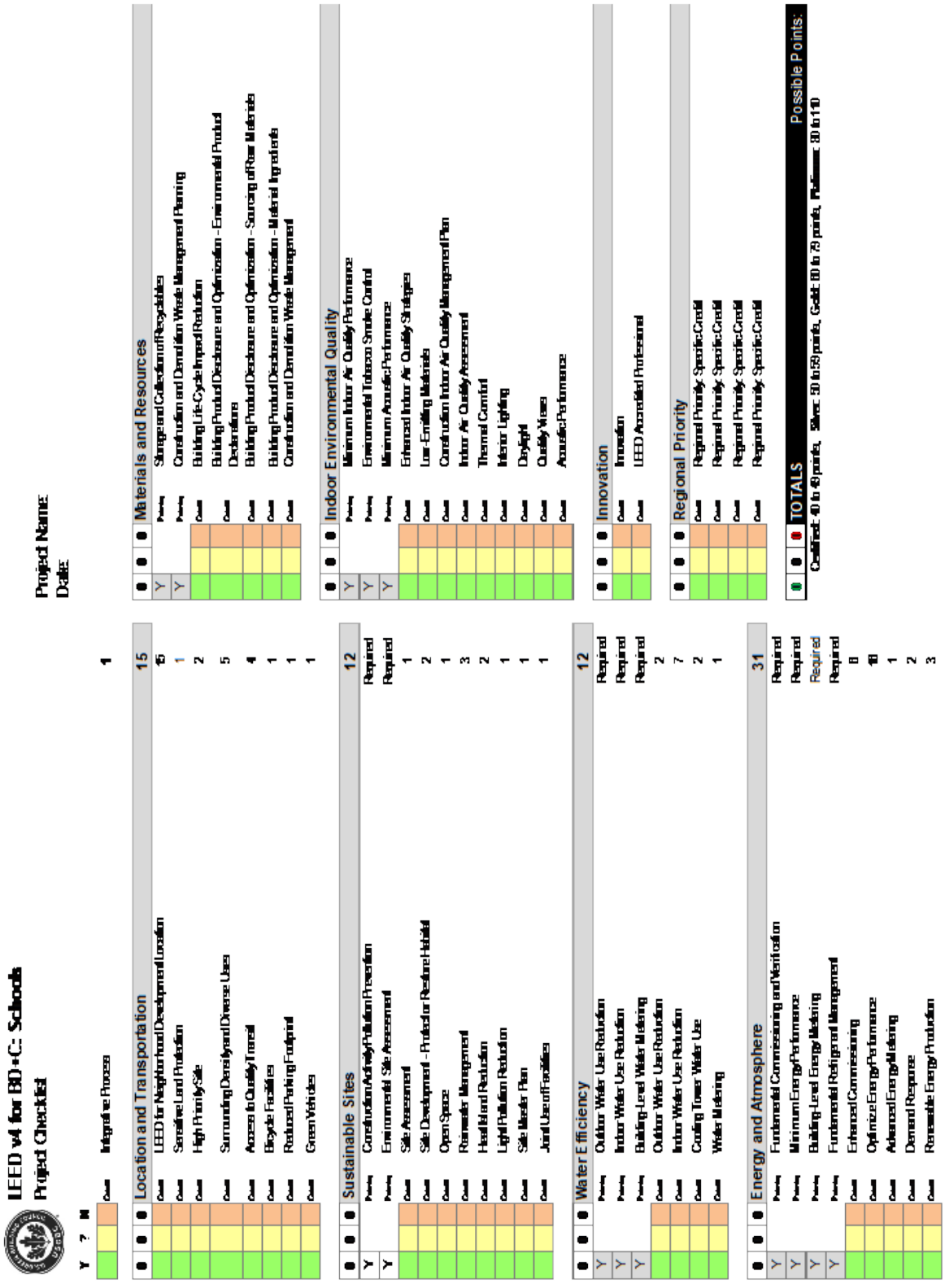
3.4 CONSTRUCTION ACTIVITY POLLUTION PREVENTION

A. Implement Erosion and Sedimentation Control Plan for all construction activities associated with this project.

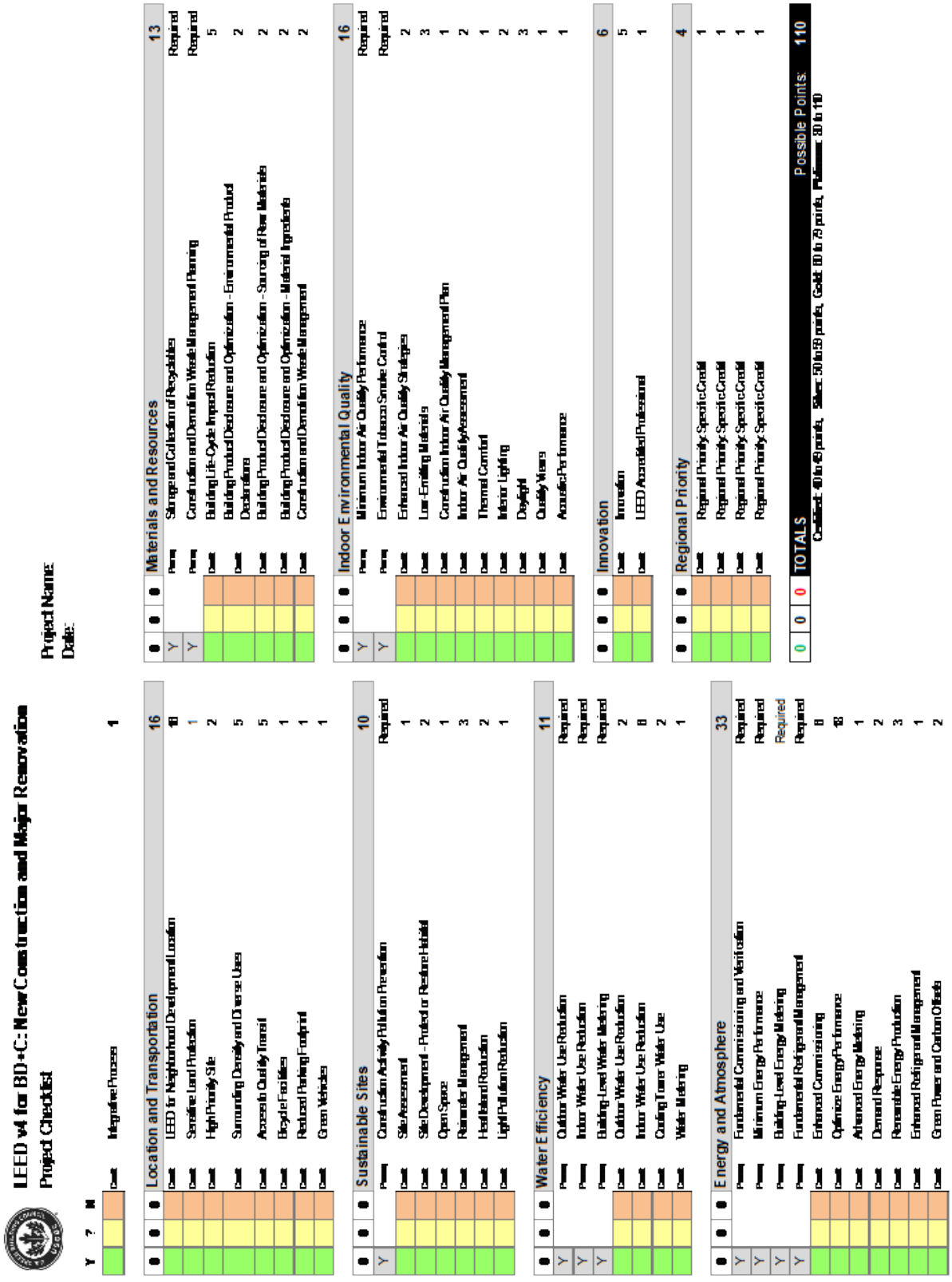
3.5 INTEGRATED PEST MANAGEMENT

A. Comply with the requirements of AISD Integrated Pest Management Plan, including specific alignment with termite control requirements.

APPENDIX A
LEED v4 for Schools Checklist



APPENDIX B
LEED v4 for New Construction and Major Renovations Checklist



APPENDIX C
Austin Energy Green Building Scorecard

AEGB 2016 COMMERCIAL RATING

Date

	Available Points	Anticipated Points	Confirmed Points
Basic Requirements			
1. Plans + Specifications	req		
2. Current Codes + Regulations	req		
3. Building Systems Commissioning	req		
4. Building Energy Performance	req		
5. Indoor Water Use Reduction	req		
6. Outdoor Water Use Reduction	req		
7. Low Emitting Mtls - Paints + Coatings	req		
8. Storage + Collection of Recyclables	req		
9. Construction Waste Mgmt	req		
10. Tenant Requirements	req		
Integrated Design			
1. Integrated Project Design	2		
subtotal	2	0	0
Site			
1. Environmental Sensitivity	2		
2. Desired Development	2		
3. Density	2		
4. Diverse + Walkable Communities	1		
5. Brownfield Redevelopment	1		
6. Site Specific Design	1		
7. Public Transportation	3		
8. Bicycle Use	1		
9. Parking Capacity	1		
10. Electric Vehicle Charging Stations	1		
11. Protect + Restore Habitat	1		
12. Beneficial Open Space	1		
13. Access to Local + Regional Produce	1		
14. Heat Island Reduction	1		
15. Light Pollution Reduction	1		
16. Integrated Pest Management	1		
subtotal	21	0	0
Energy			
1. Building Energy Performance	16		
2. Renewables	4		
3. Additional Commissioning	3		
4. Advanced Energy Metering	1		
5. Demand Response	2		
6. Green Energy	2		
7. District Cooling	1		
subtotal	29	0	0
Water			
1. Outdoor Water Use Reduction	3		
2. Building Water Use Reduction	6		
3. Process Water Use Reduction	2		
4. Stormwater Management	2		
subtotal	13	0	0
Indoor Environmental Quality			
1. Indoor Chemical + Pollutant Source Co	1		
2. Green Housekeeping	1		
3. Daylighting - Design	1		
4. Daylighting - Controls	1		
5. Views to the Outside	1		
6. Individual Controllability	1		
7. Low Emitting Materials	5		
8. Moisture Protection	1		
9. Acoustic Quality	1		
10. Outdoor Pollutant Control	1		
11. Construction Indoor Air Quality	1		
subtotal	15	0	0
Materials + Resources			
1. AdvFl Construction Waste Mgmt	1		
2. Building Materials Use Reduction	3		
3. Sustainably Sourced Material	6		
4. Certified Wood	1		
5. PVC + Phthalate Free Material	1		
subtotal	12	0	
Education + Equity			
1. Educational Outreach	2		
2. Construction Worker Equity	1		
subtotal	3	0	
Innovation			
1. Indoor Water Use Reduction - EP	1		
2. Public Transportation - EP	1		
3. Heat Island Reduction - EP	1		
4. Stormwater Management - EP	1		
5. TBD	1		
subtotal	5	0	0
TOTALS	100	0	0

APPENDIX D
Austin ISD Sustainability Scorecard

AUSTIN ISD SUSTAINABILITY SCORECARD

Y	N	NA	Mandatory Requirements	
			ALL 1M	Basis of Design Document: AE to prepare narrative at SD and update through design + Sign Commitment Letter
			ALL 2M	Design Review Process: Sustainability Review at SD, DD, CD
			ALL 3Ma	Low Emitting Materials - Adhesives, Sealants, Paints + Coatings: Low VOC
			ALL 3Mb	Low Emitting Materials - Composite wood and agrifiber: No added formaldehyde
			ALL 3Mc	Low Emitting Materials - Flooring: Green Label Plus, FloorScore
			ALL 3Md	Low Emitting Materials - Insulation (batt): No added formaldehyde
			ALL 3Me	Low Emitting Materials - Wall and Ceiling Systems: Must be SCS indoor Advantage Gold or GREENGUARD Gold Certified
			ALL 4M	Construction Waste Management: Divert 75% from landfill
			ALL 5M	IAQ During Construction: Provide IAQ Management Plan
			ALL 6M	Green Housekeeping:Refer to AISD Green Housekeeping Plan
			M 1M	Energy Efficiency - Mechanical Renovation: 10%>ASHRAE 90.1-2013
			M 2M	Commissioning - Mechanical: Reference AISD standard spec
			E 1M	Energy Efficiency - Lighting: 15% >ASHRAE 90.1-2013
			E 2M	Commissioning - Electrical: Reference AISD standard spec
			P 1M	Indoor Water Use Reduction: Use 5% less water than COA code
			P 2M	Commissioning - Plumbing: Reference AISD standard spec
			P 3M	Process Water Reduction: Comply w/ AISD process water tracking matrix
			ARCH 1M	Storage & Collection of Recyclables & Compostables
			ARCH 2M	Energy Efficiency - Envelope: Part 5 of ASHRAE 90.1-2013
			ARCH 3M	Acoustical Performance-1: Current HVAC Applications ASHRAE Handbook Ch 48
			ARCH 4M	Acoustical Performance-2: Ceiling Tiles w/ NRC of 0.85 or better
			ARCH 5M	Acoustical Performance-3: Isolate learning spaces in compliance with ANSI S12.60-2010, Part 1, Annex A.1
			SITE 1M	Native and Non-Invasive Adapted Species: Verify species using the City of Austin Grow Green Database and other resources noted in the PDM
			SITE 2M	Outdoor Water Use Reduction - 30%: Document 30% reduction
			SITE 3M	Integrated Pest Management: Refer to AISD IPM Plan
			SITE 4M	Green Vehicles: Provide 5% preferred parking for car/van pools and/or green vehicles. Provide 10% EV-ready spaces or 3% installed EV spaces

NOTE: This score card is an appendix to 01 81 13 Sustainable Construction Requirements. Not all mandatory items are applicable to all project types. The AISD PM & AE are to meet with the EWAS team to review the scorecard to determine project specific goals. This scorecard is a summary of the project specific goals defined by the design team and AISD.

Y	N	NA	Voluntary Requirements	
			ALL 1V	Optimize Energy Performance: 6% improvement over baseline
			ALL 2V	Construction Waste Management: 95% diversion from landfill
			ALL 3V	Sustainably Sourced Materials and Products: 20% of construction cost to be regionally sourced, contain recycled content, FSC certified wood
			ALL 4V	School As a Teaching Tool: Educate building occupants w/ signage, case study published on district website, digital presentations, teacher training in green curriculum, etc.
			M1V	Enhanced Refrigerant Management: No refrigerants
			M2V	Controllability of Systems - Thermal Comfort: Occupant controls
			M3V	Indoor Chemical and Pollutant Control: Walk-off mats, separate ventilation, MERV13 filters
			E 1V	Renewable Energy: Offset 1% - 10% of building energy cost.
			E 2V	Controllability of Lighting Systems: Occupant controls
			E 3V	Daylight Controls: Sensors
			P 1V	Indoor Water Use Reduction: Use 10% less water than COA code
			ARCH 1V	Envelope Commissioning - Additions & Major Renovations: Cx of envelope to comply with NIBS 3-2012
			ARCH 2V	Views to Outside: Provide 75% of occupied spaces with views
			ARCH 3V	Daylighting: Provide 70% of occupied spaces with daylighting
			ARCH 4V	Low Emitting Materials - Furniture and Furnishings: Meet CA 01350 as verified by GREENGUARD Gold Standard or SCS Indoor Advantage Gold
			ARCH 5V	Moisture Protection: Install no vinyl or plastic laminate wall coverings or other fiber reinforced plastic or vinyl as the finish material
			ARCH 6V	Low Emitting Materials - Insulation (non-batt): no added formaldehyde
			ARCH 7aV	Construction IAQ Mgmt Before Occupancy, Air Testing: Conduct IAQ testing according to AISD IAQ Testing Standards and Methods Table.
			ARCH 7bV	Construction IAQ Mgmt Before Occupancy, Flush Out: Install new filters and supply 14,000 cu.ft of outdoor air per SF
			SITE 1V	Protect and Restore Habitat: Restore 30% or more
			SITE 2V	Maximize Open Space: Provide open space equal to 30% of site
			SITE 3V	Stormwater Design Quality: Manage a volume of stormwater equal to 50% of water quality volume (WQV) by infiltration on site
			SITE 4V	Site Assessment: Design narrative
			SITE 5V	Outdoor Water Use reduction: 50% reduction or no potable water
			SITE 6V	Parking Capacity: Reduce parking by min. of 20% above code
			SITE 7V	Reduce Heat Island Effect: Green roof for 25% or shading 50% hardscape or 50% hardscape with SRI >29
			SITE 8V	Light Pollution Reduction: Meet requirements for backlight, uplight and glare (BUG) rating
			SITE 9V	Learning Environment: Outdoor classroom

APPENDIX E
Sustainability Submittal Sheets

AISD SUSTAINABILITY SUBMITTAL SHEET

EPDs | Sourcing of Raw Materials | Material Ingredients (LEED v4.1 Beta MRc Building Product Disclosure + Optimization - BPDO)

PRODUCT INFORMATION

Include permanently installed products in Divisions 03-10, incl. built-in casework & millwork items, Sections 31.60.00 Foundations, 32.10.00 Paving, 32.30.00 Site Improvements, 32.90.00 Planting. Only include furniture, furnishings, MEP components/appliances/equip. & specialty items (elevators) if used throughout all BPDO calculations. See below for additional information and reference standards.

Submittal #	
CSI # / Division Name	
Manufacturer	
Product Name	
Product Website	
Material Cost	

BPDOc ENVIRONMENTAL PRODUCT DECLARATIONS (EPDs) - OPTION 1

Declaration Type	[]	Name of 3rd-party Program
Product-specific life-cycle assessment (LCA)		
Product-specific Type III EPD - internally reviewed		
Industry-wide (generic) 3rd party certified EPD		
Product-specific Type III EPD - 3rd party certified		

☐ Product-specific declaration or EPD attached?

BPDOc SOURCING OF RAW MATERIALS - OPTION 2

Leadership Extraction Practice	%	Name / Certificate #
Extended Producer/Take Back Program		
Bio-Based Material		
Certified Wood Products (FSC chain of custody)		
Materials Reuse		
Recycled Content Post-Consumer		
Recycled Content Pre-Consumer (Post-Industrial)		

☐ Manufacturer cut sheet/signed letter verifying the following information attached?

Material Origin	%	Furthest Distance from Project Site (miles + location)
% of material extracted, manufactured and purchased within 100 miles of site		

☐ Map and/or signed letter from manufacturer confirming material origin (extraction, manufacture + purchase) attached?

BPDOc MATERIAL INGREDIENT REPORTING (MIR) - OPTION 1

Reporting Program	[]	Reporting Program	[]
Manufacturer Inventory GreenScreen		ANSI / BIFMA e3 Furniture Sustainability Standard	
Manufacturer Inventory GHS		Cradle to Cradle Material Health Certificate	
Health Product Declaration (HPD)		UL Product Lens Certification	
Cradle to Cradle V2 (Basic), V3 (Bronze)		FACTS: NSF/ANSI 336	
Declare			

☐ Reporting program docs attached?

ADDITIONAL INFORMATION + REFERENCE STANDARDS

BPDOc ENVIRONMENTAL PRODUCT DECLARATIONS Option 1. A) Product-specific publicly available life-cycle assessment conforming to ISO 14044 **or** B) Product-specific Type III EPD with internally reviewed LCA conforming to ISO 14071 **or** C) Industry-wide Type III EPD conforming to ISO14025, and EN 15804 or ISO 21930 **or** D) Product-specific Type III EPDs with external verification, conforming to ISO 14025, and EN 15804 or ISO 21930. B, C & D options: at least a cradle to gate scope.

BPDOc SOURCING OF RAW MATERIALS Option 2. All percentages are by weight and cannot exceed 100%. Bio-based excludes wood. Products extracted, manufactured AND purchased within 100 miles of project site are valued at 200%. Provide material origin info.

BPDOc MATERIAL INGREDIENTS Option 1. If pursuing Material Ingredients credit, identify which reporting program is being used to demonstrate compliance. Chemicals must be inventoried to at least 0.1% (1,000 ppm).

AISD SUSTAINABILITY SUBMITTAL SHEET

Low-Emitting Materials (LEED v4.1 Beta EQc Low-Emitting Materials) PAGE 1

PRODUCT INFORMATION

This sheet applies to all products applied or installed within the waterproofing membrane. See page 2 for additional information on credit category definitions, required data, reference standards and product requirements. Required data must be provided and standards / requirements must be met for each applicable category.

Submittal #		**Product Name / Model Number**	
CSI # - Division Name		**Supporting Documentation Website URL**	
Manufacturer		**Manufacturer Contact Information**	

PAINTS + COATINGS

			[]
VOC Content (g/L)		Supporting documentation attached?	
Volume Used (Liters)		CDPH Standard Method v1.2-2017*	
TVOC Content (mg/m3)		SCAQMD Rule #1113 or CARB 2007 SCM	
		Green Seal GS-11 VOC limits (AEGB)	
		No methylene chloride / perchloroethylene	

ADHESIVES + SEALANTS

			[]
VOC Content (g/L)		Supporting documentation attached?	
Volume Used (Liters)		CDPH Standard Method v1.2-2017*	
TVOC Content (mg/m3)		SCAQMD Rule #1168	
		No methylene chloride / perchloroethylene	

FLOORING**

			[]
Product Cost *(new to v4.1)*		Supporting documentation attached?	
TVOC Content (mg/m3)		CDPH Standard Method v1.2-2017*	
**Provide all flooring-related adhesive & coating information above.		Carpet: CRI Green Label Plus (AEGB)	
		Floor Finishes: SCAQMD Rule #1113	

COMPOSITE WOOD

			[]
Product Cost *(new to v4.1)*		Supporting documentation attached?	
		No added formaldehyde (NAF)? *or*	
		Ultra-low-emitting formaldehyde (ULEF)?	

CEILINGS, WALLS, INSULATION (note: these are separate categories in v4.1)

			[]
Product Cost *(new to v4.1)*		Supporting documentation attached?	
TVOC Content (mg/m3)		CDPH Standard Method v1.2-2017*	

FURNITURE

			[]
Product Cost		Supporting documentation attached?	
ANSI/BIFMA e3-2014		ANSI/BIFMA Standard Method M7.1-2011	
7.6.1 or 7.6.2?		ANSI/BIFMA e3-2014 7.6.1 or 7.6.2	
		Salvaged/reused?	

*CDPH Standard Method v1.1-2010 also accepted in v4.1 beta.

AISD SUSTAINABILITY SUBMITTAL SHEET

Low-Emitting Materials (LEED v4.1 Beta EQc Low-Emitting Materials) PAGE 2

ADDITIONAL INFORMATION + REFERENCE STANDARDS

Complete separate Sustainability Submittal Sheet for EACH distinct product and include all applicable information. **Requirements apply to all products applied or installed within the waterproofing membrane.** *Note: The Exterior Applied category was removed in v4.1 Beta.*

Inherently non-emitting sources (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished/untreated solid wood flooring) are considered fully compliant if they do not include organic-based coatings/binders/sealants.

All information must be verified by manufacturer or supplier. Acceptable forms of verification include: Safety Data Sheet (SDS), Product Data Sheet, Letter from Manufacturer/Supplier, Online Information on Manufacturer/Supplier Website, and Approved 3rd Party Certifications, as applicable.

Credit Categories	Definitions
Paints + Coatings	Interior paints and coatings applied on site.
Adhesives + Sealants	Interior adhesives and sealants applied on site.
Flooring	Interior-installed hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates) wall base, underlayments. Subflooring is excluded. Flooring-related adhesives & coatings such as sealer, stain & finish
Wall Panels	Interior-installed finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum/ plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments
Ceilings	Interior-installed ceiling tile, suface ceiling structures (gypsum/plaster), suspended systems, and glazed skylights
Insulation	Interior-installed thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in-place, loose-fill, blown, and sprayed insulation. HVAC ducts and plumbing piping are excluded
Furniture	Interior-installed stand-alone furniture and furnishing items purchased for project
Composite Wood	Interior-installed composite wood & agrifiber products (particleboard, MDF, plywood, wheat/strawboard, panel substrates & door cores)

Data / Standards / Requirements	Additional Information
VOC Content (g/L)	Disclosure of VOC (volatile organic compound) content must be made by the manufacturer in product data shet, SDS, etc
Volume Used (Liters)	Provide liters of product installed (1 gallon = 3.78541 liters)
CDPH Standard Method v1.2-2017 or v1.1-2010	VOC emissions evaluation. Provide Total VOCs (TVOC) after 14 days. See Reference Standards, below. Paints + coatings, adhesives + sealants: applicable to LEED only. Flooring, walls, ceiling: applicable to both LEED + AEGB
TVOC Content (mg/m3)	Per CDPH v1.1-2010 testing criteria, using classroom scenario, provide TVOC range: < 0.5; 0.5 - 5.0; > 5.0
SCAQMD Rule #1113	Current SCAQMD Rule #1113. See Reference Standards, below
CARB 2007 SCM	CARB 2007 Suggested Control Measures for Architectural Coatings. See Reference Standards, below
SCAQMD Rule #1168	Current SCAQMD Rule #1168. See Reference Standards, below
Green Seal GS-11, Ed. 3.1, 2013 *(AEGB)*	Limits (g/L): Non-flat topcoat ≤100; Flat topcoat ≤50; Primer/Undercoat ≤100; Anti-corrosive coating ≤250. AEGB only
No methylene chloride / perchloroethylene	No intentionally added methylene chloride or perchloroethylene
CRI Green Label Plus / Certified *(AEGB)*	Carpet + Rug Institute Green Label Plus (carpet); Green Label Certified (cushions). AEGB only
Floor Finishes: SCAQMD Rule #1113	Sealer, stain & finish for concrete, wood, bamboo, cork & other flooring: SCAQMD Rule 1113 VOC limits
Composite wood/agrifiber products	No added formaldehyde resins (NAF) OR meet CARB ATCM emissions for ultra-low emitting formaldehyde (ULEF)
Furniture Evaluation Type	Indicate ANSI/BIFMA section 7.6.1 or 7.6.2, CDPH testing for classroom furniture, or salvaged/reused
ANSI/BIFMA Standard Method M7.1-2011	New furniture and furnishings must comply with testing protocol. See Reference Standards, below
ANSI/BIFMA e3-2014	Section 7.6.1 (1/2 credit) or 7.6.2 (full credit). Alt: CDPH for classroom furniture. See Reference Standards, below
CDPH Standard Method v1.2 (classroom)	Classroom furniture must use the standard school model in CDPH Standard Method v1.2-2017 or v1.1-2010
No hot-mopped asphalt & coal tar sealants	Hot-mopped asphalt & coal tar sealants are prohibited

REFERENCE STANDARDS

California Department of Public Health (CDPH) Standard Method v1.2-2017: Claims of compliance must state applicable exposure scenario (classroom). For wet-applied products: state amount applied in mass per surface area & range of Total VOCs after 14 days. **V1.1-2010 also accepted in v4.1 Beta.**

South Coast Air Quality Management District (SCAQMD) Rule #1113: All paints and coatings applied on site and within the weatherproofing membrane must meet this requirement (alt: CARB 2007 SCM for Architectural Coatings). Effective February 5, 2016 (LEED) and current regulations (AEGB).

California Air Resources Board (CARB) 2007, Suggested Control Measures (SCM) for Architectural Coatings: All paints and coatings applied on site and within the weatherproofing membrane must meet this requirement (alt: SCAQMD Rule #1113).

Green Seal Environmental Standard GS-11 Edition 3.1 2013 Section 3.4: All paints, primers, anti-corrosive coatings applied on site and within the weatherproofing membrane must not exceed the VOC limits. (AEGB)

South Coast Air Quality Management District (SCAQMD) Rule #1168: All adhesive and sealants applied on site and within the weatherproofing membrane must meet this requirement. Effective October 6, 2017 (LEED) and current regulations (AEGB).

ANSI/BIFMA Standard Method M7.1-2011: New furniture and furnishings within the waterproofing membrane must comply with testing protocol.

ANSI/BIFMA e3-2014 Furniture Sustainability Standard Section 7.6.1 & 7.6.2, using appropriate scenario.

AISD SUSTAINABILITY SUBMITTAL SHEET

Exterior Lighting + Internally Illuminated Exterior Signage (LEED v4/v4.1 SSc Light Pollution Reduction)

PRODUCT INFORMATION

Include information applicable to EACH type of exterior fixture. Accompany w/ verifying documentation from manufacturer or supplier.

Submittal #	
CSI # - Division Name	
Lighting Rep / Contact	

BACKLIGHT / UPLIGHT / GLARE (BUG) RATING

Provide fixture type / ID per lighting plan, and catalog number and BUG rating per manufacturer data. Additional information (mounting height, distance from LEED boundary, lighting zone) will be needed to verify compliance.

Fixture Type	Quantity	Manufacturer	Catalog Number	Landscape or Façade? (Y/N)	BUG RATING B	U	G

☐ Documentation verifying BUG rating (photometric data/ies files, cut sheet) attached?

INTERNALLY ILLUMINATED EXTERIOR SIGNAGE

Provide maximum luminance data for any exterior signage that is internally illuminated.
Do not exceed a luminance of **200 cd/m2 (nits) during nighttime hours and 2,000 cd/m2 (nits) during daytime.**

Sign Type	Quantity	Manufacturer	Description	LUMINANCE Nighttime	Daytime

☐ Documentation verifying maximum luminance data attached?

AISD SUSTAINABILITY SUBMITTAL SHEET

Appliances + Equipment (LEED v4/v4.1 WEc Water Reduction + EAp/c Refrigerant Management)

PRODUCT INFORMATION

Include all information applicable to EACH type of appliance and equipment. Accompany w/ verifying documentation from manufacturer or supplier. Acceptable documentation includes: Safety Data Sheet (SDS), Product Data Sheets, Letter from Manufacturer/Supplier, Information from Manufacturer/Supplier Website, Approved 3rd Party Certifications.

Submittal #		Product Name	
CSI # - Division Name		Model Number	
Manufacturer		Product Website	

WATER USE

For water-using equipment, fill in actual water use; do not exceed maximum water use indicated.

Equipment Type	Water Use Standard / Maximum Allowable Water Use per Unit	Actual Water Use Per Unit	Number of Units
Ice Machine	ENERGY STAR or equiv.		
Dishwasher (Residential)	ENERGY STAR or equiv.		
Dishwasher (Commercial)			
Undercounter	1.6 gal/rack		
Stationary, single tank, door	1.4 gal/rack		
Single tank, conveyor	1.0 gal/rack		
Multiple tank, conveyor	0.9 gal/rack		
Flight machine	180 gal/rack		
Pre-rinse spray valve	1.3 gal/minute		
Combination Oven	1.5 gal/hr/pan including condensate cooling water		
Food steamer (batch - no drain connection)	2 gal/hr/pan including condensate cooling water		
Food steamer (cook-to-order w/ drain connection)	5 gal/hr/pan including condensate cooling water		
Clothes washer (residential)	ENERGY STAR or equiv.		
Clothes washer (commercial)	CEE Tier 3A		
Water Feature (such as fountain)	Use at least 50% non-potable water supply		
Other equipment not listed here	Performance baseline based on industry standards		

☐ Documentation verifying water use per unit and/or ENERGY STAR (manufacturer's info, cutsheets) attached?

REFRIGERANT USE

For refrigerant-using equipment, fill in refrigerant type if equipment contains ≥ 0.5 lbs. CFCs are prohibited in HVAC+R systems.

Equipment Type	Refrigerant type	Unit (tons)	Ozone Depletion Potential (ODP)	Global Warming Potential (GWP)
HVAC Unit 1				
HVAC Unit 2				
HVAC Unit 3				
HVAC Unit 4				
HVAC Unit 5				
Refrigerator				
Freezer				
Ice Machine				
Other Equipment				

☐ Documentation verifying refrigerant (manufacturer's info, cutsheets) attached?

END OF SECTION 01 81 13

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.

B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

1.05 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc; ____: www.armstrong.com/#sle.
   2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.

B. Suspension Systems:
   1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels Type ACT-1
   1. VOC Content: Certified as Low Emission by one of the following: SCS Indoor Advantage Gold or GREENGUARD Gold Certification.
   2. Size: 24x48 inches
   3. NRC Rating: 0.70 minimum, determined in accordance with ASTM E1264
   4. Panel Edge: Square
   5. Surface Color: White
   6. Suspension System: Exposed Grid
   7. Pattern: Match existing adjacent ceiling tile to remain. GC to confirm.

C. Acoustical Panels Type ACT-2
   1. VOC Content: Certified as Low Emission by one of the following: SCS Indoor Advantage Gold or GREENGUARD Gold Certification.
   2. Size: 24x24 inches
   3. NRC Rating: 0.70 minimum, determined in accordance with ASTM E1264
   4. Panel Edge: Square
   5. Surface Color: White

6. Suspension System: Exposed Grid
7. Pattern: Match existing adjacent ceiling tile to remain. GC to confirm.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System Type ____: Formed steel, commercial quality cold rolled; heavy-duty.
   1. Finish: White painted.
   2. Products: Match existing adjacent ceiling suspension system to remain. GC to confirm.
      a. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Locate system on room axis according to reflected plan.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 220100 – COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for Plumbing systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section 016500 – "GENERAL COMMISSIONING REQUIREMENTS" for general commissioning process requirements.

2. Division 23 Section 230100 – "COMMISSIONING OF MECHANICAL SYSTEMS".

3. Division 26 Section 260100 - "COMMISSIONING OF ELECTRICAL SYSTEMS".

1.3 DEFINITIONS

A. Commissioning Authority (CxA): Independent agent hired by Owner and not associated with General Contractor or its subcontractors, Architect or its sub-consultants, or Construction Administrator or its staff or consultants. Under Owner's direction, and not General Contractor's direction, CA will direct and coordinate day-to-day commissioning activities without assuming oversight responsibilities.

B. Refer to section 016500- GENERAL COMMISSIONING REQUIREMENTS for additional definitions and assignment of responsibilities.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

B. Perform commissioning tests at the direction of the CxA.

C. Attend construction phase controls coordination meeting.

D. Attend testing, adjusting, and balancing review and coordination meeting.

E. Participate in plumbing systems, assemblies, equipment, and component maintenance orientation and inspection.

F. Provide information requested by the CxA for final commissioning documentation.

G. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

H. Complete and provide to CxA project-specific pre-functional/construction checklists and commissioning process test procedures for actual plumbing systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

I. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.

J. Verify testing, adjusting, and balancing of plumbing work are complete.

K. Provide test data, inspection reports, and certificates.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing pre-functional/construction checklists and manufacturer's pre-start and startup checklists for plumbing systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.
5. Certificate of readiness certifying that plumbing systems, subsystems, equipment, and associated controls are ready for functional testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.6 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, pre-start, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall complete Pre-functional Testing to document compliance with installation and pre-functional checklists prepared by Commissioning Authority for Division-22 items.

B. Request verification of Pre-functional checklists by CxA prior to proceeding with system start-up and Functional Testing of systems.

C. Refer to Section 016500 - GENERAL COMMISSIONING REQUIREMENTS for issues relating to pre-functional checklists and testing, description of process, details on non-conformance issues relating to pre-functional checklists and test.

3.3 SYSTEM START-UP & INSPECTIONS

A. Contractor is solely responsible for system start-up. CxA may, at his discretion, witness start up procedures, but will not witnes any Functional Testing of systems until Contractor has completed start-up and resolved all operating deficiencies.

B. Contractor is solely responsible for all tests and inspections required by the Authority Having Jurisdiction (AHJ). All test reports and certificates required by the AHJ shall be submitted prior to Functional Testing.

3.4 TESTING PREPARATION

A. Certify that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that plumbing instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that any required testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, and alarm conditions).

E. Inspect and verify the position of each device and interlocks identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as required.

3.5 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of plumbing testing shall include entire plumbing installation. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Tests will be performed using design conditions whenever possible.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. The CxA may direct that set points be altered when simulating conditions is not practical.

F. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

G. If tests cannot be completed because of a deficiency outside the scope of the plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

H. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 GENERAL TESTING PROCEDURES FOR PLUMBING SYSTEMS, SUBSYSTEMS, AND EQUIPMENT

A. Pipe system cleaning, flushing, hydrostatic test and chemical treatment requirements are specified in Division 22 piping Sections. Plumbing Subcontractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.

3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

B. Plumbing Equipment System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item to be tested. Refer to Section 016050

C. Plumbing Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of hydronic and other distribution plumbing systems.

D. Refer to Section 016500 - GENERAL COMMISSIONING REQUIREMENTS for specific equipment testing requirements.

E. .

3.7 TRAINING

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

3.8 O&M MANUALS

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS and section 017800 CLOSEOUT SUBMITTALS.

END OF SECTION

SECTION 22 02 00 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departure and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as reasonably practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is equal to that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent Drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings, or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to: materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Plumbing and Fire Protection items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details with regards to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building/job-site, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least seven (7) working days prior to bid; the greater or more

costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified elsewhere, or necessary for complete and functioning plumbing systems shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the Commissioning process as required; including, but not necessarily limited to: meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed Shop Drawings.

B. All piping, fixture, or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit Shop Drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the owner.

D. Additional coordination with Electrical Subcontractor may be required to allow adequate clearances of electrical equipment, fixtures, and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts, or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. 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 therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the piping, fixtures and equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting is included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to plumbing systems.

C. Furnishing and installing all required plumbing equipment, control relays and electrical interlock devices, conduit, wire and junction boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of Owner occupancy, or the date all punch list items have been completed, or the date final payment has been received. Refer to Division 01 for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such times as the project is ready to receive the equipment, pipe or valves - properly protected from incidental damage and weather damage.

C. Damaged equipment, valves or pipe shall be promptly removed from the site and new, undamaged equipment, valves and pipe shall be provided in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

A. The plumbing systems and the component parts thereof shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate pipe and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect/Engineer, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection, relocation, and upgrade of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the following nationally accepted codes and standards, including, but not necessarily limited to:

1. American Standards Association, ASA.
2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
3. American Society of Mechanical Engineers, ASME.
4. American Society of Plumbing Engineers, ASPE.
5. American Society of Testing Materials, ASTM.
6. American Water Works Association, AWWA.
7. National Bureau of Standards, NBS.
8. National Fire Protection Association, NFPA.
9. UL, LLC (formerly Underwriters Laboratories).
10. FM Global.
11. International Energy Conservation Code, IECC.
12. International Fire Code.
13. International Gas Code.
14. Uniform Plumbing Code

D. Where differences exist between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Architect/Engineer in writing of all differences.

E. When directed in writing by the Architect/Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards. Correct the deficiencies and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted",

"Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver new to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its Subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy

technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 2009 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings. It will not be the province of the Specifications to mention any part of the work which the Drawings are competent to fully explain in every particular and such omission shall not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least seven (7) working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution by made without the written permission of the Architect or Engineer and Owner. **Request for prior approval must be made in writing at least ten (10) days prior to the bid date without fail.**

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equal construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical and Plumbing Design Documents and all other trades, including Division 26.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected Subcontractors shall be the responsibility of this bidder and not the Owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a written acceptance allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades and pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of Shop Drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty (30) day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive Shop Drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all Shop Drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.

3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on Shop Drawings and submittals.

C. Equipment and materials submittals and Shop Drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of Shop Drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where Shop Drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop Drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The Contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not

approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.

4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous Shop Drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all Shop Drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without Shop Drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. AISD Sustainability Sheets found in the AISD Project Development Manual must be submitted for sustainable products. Submittals include Low-Emitting Materials.

I. Submittals are required for, but not necessarily limited to, the following items:

1. Basic Materials.
2. Plumbing Fixtures and Valves.
3. Supports and Carriers.
4. Plumbing Piping.
5. Piping, Vessel, and Equipment Insulation.

J. Refer to other Division 22 sections for additional Shop Drawing and submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of

importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, equipment, and other materials. Include the following:
   a. Wall locations and types.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm, sanitary sewer piping and plumbing piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stem movement.
   k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting Shop Drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 22.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work; precise locations of all concealed pipe; locations of all valves, controls and operable devices; and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Record Drawings shall indicate, at a minimum, the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices located and numbered, unions located, and with items requiring maintenance located

(i.e., traps, strainers, expansion fittings, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.

2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.

E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F. If the Contractor does not keep an accurate set of Record Documents, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G. Upon completion of the Work, the Contractor shall submit three (3) full size sets of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____
(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled dates for each test. This detailed completion and test schedule shall be submittal at least ninety (90) days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit four (4) copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in other Sections of Division 22.

1.17 OPERATIONS AND MAINTENANCE MANUALS

A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 22. In addition to the requirements of other Sections, this shall include the following information for fixtures, specialties, and equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
8. Servicing instructions and lubrication charts and schedules.
9. Equipment and motor name plate data.
10. Wiring diagrams.
11. Exploded parts views and parts lists for all equipment and devices.
12. Color coding charts for all painted equipment and conduit.
13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow ¼” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Plumbing Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C. In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E. **Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing**. The Contractor will

subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include a minimum of 12 hours of on- site training in three (3) shifts of four (4) hours each.

B. Before proceeding with the instruction of Owner’s Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he or she has a proper understanding of the operation and maintenance of the systems and then resubmit the signed outlines.

C. Refer to other Sections of Division 22 for additional Operator Training requirements.

1.19 FINAL COMPLETION

A. At the completion of the work, all equipment, operable appurtenances, and systems shall be tested. All faulty equipment and material shall be repaired or replaced. Refer to other Sections of Division 22 for additional requirements.

B. Clean and adjust all fixtures, flushometers, valves and operable devices. Replace faulty or otherwise damaged parts immediately prior to final acceptance.

C. Touch up and/or refinish any scratched equipment and devices immediately prior to final acceptance. This shall be acceptable **only for minor superficial scratches**, the determination of which rests solely on the judgment of the Architect or Engineer.

1.20 CONTRACTOR'S GUARANTEE

A. Use of the Plumbing systems to provide temporary service during the construction period shall not be allowed without written permission from the Owner, and, if granted, shall not be cause for the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one (1) year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. Refer to other Sections of Division 22 for additional guarantee or warranty requirements.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for re-use by Architect/Owner or others on extensions of this project or on any other project. Any such re-use or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without

liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any re-use or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
2. If the client, Architect/Owner, or developer of the project requires electronic media for "record purposes", then an AutoCAD based compact disc ("CD") will be prepared. The "CD" will be submitted with all title block references intact and will be formatted in a "plot" format to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

E. At the Architect/Owner's request, Engineer will prepare one "CD" of electronic media to assist the Contractor in the preparation of submittals. The Engineer will prepare and submit the "CD" to the Architect/Owner for distribution to the Contractor.

1. The "CD" will be prepared and all title blocks, names and dates will be removed. The "CD" will be prepared in a ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with "Buy American Act."

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks unless indicated otherwise.

C. All access panels located in wet areas such as toilet rooms, locker rooms, shower rooms,

natatoriums, kitchens, and any other wet areas shall be constructed of stainless steel.

D. Access doors shall be as follows:

1. Plastic Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.2 EQUIPMENT PADS

A. Provide four (4) inch high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

B. Provide six (6) inch high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Provide a four (4) foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in other Divisions (10, 11, 12, 13, 21, 22, etc.) for additional rough-in requirements as necessary and provide accordingly.

3.2 PLUMBING INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of plumbing and fire systems, materials, and equipment. Comply with the following requirements:

1. Coordinate plumbing and fire protection systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, leave-outs, and other openings in building components during progress of construction to allow for plumbing installations.
4. Coordinate the installation of required supporting devices, sleeves, and pathways to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of plumbing and fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access panels or doors where valves, operable devices, and equipment are concealed behind finished surfaces. Refer to Article 2.1 of this Section and to Architectural documents for specifications and locations.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, valves, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Plumbing Equipment:
    a. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop Drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chains. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the Record Drawings.

3.3 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of plumbing equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.

3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Article 1.11 DEFINITIONS AND SYMBOLS for definition of "Installer."

C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, equipment, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and the Architect/Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

B. Start-up for major plumbing and fire protection equipment shall be performed by a factory authorized technician. Such equipment shall include, but not necessarily be limited to, the following: domestic water boilers and packaged water heating systems, water softeners, ultra-pure water equipment systems, domestic water booster pumps, fire pumps, and break tank level alarm systems. Refer to other Sections of Divisions 21 and 22 for additional requirements.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, utilities, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site

conditions shall be resolved by this Contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe, supports, and hangers. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. Ensure existing piping and equipment to remain that is adjacent to and impacted by the scope of Work is properly supported, fastened, and secure.

E. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

F. Certain work during the demolition phase of construction may require overtime, night time, or weekend shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

G. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and disposed of lawfully.

H. Equipment, piping or other potential hazards to the working occupants of the building or the general public shall not be left overnight outside of the designated working or construction area.

I. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

J. Include in the contract price all rerouting of existing pipe, utilities, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Provide all temporary pipe, utilities, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.

K. All existing plumbing fixtures, pipe, utilities, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

L. Pipe, utilities, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, utilities, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

M. No portion of the **fire protection systems** shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner’s representative in order to protect systems that shall remain in service.

N. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

O. Refer to Architectural Demolition and/or Alteration plans for actual locations of walls, ceiling, etc., being removed and/or remodeled.

END OF SECTION

SECTION 22 07 19 – PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Furnish and install piping insulation to:

1. Interior domestic hot water and hot water return piping.
2. Interior domestic cold water piping.
3. Exterior domestic cold water piping.
4. Drain bodies and associated piping.
5. Condensate drainage piping.
6. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D. For insulation purposes, piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer wells, unions, pressure reducing stations, and orifice assemblies.

1.3 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories. Contractor shall submit AISD Sustainability Submittal Sheets as found in the AISD Project Development Manual and comply with sustainability requirements.

1.5 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

PART 2 - PRODUCTS

2.1 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.2 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.

2.3 SUSTAINABILITY REQUIREMENTS: Low-Emitting Materials are required and must conform to VOC limits, TVOC content, meet CPDH Standard Method v1.1-210, meet SCAQMD Rule @1113 or CARB 2007 SCM, list Green Seal GS-11 VOC limits and confirm that there is no methylene chloride/perchloroethylene.

2.4 A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.5 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.6 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.7 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

2.8 APPROVED MANUFACTURERS

A. Calcium silicate materials shall be as manufactured by Johns Manville.

B. Glass fiber materials shall be as manufactured by Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

C. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armstrong, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

D. Armaflex elastomeric cellular thermal insulation by Armstrong.

E. Phenolic foam insulation shall be as manufactured by Kooltherm Insulation (Koolphen).

F. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products, Inc.

2.9 MATERIALS

A. INTERIOR DOMESTIC WATER PIPE: provide fiberglass pipe insulation with all service jackets with self sealing lap joint.

B. EXTERIOR DOMESTIC WATER PIPE: Provide elastomeric cellular thermal, or preformed phenolic foam pipe insulation with secured aluminum jacketing.

C. DRAIN BODIES AND DOWNSPOUTS: Insulate underside of roof and overflow drain bodies, associated horizontal piping, including first turn down to vertical conductor. Insulate chilled water waste lines from drinking fountain to junction with main waste stacks. Insulate branch lines including traps and exposed underside of floor drains receiving cooling coil condensate, same as water piping where exposed to building occupant view. When concealed, insulation may be same as specified for external duct wrap.

D. CONDENSATE DRAINAGE PIPING: Fire resistant fiberglass insulation; insulation not required when piping is exposed on roof.

E. ALUMINUM OR STAINLESS STEEL JACKETING: Utilize strap-on type jacketing, banding, and accessories. Provide pre-formed fitting covers for all elbows and tees.

PART 3 - EXECUTION

3.1 All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

3.3 Pipes located outdoors or in tunnels or crawl spaces shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

3.4 All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

3.5 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, an isolating seal shall be formed between the vapor barrier jacket and the bare pipe. The seal shall be by the applications of adhesive to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber

covers finished with two brush coats of vapor barrier mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor barrier jacket.

D. At hangers and supports, provide a high density foam insulation insert that extends 2" beyond the shield on each side and a protective shield/saddle to prevent compression/damage. Secure shield/saddle to insulation using mastic or strapping tape.

3.6 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe.

B. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

PART 4 - SCHEDULES

4.1 LOW TEMPERATURE SURFACES		MINIMUM INSULATION THICKNESS BASED ON FIBERGLASS
A.	Exposed exterior domestic water pipe:	1½ inch
B.	Interior domestic cold water pipe:	1 inch
C.	Condensate drain lines:	¾ inch
D.	Drains receiving condensate:	1 inch
E.	Concealed piping from roof drains:	1½ inch blanket wrap
F.	Exposed piping from roof drains:	1 inch thick rigid with all service jacket

4.2 HIGH TEMPERATURE SURFACES			MINIMUM INSULATION THICKNESS
A.	Domestic Hot Water and Domestic Hot Water Return Piping		
	1.	Pipe sizes 1-1/4 inch and smaller with Operating temperatures of 140°F or less	1 inch
	2.	Pipe sizes 1-1/2 inch and larger with Operating temperatures of 140°F or less	1-1/2 inch
	3.	Pipe sizes 1-1/4 inch and smaller with Operating temperatures greater than 140°F	1-1/2 inch
	4.	Pipe sizes 1-1/2 inch and larger with Operating temperatures greater than 140°F	2 inch

END OF SECTION

SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the piping covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Pipe and pipe fittings:

a. Sanitary drainage piping system.

b. Storm drainage piping system.

c. Sub-surface drainage piping system.

d. Acid waste drainage piping system.

e. Domestic water piping system.

2. Adapters, Transitions, Unions, Couplings, Flanges, Connectors

3. Valves

4. Excavation, Bedding, and Backfill

1.3 RELATED WORK

A. Section 22 05 29 – Hangers and Support for Plumbing Piping and Equipment.

B. Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping.

C. Section 22 05 53 – Identification for Plumbing Piping and Equipment.

D. Section 22 07 19 – Plumbing Piping Insulation.

E. Section 22 11 16 – Domestic Water Piping – Cross-Linked Polyethylene (PEX)

F. Section 22 11 19 – Plumbing Specialties.

G. Section 22 30 00 – Plumbing Equipment.

H. Section 22 40 00 – Plumbing Fixtures.

1.4 REFERENCES

A. ASME – Boiler and Pressure Vessel Code.

B. ASME Section IX – Welding and Brazing Qualifications.

C. ASME B1.20.1 – Pipe Threads, General Purpose.

D. ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

F. ASME B16.4 – Gray Iron Threaded Fittings: Classes 125 and 250.

G. ASME B16.5 – Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.

H. ASME B16.14 – Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

J. ASME B16.23 – Cast Copper Alloy Solder Joint Drainage Fittings: DWV.

K. ASME B16.51 – Copper and Copper Alloy Press-Connect Pressure Fittings.

L. ASME B31.3 – Process Piping.

M. ASME B31.9 – Building Services Piping.

N. ASTM A47 – Standard Specification for Ferritic Malleable Iron Castings.

O. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

P. ASTM A74 – Standard Specification for Cast Iron Soil Pipe and Fittings.

Q. ASTM A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

R. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

S. ASTM A197 – Standard Specification for Cupola Malleable Iron.

T. ASTM A395 – Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

U. ASTM A536 – Standard Specification for Ductile Iron Castings.

V. ASTM A582 – Standard Specification for Free-Machining Stainless Steel Bars.

W. ASTM B32 – Standard Specification for Solder Metal.

X. ASTM B42 – Standard Specification for Seamless Copper Pipe, Standard Sizes.

Y. ASTM B43 – Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

Z. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings.

AA. ASTM B75 – Standard Specification for Seamless Copper Tube.

BB. ASTM B148 – Standard Specification for Aluminum-Bronze Sand Castings.

CC. ASTM B306 – Standard Specification for Copper Drainage Tube (DWV).

DD. ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications.

EE. ASTM B828 – Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

FF. ASTM C33/C33M – Standard Specification for Concrete Aggregates.

GG. ASTM C94 – Standard Specification for Ready-Mix Concrete.

HH. ASTM C150 – Standard Specification for Portland Cement.

II. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

JJ. ASTM C1053 – Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.

KK. ASTM C1173 – Standard Specification for Flexible Transition Couplings for Underground Piping Systems.

LL. ASTM C1277 – Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

MM. ASTM C1540 – Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

NN. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

OO. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

PP. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

QQ. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

RR. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

SS. ASTM D2464 – Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

TT. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

UU. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

VV. ASTM D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

WW. ASTM D2665 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

XX. ASTM D2672 – Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.

YY. ASTM D2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

ZZ. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

AAA. ASTM D2843 – Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

BBB. ASTM D2846 – Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot and Cold Water Distribution Systems.

CCC. ASTM D2855 – Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.

DDD. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

EEE. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

FFF. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

GGG. ASTM D3311 – Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.

HHH. ASTM D4976 – Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

III. ASTM D5926 – Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems.

JJJ. ASTM D6707 – Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications.

KKK. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

LLL. ASTM F439 – Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

MMM. ASTM F441 – Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

NNN. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

OOO. ASTM F493 – Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

PPP. ASTM F656 – Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

QQQ. ASTM F913 – Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

RRR. ASTM F1336 – Standard Specification for Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings.

SSS. ASTM F1476 – Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

TTT. ASTM F1548 – Standard Specification for Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications.

UUU. AWS A5.8 – Specification for Filler Metals for Brazing and Braze Welding.

VVV. AWS 5.31 – Specification for Fluxes for Brazing and Braze Welding.

WWW. AWWA C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

XXX. AWWA C111 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

YYY. AWWA C209 – Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

ZZZ. AWWA C219 – Bolted, Sleeve-Type Couplings for Plain-End Pipe.

AAAA. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.

BBBB. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Services.

CCCC. AWWA C651 – Disinfecting Water Mains.

DDDD. CISPI 301 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

EEEE. CISPI 310 – Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

FFFF. ASSE 1003 Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.

GGGG. ASSE 1079 – Performance Requirements for Dielectric Pipe Unions.

HHHH. UL 94 Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

IIII. UL 1285 Standard for Safety Pipe and Couplings, PVC and PVCO for Underground Fire Service.

JJJJ. NSF/ANSI 61 – Drinking Water System Components – Health Effects.

KKKK. NSF/ANSI 372 – Drinking Water System Components – Lead Content.

LLLL. Federal Specifications and Standards DD-G-541B – Glass (Laboratory).

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and **country of origin**.

D. Foreign pipe, fittings or valves are unacceptable.

E. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.

F. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

G. Welders Certification: In accordance with ASME Section IX.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data under provisions of Division One.

C. Include pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information, product certifications, and **country of origin**. Indicate valve data and ratings.

D. Contractor shall submit AISD Sustainability Submittal Sheets as found in the AISD Project Development Manual and comply with sustainability requirements.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E. Provide temporary protective coating on cast iron and steel valves.

F. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A. Perform work in accordance with plumbing and building codes having jurisdiction.

B. **No PVC pipe or fittings, or similar un-rated material, will be allowed in any areas where pipe is to penetrate a fire rated assembly or is to be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure**.

PART 2 - PRODUCTS

[LEAVE A3 for aggressive soil conditions]

A. PVC Pipe: ASTM D1785/D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.1 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron, ASTM A74 drainage pattern.
2. Joints: Hub and spigot, ASTM C564 neoprene, compression type gaskets or lead and oakum.
3. Provide ASTM D4976 polyethylene protective wrap in tubular or sheet form, minimum 8 mil nominal thickness, in accordance with manufacturer's installation guidelines, for all piping.

B. PVC Pipe: ASTM D1785/D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311/D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger. Mating surfaces shall be prepared with ASTM F656 purple primer immediately prior to cement application.
3. Acceptable except for kitchen waste and vent systems including piping associated with the grease trap, which shall be as specified below.

2.2 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, ABOVE GRADE

[SELECT "A" OR "B"]

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron, ASTM A74 drainage pattern.
2. Joints: Hub and spigot, ASTM C564 neoprene, compression type gaskets or lead and oakum.

B. Copper Tubing: ASTM B306, DWV, for sizes 2" and smaller.

1. Fittings: ASME B16.23 cast copper alloy solder joint drainage fittings (DWV), or ASME B16.29, wrought copper and wrought copper alloy solder joint drainage fittings (DWV).
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead).
3. Joints between copper and cast iron pipe shall be made by way of copper soldered to a brass ferrule and the ferrule joined to the cast iron hub by a compression or caulked joint.

2.3 DOMESTIC WATER PIPING, WITHIN BUILDING, BELOW GRADE

A. Copper Tubing: ASTM B88, Type K, soft annealed.

1. No joints allowed below slab, run tubing continuous.
2. Provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, for all piping buried or in contact with concrete, to a minimum of 6" above finished floor. Chase Construction Products Tapecoat H35 or approved equivalent.
3. Applies to installations including services to island sinks and trap primer lines.

2.4 DOMESTIC WATER PIPING, WITHIN BUILDING, ABOVE GRADE

[Note: There are a variety of methods for joining copper pipe. Solder (aka sweat) joints are the traditional, tried and true, universally accepted method for joining copper pipe.

There are also mechanical joining methods, including: and coupling systems and press-connect fitting and joining systems.

HOWEVER, The acceptability of grooved joints and press-connect joints must be confirmed with the owner; some owners may still insist on sweat fittings across the full range of pipe sizes.

Press-connect joining systems are available for pipe sizes 1/2" through 2" in size.

Our standard is to call for sweat joints for sizes 2" and smaller and for grooved joints for pipe sizes 2-1/2" and larger.

The inclusion of paragraph A3 below allows for the use of press-connect fittings in the available sizes in lieu of sweat joints. Please note that A3 as written does not allow for the use of press-connect valves and we do not have press-connect valves listed in our "valve" articles.

A. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper alloy solder joint pressure fittings.
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.
3. Fittings and joints for pipe sizes 1/2" through 4" may be mechanical press-connect system joints with ASME B16.51 lead-free copper bodied fittings with integral ethylene-propylene diene monomer rubber (EPDM) sealing gaskets. All fittings, couplings, and adapters shall be the product of a single system manufacturer and only that manufacturer's approved press tools, kits, and jaws shall be used.
   a. EPDM o-rings shall be pre-installed and lubricated with ANSI/NSF 61 listed lubricant.
   b. All installers of copper press-connect fittings shall be trained by the fitting manufacturer's appointed representative and carry such credentials for the duration of the project.
   c. The fitting manufacturer's representative shall conduct periodic inspections of the installation and shall provide written reports of such inspections to the Contractor and Engineer, including any observed deviations from the manufacturer's recommended installation practices.
   d. Acceptable system manufacturers: Viega or pre-approved equal.

4. Fittings and joints for pipe sizes 2-1/2 inch and larger shall be rolled groove type for copper tubing with all tools, couplings, adapters, fittings, gaskets, and **valves** the product of a single system manufacturer.
   a. Fittings shall be cast bronze using lead-free alloys per ASTM B584 or copper wrought copper constructed to ASTM B75, compliant with NSF/ANSI 61 for potable water service applications, and meet ASTM F1548.
   b. Couplings shall be epoxy/enamel (rust-inhibiting) coated ductile iron housings conforming to ASTM A536.
   c. Gaskets shall be EPDM for potable water, meeting ASTM F1476, and NSF 61/NSF 372 certified for potable water service from 30 degrees to 180 degrees F.
   d. Acceptable system manufacturers: Victaulic, Grinnell, Anvil Gruvlok.

OR

* * * * * *

B. PVC Pipe: ASTM D1785, NSF 61 schedule 40 system, the product of a single manufacturer.

1. Fittings: ASTM D2466 schedule 40 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

C. PVC Pipe: ASTM D1785, NSF 61 schedule 80 system, the product of a single manufacturer.

1. Fittings: ASTM D2464/D2467 schedule 80 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. CPVC Pipe: ASTM D1784 minimum cell classification 23447 for chlorinated polyvinyl chloride compounds, NSF 61 schedule 80 system, the product of a single manufacturer per ASTM F441.

1. Fittings: ASTM F439 schedule 80 CPVC.
2. Joints: solvent cement in accordance with manufacturer's recommendations using ASTM F493 cement, in conjunction with ASTM F656 primer when recommended or when required by code.
3. **Compliance: Pipe material shall be tested to UL 273/ASTM E84 and listed as having flame spread/smoke developed values not to exceed 25/50 and be approved by the local AHJ as acceptable for use in return air plenums.**
4. Acceptable system manufacturers:
   a. Spears Manufacturing Company EverTUFF
   b. Georg Fischer Harvel, LLC

2.5 ADAPTERS, TRANSITIONS, UNIONS, COUPLINGS, FLANGES, CONNECTORS

A. (Non-Acid Waste) Drainage Applications:

1. Provide approved listed adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements.
2. For dissimilar piping above ground, provide stainless steel shielded, molded elastomeric couplings and adapters meeting ASTM C564 and ASTM C1460. Applies to installations including cast iron to PVC transitions immediately adjacent to building slabs on grade.

3. For dissimilar underground piping not below building slab, provide shear resistant .012" thick 300 series stainless steel shielded, PVC gasketed flexible couplings and adapters meeting ASTM D5926 and ASTM C1173. For direct-bury applications, provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, to completely wrap the shield, banding, and screws. Chase Construction Products Tapecoat H35 or approved equivalent.
4. Acceptable manufacturers:
   a. Anaco-Husky/Cremco
   b. Mission Rubber Company LLC
   c. Fernco, Inc.
   d. Fernco, Inc. Strong Back RC 1000 Series (underground piping, not below building slab; or readily accessible underground piping transitions in backwater valve pits, etc.)
5. Adapters, couplings, bushings for copper DWV pipe shall be cast bronze or wrought copper, ASME B16.23/B16.29.

B. Domestic Water Applications:

1. Provide joints between various materials with approved adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements and the manufacturer's instructions.
2. For copper tube and pipe: adapters, bushings, plugs, caps, and couplings shall be wrought copper or cast bronze; flanges (minimum class 150) and unions shall be cast bronze. Provide with solder or threaded connections as necessary and as produced to applicable ASME standards B16.15, B16.18, B16.22, B16.24, B16.50, B1.20.1. All such appurtenances shall be for use in above ground potable water systems.
3. Above slab transitions for water service entries:
   e. 100% fusion bonded epoxy coated ASTM A536 cast ductile iron construction coupling with acrylonitrile butadiene rubber (NBR) gaskets and EPDM insulating boot for water service. 5/8 inch high strength stainless steel bolts and nuts. Coupling shall meet AWWA C219. Romac Industries, Inc. IC501 or pre-approved equivalent.
   f. 100% fusion bonded 14 mil epoxy coated coupling with ASTM A536 cast ductile iron rings. Complete with acrylonitrile butadiene rubber (NBR) gaskets and type 304 stainless steel bridge, spacers, nuts, and bolts. Coupling shall meet AWWA C219, NSF 61, and NSF 372. Krausz USA Hymax Grip Coupling Restraint or pre-approved equivalent.
4. Dielectric connections:
   a. For pipe sizes 2 inch and smaller, provide lead-free dielectric unions, rated to 180 F at 250 psi and compliant to ASSE 1079.
   b. For pipe sizes larger than 2 inches, provide lead-free dielectric flanged pipe fittings, rated to 180 F at 175 psi and meeting ASME B16.1.
   c. For grooved copper joining systems, provide grooved end dielectric transition fitting from system manufacturer, with virgin polypropylene internal lining, meeting NSF 61.

C. General:

1. Unions for ferrous pipe shall be ASTM B16.39 galvanized malleable iron, threaded, minimum pressure class 150.
2. Plugs and bushings for ferrous pipe shall be ASME B16.14 galvanized malleable iron, threaded.

3. Nipples for ferrous pipe shall be schedule 40, galvanized, ASTM A53 welded steel pipe nipples, threaded, meeting ASTM A733.
4. Couplings for ferrous pipe shall be galvanized steel, threaded, manufactured in accordance with ASTM A865.
5. Flanges for ferrous pipe shall be galvanized forged steel construction, either socket weld or slip-on weld type, minimum pressure class 150, manufactured to ASME B16.5.
6. Bolts, nuts, and gaskets for flanged connections shall be appropriate to the pipe material, fluid type, temperature, and pressure. 1/16" thick pre-formed neoprene, typical.
7. Provide flexible stainless steel connectors at pumps and other such equipment, in accordance with manufacturer's recommendations. Connectors shall have corrugated hose and braided 300 series stainless steel jacketing. Carbon steel flanged or grooved ends as appropriate. NSF 372 lead-free for all potable water applications. Metraflex Company or pre-approved equivalent.

[Note: Kitz is a reputable but Japanese based manufacturer. They do NOT offer valves that meet domestic manufacture requirements so they are no longer listed as a first spec manufacturer. They may come up as a V.E. item, and are a valid consideration. Kitz could potentially apply to iron gate valves, ball valves (forged brass in sizes up through 3"and cast bronze bodied in 4" only), butterfly valves, and iron check valves (flanged).]

2.6 GATE VALVES (IRON)

A. ASTM A126 cast iron bodied, class 125 gate valve with bolted bonnet, non-rising ASTM B16 brass stem and packing gland, solid wedge, cast iron hand-wheel. Bronze wedge for sizes up through 6" and cast iron wedge with bronze bushing and wedge face rings for sizes 8" and larger.

B. Basis of design:

1. NIBCO T-619 (threaded) for sizes 2" through 4".
2. NIBCO F-619 (flanged) for sizes 6" and larger.

C. Acceptable alternate manufacturers:

1. Apollo
2. Milwaukee

D. Applies to only to limited installations such as services from submersible pumps and ejectors. Not to be used for domestic water systems.

2.7 GATE VALVES (DUCTILE IRON)

A. Fusion bonded epoxy coated ASTM A536 ductile iron bodied, class 125 gate valve with bolted bonnet, non-rising Type 304 stainless steel stem, resilient wedge. End connections as suited for adjacent piping. Provide with square operating nut for extended handle operation or with hand-wheel as appropriate for depth of burial and access. Certified lead-free to NSF 61/NSF 372 and AWWA C509 & C515 compliant (3" and larger).

B. Basis of design:

1. NIBCO 619 series for sizes 2" through 12".

C. Applies to outdoor, buried below grade domestic water main installations beyond 5 feet from the building edge. Not to be used inside of buildings.

2.8 BALL VALVES

[Note: Regarding ball valves 2-1/2" and larger: they are rather expensive, they take up significant space to install and fully operate the handle, and they can take significant effort to physically operate in larger sizes – although gear operated versions are available.
Therefore, for sizes 2-1/2" and larger, if acceptable to the owner, butterfly valves are preferable to ball valves. This must be confirmed on a project by project basis. IF butterfly valves are acceptable, then delete B2, C, D3 and D4 immediately below.]

[Note: While press-connect fitting manufacturers also offer ball valves with press-fit ends, these are not included below.]

A. All bronze cast construction two-piece 600 psi body, blow-out proof stem, Teflon seated, lead-free, with stainless steel trim (including ball, stem, and valve handle). Threaded connections. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. Basis of design (bronze valves):

1. NIBCO T-585-66-LF (full port) for all sizes up through 2".
2. NIBCO T-580-66-LF (conventional port) for sizes 2-1/2" and 3".

C. Valves 4" and larger shall be split body stainless steel construction, 275 psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150, full port design with manual gear operator. NIBCO F-515-S6-F-66-FS.

D. Acceptable alternate manufacturers:

1. Apollo 77 CLF-A series (full port) for all sizes up through 2".
2. Milwaukee UPBA-400S (full port) for all sizes up through 2".
3. Apollo 77 CLF-A series (full port) for size 2-1/2" and Apollo 70LF-140 series (standard port) for 3".
4. Milwaukee UPBA-100S (standard port) for sizes 2-1/2" and 3".

E. Applies to domestic water system installations.

F. Provide valves complete with extended lever handles as required to accommodate insulation and full valve operation.

G. Provide valves complete with memory stop kit where used for balancing applications.

1.17 BUTTERFLY VALVES

A. ASTM A536 ductile iron bodied, (minimum) 200 psi lug type wafer style butterfly valve with ASTM A582 Type 400 series stainless steel stem, ASTM B148 aluminum bronze disc, and EPDM rubber seat/lining. Extended neck. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. Basis of design:

1. NIBCO LD-2000-3 (lever handle operated) for sizes 2-1/2" through 4".
2. NIBCO LD-2000-5 (manual gear operated) for sizes 6" and larger.
3. Install between standard ASME (minimum) class 125 flanges in accordance with manufacturer's recommendations.

C. Acceptable alternate manufacturers:

1. Apollo
2. Milwaukee ML233E (lever handle operated) and ML333E (manual gear operated).

D. Applies to domestic water system installations.

2.9 BUTTERFLY VALVES (GROOVED)

A. Grooved end, lead-free, copper alloy bodied, 300 psi butterfly valve with EPDM encapsulated ductile iron or aluminum bronze disc, EPDM seat/seal, stainless steel stem and trim, and extended neck. ANSI/NSF 61 certified for potable water systems. Lever handle operated for sizes 2-1/2" through 4" and manual gear operated with handwheel for sizes 6" and larger.

B. Acceptable manufacturers:

1. Victaulic 608N (cast brass body with aluminum bronze construction disc).
2. Grinnell B680 (ASTM B584 bronze bodied).
3. Anvil Gruvlok Series 6700 CTS (ASTM B584 bronze bodied).

C. Applies only to domestic water system installations employing grooved copper joining systems, as specified elsewhere in this section. Manufacturers shall only be acceptable where their grooved systems are provided.

2.10 CHECK VALVES (BRONZE)

A. ASTM B62/ASTM B584 bronze body and disc, minimum 200 psi (cold working pressure) Y-pattern horizontal swing type check valve with removable bronze bonnet, Type 300 series stainless steel nuts and hinge pin, and PTFE disc seat. Threaded connections. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. ASTM A126 cast iron bodied, (minimum) class 125 globe style spring loaded (silent) check valve with ASTM B584 bronze disc and seat. Flanged connections. Certified lead-free to NSF 61/NSF 372 and suited to 200 degrees F.

C. Basis of design:

1. NIBCO T-413-Y-LF (Y-pattern swing type) for sizes up through 2".
2. NIBCO F-910-B-LF (globe style spring loaded type) for sizes 2-1/2" and larger.

D. Acceptable alternate manufacturers:

1. Apollo (for sizes up through 2")

E. Applies to domestic water system installations including associated pump discharge lines. Valves shall be suited for installation in both horizontal lines and vertical lines with upward flow, in accordance with manufacturer's recommendations.

2.11 CHECK VALVES (IRON)

A. ASTM A126 cast iron bodied, (minimum) class 125 conventional horizontal swing type check valve with bronze, cast or ductile iron disc. 200 psi cold working pressure. Threaded or flanged connections.

B. Basis of design:

1. NIBCO T-918-B (threaded connections) for sizes 2” through 4”.
2. NIBCO F-918-B (flanged connections) for sizes 6” and larger.

C. Acceptable alternate manufacturers:

1. Apollo (flanged in all sizes)
2. Milwaukee F-2974A (flanged in all sizes)

D. Applies only to limited installations such as services from submersible pumps and ejectors. Not to be used for domestic water systems.

2.12 PRESSURE REGULATING VALVES (PRV’s)

A. ASTM B62/ASTM B584 bronze bodied direct acting, ASSE 1003 single diaphragm type pressure regulating valve with removable bronze bonnet, in-line stainless steel strainer and spring, and FDA approved EPDM seat disc and Buna-N diaphragm. Threaded connections. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. NSF 61 epoxy coated ductile iron bodied pilot-operated globe style pressure regulating valve assembly. Complete with low-flow bypass and stainless steel, bronze, and copper trim and fittings. NSF 61 EPDM seat disc and diaphragm. Threaded or flanged connections. Suited to 180 degrees F.

C. Basis of design:

1. Apollo PRH-T-Y-LF (36HLF series) for direct acting valves, sizes up through 3”.
2. Apollo A127-LF series for pilot operated valves, sizes 1-1/4” through 4”.

D. Acceptable alternate manufacturers:

1. Cla-Val
2. Victaulic (pilot-operated valves)

E. PRV’s shall automatically reduce inlet pressure to a steady lower downstream pressure, regardless of changing flow rate. Provide complete with inlet strainer, inlet and outlet pressure gauges, isolation valves, and unions. Provide bypass line around assembly with normally closed valve.

2.13 BALANCING VALVES

A. Self-contained, fully automatic thermally actuated balancing valve shall continuously adjust flow to maintain the desired domestic hot water temperature within the branch line, regardless of system operating pressure. Valve shall modulate between open and closed position within a 10 degrees F range. Valve body and all internal components shall be constructed of stainless steel with major components constructed of Type 303 stainless. Rated for 200 psi maximum working pressure and no less than 250 degrees F maximum working temperature. Lead-free and ANSI/NSF 61 compliant. Threaded connections.

B. Basis of design:

1. ThermOmegaTech Circuit Solver, sizes 1/2" through 2”. Provide a union and ball type shutoff valve on both sides of the balancing valve.

2. ThermOmegaTech Circuit Solver with integrated union (CSU) assembly, sizes 1/2" and 3/4". Balancing valve assembly shall come complete with union body and ball type shutoff valves on both sides.

C. Applies to circulated domestic hot water system installations including multi-branch parallel piping circuits and single-loop piping circuits.

1. Provide balancing valve at end of **each** domestic hot water supply line (after last fixture served) just prior to the hot water return line, as indicated on Drawings and in accordance with manufacturer's installation recommendations.
2. Provide a pipe tee or elbow with bushing as appropriate, 3/4" threaded thermowell, and bi-metal adjustable angle 3 inch dial thermometer upstream of each balancing valve. Thermowell stem length and thermometer temperature probe length to be suited for pipe size, insulation thickness, and to ensure clearance for maintenance access and easy viewing of thermometer. Trerice bimetal/sensor, threaded-stepped shank thermowell (style 76) of lead-free brass (PBF) material. Trerice Model B836 thermometer with 300 stainless steel case and stem, hermetically sealed, double strength glass windowed, aluminum white-faced dial, complete with external reset and 0 to 200 degrees F range. Thermowell and thermometer face to be oriented upright for readability.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General requirements for piping:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
2. Remove any scale, oil and dirt, on inside and outside, before assembly.
3. Prepare piping connections to equipment with flanges or unions.
4. Confirm pipe placement, depth/elevation, and flow lines prior to any installation.

B. General requirements for valves:

1. Install valves with stems upright or horizontal, not inverted.
2. Valves shall be line-sized unless specifically noted otherwise.
3. Provide clearance for installation of insulation and access to valves and operable fittings. Valves installed beyond reasonable reach shall be provided with a chain operator.
4. Provide access doors where valves and operable fittings are not otherwise accessible. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.
5. Gate valves installed below grade shall be covered with an adjustable cast iron roadway box extended to grade. Cover shall be cast iron with 'water' cast on top of cover and shall be set flush to finished paving or 2" above finished earthen grade. Box shall be supported from undisturbed soil or concrete base and shall not introduce any stress to piping under all traffic conditions.

C. Install all materials in accordance with the manufacturer's published instructions.

D. All exposed sewer and water pipe in toilet rooms or other finished areas of the building shall be chrome plated.

E. Provide non-conducting dielectric connections wherever joining dissimilar metals.

F. Route piping in an orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on drawings, and maintain gradients.

G. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide encasement for and support for utility meters in accordance with the requirements of utility companies.

L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

M. Maintain uniformity in the installation of piping materials and joining methods. Do not mix material types.

N. Where connecting new underground sanitary, storm, or vent piping to existing piping of dissimilar material, provide suitable mechanical transition fittings complete with corrosion protection for metallic elements. Chase Construction Products Tapecoat H35 or approved equivalent and a final coat of coal tar to completely cover the transition.

O. Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

P. Waste nipple from wall to tapped tee shall be schedule 40 threaded galvanized steel pipe or brass or copper with threaded adapter.

Q. General requirements for cast iron piping installation:

1. Install all pipe and fittings in accordance with published recommendations from the manufacturer and the Cast Iron Soil Pipe Institute (CISPI). Specific items referenced below are not intended as a substitute for the complete and latest recommendations.
2. Install bell and spigot type pipe with bell end upstream.
3. Above ground horizontal pipe (suspended) shall:
    a. Be supported at no less than at every joint, and within 18” of the hub or coupling.
    b. Be maintained in alignment. Sagging or grade reversal shall be unacceptable.
    c. Be supported at terminal ends of all runs or branches and at each change of direction or alignment.
    d. Have all closet bends, traps, trap arms, and similar branches firmly secured.
    e. Be braced to prevent movement or joint separation.
    f. Be provided with suitable sway bracing (such as clamps, rods, and hardware) where pipe and fittings are suspended in excess of 18” by means of non-rigid hangers.
4. Above ground vertical pipe shall:
    a. Be secured at each stack base.

b. Be secured at each floor and riser clamps shall be provided on no greater than 15’-0” intervals.
c. Be adequately supported to keep the system (pipe and contents) in alignment.

5. Provide seismic restraints in seismically active areas, whether specifically required by the prevailing code or not.

R. For all underground non-metallic piping outside the building, provide minimum 14 AWG solid copper tracer wire (ASTM B-1, B-3) with high molecular weight polyethylene insulation (HMWPE) per ASTM D-1248. Wire shall be suited for direct bury applications to facilitate the detection and tracing of underground piping systems. THHN wire and other such nylon jacketing shall not be allowed. Insulation color shall be provided per the particular utility, in accordance with the American Public Works Association (APWA) uniform color code. Provide corrosion proof wire connectors with twist locking design and protective dielectric sealant. Copperhead Industries, LLC Snakebite or pre-approved equivalent. Tracer wire shall be placed in the same orientation as the installed pipe and laid six inches directly above the piping. One end of the tracer wire shall be brought aboveground at a building wall or riser for easy identification.

S. **No PVC pipe or fittings, or similar un-rated material, will be allowed in any areas where pipe is to penetrate a fire rated assembly or is to be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure**

T. Installations of underground thermoplastic piping systems shall be in strict conformity with the manufacturer’s published instructions and the requirements of ASTM D2321 (gravity pipe) and ASTM D2774 (pressure pipe).

U. Installation of above ground thermoplastic piping systems shall be in accordance with the manufacturer’s recommendations. The specific items indicated below are not intended as a substitute for the complete and latest manufacturer’s recommendations.

1. Hangers and supports shall not compress, distort, cut, or abrade the piping. Nor shall they force the pipe and fittings into position.
2. Piping shall be supported at intervals sufficiently close to maintain pipe alignment and to prevent any sagging or grade reversal. System maximum operating temperature will determine support spacing.
3. Piping shall be supported at all branch ends and at all changes of direction, as close as practical to the fitting to avoid introducing excessive torsional stresses into the system.
4. Directly support (or if need be, immediately adjacent to) concentrated loads in the system, such as valves and other appurtenances.
5. Allowances must be made for thermal expansion and contraction of the piping system where temperature fluctuations can reasonably be expected to produce such movement. Provide and place hangers accordingly so as not to restrict.
6. Plastic piping systems shall not be placed alongside steam or other high temperature pipe lines or other high temperature objects.
7. Drainage piping shall be supported at trap arms as close as possible to the trap and all closet bends shall be supported and braced.

V. Installation of solvent cement joints for PVC and CPVC piping shall be in strict conformity with the requirements of ASTM D2855 and manufacturer’s published instructions.

W. Provide approved heavy duty transition coupling at each transition from above ground cast iron pipe to underground PVC pipe as specified elsewhere in this section. Transition shall

be made as close as possible to the floor for sanitary DWV piping systems and at test tee “minimum 12 inches A.F.F.” for storm drainage piping. Support vertical cast iron pipe from floor anchors using riser clamp and galvanized all thread rod as specified in Section 22 05 29.

X. All grooved system tools and components (couplings, adapters, fittings, gaskets, **valves**, and specialties) shall be the product of a single domestic system manufacturer.

Y. Grooved pipe system manufacturer shall provide on-site training for contractor’s field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products at no additional cost to the owner.

3.2 APPLICATION

A. Provide union downstream of all valves at equipment or apparatus connections.

B. Provide male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections.

C. Provide approved isolation valves for shut-off and to isolate all equipment items and distinct parts of systems. Isolation valves shall be provided for both hot and cold water in locations including, but not necessarily limited to, the following:

1. At each floor for each domestic water tap branching off from a vertical riser.
2. At each domestic water branch line capped for future use.
3. At each restroom or restroom group.
4. At each hose bibb, wall hydrant, hose reel, and trap primer device (except for flush valve or tailpiece type trap primer devices).
5. At each domestic water branch line within 24” of the corresponding main.
6. At each plumbing fixture not otherwise served by a localized fixture group isolation valve.

D. Each plumbing water rough-in stub out shall be fitted with a supply stop.

E. Valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service, the valve handle shall be equipped with adjustable memory stop device.

F. Provide non-slam type check valves on discharge lines from all water pumps. Install at a minimum length of 5 times the pipe diameter from the pump and in accordance with manufacturer’s installation recommendations.

3.3 ERECTION TOLERANCES

A. All gravity drainage lines in the building shall have 1/4 inch per foot fall where possible and not less than 1/8 inch per foot fall toward the main sewer. Pipe must be laid so that the slope will be uniform and continuous. Permission shall be secured from the Architect and Engineer before proceeding with any Work where existing conditions prevent the installation at the minimum grade specified.

B. All vent and branch vent pipes shall be graded and connected as to drip back by gravity to the drainage pipe it serves. A slope of 1 inch per 40 feet will suffice for this requirement, subject to the approval of the local Authority Having Jurisdiction.

C. Slope all horizontal water piping with uniform pitch of 1/8 inch per 10 feet to low points to allow for complete system drainage. For long runs, where constant pitch cannot be maintained, provide intermediate low points and rise up again from such locations. Slope horizontal branches back to mains or risers. Provide clearly identified supplementary drain valves where hose bibbs, hydrants, or sill cocks will not suffice for this requirement.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, all domestic water systems shall be complete, thoroughly flushed clean and free of all foreign matter or erection residue.

B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. On building side of the main shut off valve, provide a 3/4" connection through which chlorine can be introduced into the water piping

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, in sufficient quantity to obtain 50 to 80 mg/L residual free chlorine solution throughout the entire domestic water piping systems.

E. Bleed water from outlets as required to ensure complete distribution and test for disinfectant residual at a minimum 15 percent of total outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.5 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services connecting to existing building services or utility lines as shown on the drawings.

B. Before commencing work, field verify invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover as required.

C. Provide new domestic water service connecting to existing building services or utility lines as shown on plans. Assure connections are in compliance with requirements of the jurisdiction having authority.

D. Extension of services to the building shall be fabricated from the same materials as the utility service lines or those materials specified herein.

E. Should points of connection vary from those indicated on the drawings contractor shall properly allow for this in the actual connections field fabricated.

3.6 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out after completion of the installation.

B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned.

3.7 TESTING OF PLUMBING PIPING SYSTEMS

A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

G. Domestic Water: Pressure test at one and one half times the normal working pressure or 125 psig, whichever is the greater, for 24 hours.

H. Sanitary Soil, Waste and Vents and Storm Sewer:

1. After the rough-in soil, waste and vent and other parts of the sanitary sewer including branch laterals have been set from the lowest level, at point of connection to existing utility lines, to above the floor line, all outlets shall be temporarily plugged or capped, except as are required for testing as described herein. Ground work shall not permit the backfill of trenches to cover any joints until the completion of testing. Back fill shall be limited to mid sections of full joints of piping only. For pipe in ground the piping shall be readied as described herein and filled with water to a verifiable and visible level to 10' above the lowest portions of the system being tested.
2. On multi-level buildings only one floor level shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case

of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention period, there shall be no perceptible lowering of the water level in the system being tested.

3. Should the completion of these tests leave any reasonable question or doubt of the integrity of the installation, additional tests including peppermint smoke, or other measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

3.8 COMPLETE FUNCTIONING OF WORK

A. All work reasonably implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division, unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fixtures covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Plumbing Fixtures

2. Fixture Carriers

3. Faucets, Supplies, and Trim

4. Flushometers

1.3 RELATED WORK

A. Section 22 05 29 – Hangers and Support for Plumbing Piping and Equipment

B. Section 22 10 00 – Plumbing Piping

C. Section 22 11 19 – Plumbing Specialties

D. Section 22 30 00 – Plumbing Equipment

1.4 REFERENCES

A. ASME A112.4.3 – Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System

B. ASME A112.6.1M – Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use

C. ASME A112.18.1 – Plumbing Supply Fittings

D. ASME A112.18.2 – Plumbing Waste Fittings

E. ASME A112.18.9 – Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures

F. ASME A112.19.1 – Enameled Cast Iron and Enameled Steel Plumbing Fixtures

G. ASME A112.19.2 – Ceramic Plumbing Fixtures

H. ASME A112.19.3 – Stainless Steel Plumbing Fixtures

I. ASME A112.19.7 – Hydromassage Bathtub Systems

J. NSF/ANSI 61 – Drinking Water System Components – Health Effects

K. ANSI Z358.1 – Emergency Eyewash and Shower Equipment

L. ASSE 1016 – Performance Requirements for Individual Thermostatic, Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.

M. ASSE 1037 – Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures

N. ADA (Americans with Disabilities Act)

O. TAS (Texas Accessibility Standards)

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Warranty: Warrant the work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or non-conforming materials and workmanship.

C. Defects shall include, but not necessarily be limited to, the following:

1. Noisy operation.
2. Noticeable deterioration of finish.
3. Leakage of water.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data under provisions of Division One.

C. Include component sizes, rough-in requirements, service sizes, finishes, materials, dimensions, performance information, and accessories.

D. Manufacturer’s Installation Instructions: Indicate assembly and support requirements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Provide pre-printed operating and maintenance instructions for each item specified. Instruct and demonstrate the proper operation and maintenance to the Owner's designated representative.

1.8 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on the Contract Documents.

B. Confirm and field coordinate that millwork is constructed with adequate provisions for the installation of counter top lavatories and sinks.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. GENERAL: Provide plumbing fixtures in accordance with manufacturer's recommendations and as indicated and scheduled on Drawings. Acceptable manufacturers of each fixture type are as indicated below.

1. Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise.
2. Fixture drilling shall match faucet spread and match any related trim and accessories.
3. ALL PLUMBING FIXTURES SHALL MEET EPA'S WATERSENSE CRITERIA.
4. REFER TO AISD'S PROJECT DEVELOPMENT MANUAL FOR ACCEPTABLE MANUFACTURER'S AND ALL FIXTURE REQUIREMENTS.

B. WATER CLOSETS, URINALS, LAVATORIES (Vitreous China)

1. American Standard
2. Kohler
3. Sloan

C. LAVATORIES

1. AMERICAN STANDARD
2. SLOAN
3. KOHLER

D. SINKS – FREESTANDING (Stainless Steel)

1. Elkay
2. Just
3. American Standard

E. MOP SINKS

1. Stern-Williams
2. Fiat
3. E.L. Mustee & Sons

F. CUSTODIAL SERVICE SINKS (Enameled Cast Iron) **[these are traditional style, mounted off-the-floor, with a P-trap standard]**

1. American Standard
2. Just
3. Fiat

G. EMERGENCY SAFETY FIXTURES

1. Bradley
2. Guardian
3. Chicago
4. Haws

H. DRINKING FOUNTAINS AND WATER COOLERS

1. Halsey Taylor
2. Elkay

2.2 FAUCETS, SUPPLIES, AND TRIM

A. GENERAL: Provide faucets, supplies, and trim in accordance with manufacturer's recommendations, as appropriate for fixtures to be served, and as indicated and scheduled on Drawings. Acceptable manufacturers for each type of appurtenance are as indicated below.

1. Flushometer flush rate shall match gallon-per-flush criteria of fixtures served.
2. Strainers shall be heavy cast brass chrome plated with matching grid type strainer, with or without overflow as required, 17 gauge seamless brass tailpiece of length determined by installation requirements. Provide complete with washers and brass locknut.
3. P-traps shall be 17 gauge seamless chrome plated brass, adjustable type. Provide complete with cleanout plug, chrome plated brass slip nuts, wall bend, and wrought brass escutcheon of depth determined by installation requirements.
4. Angle stops shall be lead-free commercial pattern chrome plated brass, quarter turn ball type with loose key handles. Provide complete with chrome plated copper supply risers and wrought brass escutcheon of depth determined by installation requirements.
5. Toilet seats shall be commercial grade and provided complete with stainless steel posts and self-sustaining check hinges.
6. Pipe trim insulation shall be compliant, white molded vinyl, fade/discoloration-resistant, bacteria/fungal-resistant insulation.

B. FAUCETS

1. Chicago
2. Zurn
3. Moen Commercial
4. Delta Commercial
5. American Standard
6. Kohler

C. SHOWER VALVES

1. Acorn
2. Bradley
3. Chicago
4.
5. Zurn

D. FLUSHOMETERS

1. Sloan
2. Zurn
3. Moen Commercial
4. Delta Commercial
5. American Standard
6. Toto

E. SUPPLY STOPS

1. McGuire
2. Zurn
3. Chicago

F. CHROME PLATED TUBULAR BRASS

1. McGuire
2. Zurn
3. Kohler

G. TOILET SEATS

1. Church
2. Bemis
3. American Standard
4. Zurn
5. Toto

H. PIPE TRIM INSULATION

1. Truebro
2. McGuire
3. Plumberex

2.3 FIXTURE CARRIERS

A. GENERAL: ANSI/ ASME A112.6.1M; Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise. Fixture carrier foot supports shall be securely anchored to the floor with 1/2” bolts and anchors at all locations.

1. Chair type carriers shall be adjustable, with coated cast iron body with integral no hub waste and vent connections, complete with gasketed adjustable faceplate assembly, adjustable nipple with test cap, neoprene bowl gasket, lugs for floor and wall attachment, threaded fixture studs, and hardware. Provide single or double type of vertical or horizontal configuration as required and with auxiliary inlet as required.
2. Lavatory carriers shall be adjustable, with steel uprights and welded base feet, coated cast iron support brackets, cast or ductile iron concealed support arms, alignment rod,

complete with leveling and support hardware. Provide single or back to back configuration as required.

3. Drinking fountain and urinal carriers shall be adjustable, with steel uprights and welded base feet, upper and lower bearing plates, threaded rods, and mounting hardware. Provide single or side-by-side configuration as required

B. ACCEPTABLE MANUFACTURERS

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

PART 3 – EXECUTION

3.1 PREPARATION

A. EXAMINATION OF CONDITIONS: Examine conditions affecting this work. Report unsatisfactory conditions to the proper authority and do not proceed until those conditions have been corrected. Commencing work implies acceptance of existing conditions as satisfactory to the outcome of this work.

B. Coordinate [cutting] [forming] of [roof] [floor] construction to receive drains to required invert elevations.

3.2 INSTALLATION

A. Install fixtures in locations and heights as shown on Drawings and as directed by the Architect.

B. Install materials plumb, level, securely, and in accordance with manufacturer's recommendations.

C. All rough-in pipe openings for final connections with supply, waste, vent, and storm systems shall be closed with caps or plugs during early stages of construction and installation. Tape shall not be considered sufficient protection.

D. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

E. Provide ball valves in piping serving batteries of fixtures. Label stops "Hot" and "Cold." Valves shall be located above accessible ceilings. If ceilings are not accessible, provide access panels of adequate size to ensure valves are fully accessible and can be fully operated.

F. Provide lockable ball valves in piping serving emergency safety fixtures and clearly label such valves as to the fixtures served.

G. Plumbing fixtures shall be supported by a concealed carrier where required to properly support the fixture specified. All carriers to be securely mounted, bolted and checked prior to concealment.

H. Caulk around fixtures with best grade white silicone caulking. Do not use grout.

I. All handles on supply and drainage fittings or other brass items shall be properly lined up and adjusted. Fittings shall not be left in any haphazard manner.

J. All fixtures shall have individual chrome plated heavy pattern loose key quarter-turn cutoff stops on supply lines, complete with escutcheons. Where same are not specified as a part of the fixture trim, they shall be installed as close to fixtures as possible in the hot and cold water supply.

K. Install each fixture with trap, easily removable for servicing and cleaning.

L. All showers and similar installations shall be installed with type “L” copper pipe between shower valve and shower head rough-in. The termination point shall have a brass drop ear elbow for shower head arm connection. Contractor shall provide proper anchoring support.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Review architectural drawings. Confirm configuration and orientation of shower controls and trim prior to rough-in and installation.

3.4 ADJUSTING

A. Adjust work under provisions of Division One.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.5 CLEANING

A. Clean work under provisions of Division One.

B. At completion clean plumbing fixtures and appurtenances.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Division One.

B. Do not permit use of fixtures.

3.7 ADA ACCESSIBLE FIXTURES

A. At all locations required to be accessible, such fixtures, controls, and final installations shall comply with the requirements of ADA and any applicable state accessibility standards. Install fixtures to heights, indicated on architectural drawings.

B. All exposed water supply and drain pipes under accessible lavatories and sinks shall be insulated with securely fastened pipe trim insulation kits of the proper model for the fixtures specified.

C. Wall mounted drinking fountains and coolers which protrude into passages or corridor space, whether single or paired with an adjacent accessible fixture, shall be supplied with a matching skirt or apron to lower the underside clearance of the non-accessible fixture equal to that required for accessible fixture.

END OF SECTION

SECTION 230100 – COMMISSIONING OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for mechanical (HVAC&R) systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section 016500 – "GENERAL COMMISSIONING REQUIREMENTS" for general commissioning process requirements.

2. Division 22 Section 220100 - "COMMISSIONING OF PLUMBING SYSTEMS".

3. Division 26 Section 260100 - "COMMISSIONING OF ELECTRICAL SYSTEMS".

1.3 DEFINITIONS

A. Commissioning Authority (CxA): Independent agent hired by Owner and not associated with General Contractor or its subcontractors, Architect or its sub-consultants, or Construction Administrator or its staff or consultants. Under Owner's direction, and not General Contractor's direction, CA will direct and coordinate day-to-day commissioning activities without assuming oversight responsibilities.

B. Refer to section 016500- GENERAL COMMISSIONING REQUIREMENTS for additional definitions and assignment of responsibilities.

1.4 REFERENCES

A. National Environmental Balancing Bureau (NEBB) - Procedural Standards for Building Systems Commissioning

B. American Air Balance Council (AABC) - Commissioning Guideline

C. SMCNA - HVAC Systems commissioning Manual

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

B. Perform commissioning tests at the direction of the CxA.

C. Attend construction phase controls coordination meeting.

D. Attend testing, adjusting, and balancing review and coordination meeting.

E. Participate in mechanical systems, assemblies, equipment, and component maintenance orientation and inspection.

F. Provide information requested by the CxA for final commissioning documentation.

G. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

H. Complete project-specific pre-functional/construction checklists and commissioning process test procedures for actual mechanical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

I. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.

J. Verify testing, adjusting, and balancing of Work are complete.

K. Provide test data, inspection reports, and certificates in Systems Manual.

1.6 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for mechanical systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.
5. Certificate of readiness certifying that mechanical systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

1.7 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, pre-start, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall conduct Pre-functional Testing to document compliance with installation and pre-functional checklists prepared by Commissioning Authority for Division-23 items.

B. Request verification of Pre-functional checklists by CxA prior to proceeding with system start-up and Functional Testing of systems.

C. Refer to Section 016500 - GENERAL COMMISSIONING REQUIREMENTS for issues relating to pre-functional checklists and testing, description of process, details on non-conformance issues relating to pre-functional checklists and test.

3.3 SYSTEM START-UP & INSPECTIONS

A. Contractor is solely responsible for system start-up. CxA may, at his discretion, witness start up procedures, but will not perform any Functional Testing of systems until Contractor has completed start-up and resolved all operating deficiencies.

B. Contractor is solely responsible for all tests and inspections required by the Authority Having Jurisdiction (AHJ). All test reports and certificates required by the AHJ shall be submitted prior to Functional Testing.

C. Contractor shall provide no less than 48 hours notice prior to conducting tests specified in other sections of the specifications, including:

1. Duct pressure tests
2. Hydronic piping pressure tests
3. Hydronic piping flushing

CxA shall witness tests at his discretion. Test results shall be documented with respective Pre-functional/construction checklists

3.4 FUNCTIONAL TESTING PREPARATION

A. Certify that mechanical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that mechanical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, corrective work approved, and balance has been verified by CxA (see paragraph below).

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, and alarm conditions).

E. Inspect and verify the position of each device and interlocks identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed.

3.5 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Upon completion of testing and balancing work, submit a copy of the report for CxA via Architect. CxA shall review report and issue comments via the Architect.

C. Verification: The CxA will notify Contractor seven (7) days in advance of the date of field verification. Notice will not include data points to be verified. This verification must take place prior to Functional Testing of systems.

1. Provide technicians, instrumentation, and tools to verify testing and balancing of mechanical systems at the direction of the CxA.
2. The testing and balancing Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.6 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of mechanical testing shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each space served. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Tests will be performed using design conditions whenever possible.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Contracting Officer and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CxA may direct that set points be altered when simulating conditions is not practical.

G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the mechanical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.7 GENERAL TESTING PROCEDURES FOR HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT

A. HVAC Instrumentation and Control System Testing: Contractor shall fully test operation of controls system prior to requesting Functional Testing of equipment and systems with CxA. Point-to-point check out sheets and as-built control diagrams shall be provided to CxA so he may develop testing procedures. Refer to Section 230926c BUILDING AUTOMATION SYSTEM COMMISSIONING REQUIREMENTS for commissioning of controls.

B. Mechanical Subcontractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan for piping systems. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA.

C. HVAC Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air distribution systems, chilled water systems and hot water systems.

D. HVAC Equipment Testing: Provide technicians, instrumentation, tools, and equipment to test performance of all HVAC equipment as outlined below.

3.8 FUNCTIONAL TEST PROCEDURES FOR SYSTEMS TO BE COMMISSIONED

A. General

1. The following paragraphs outline the functional test procedures for the various Div. 23 items to be commissioned. Functional testing will take place only after pre-functional checklists have been completed, equipment has been started-up, TAB has been verified, and Contractor has certified that systems are ready for functional testing.
2. All systems controlled via the Building Automation System shall have all control points and sequences tested by Controls Contractor prior to requesting testing by Commissioning Authority. Refer to Section 230926c BUILDING AUTOMATION SYSTEM COMMISSIONING REQUIREMENTS for commissioning of controls.
3. Refer to Section 016500 - GENERAL COMMISSIONING REQUIREMENTS for specific systems to be tested.

B. All Equipment:

1. Verify nameplate information (serial numbers, model numbers, etc.); verify that equipment capacity is in accordance with requirements of construction documents.
2. Verify unit runs smoothly and quietly.
3. Verify operation of safeties.
4. Verify electrical wiring and grounding is correct.
5. Verify maintenance and NEC clearances are maintained.
6. Verify Pre-Functional Checklists have completed.

C. Cooling Towers:

1. Record outside air temperature during test.
2. Record programmed setpoints (condenser water temp, OA reset temps, heater temp, freeze control temp, low-limit temp.)
3. Record programmed schedules
4. Verify fans run smoothly and quietly.
5. Verify voltages and amperages are within tolerance.
6. Verify correct fan rotation (in VFD Auto, Hand, Manual, and Bypass positions).
7. Verify tower data in TA&B report versus design
8. Verify fan modulation to maintain temperature setpoint.
9. Verify condenser water bypass valve operation
10. Verify all alarms and safeties.
11. Verify all interlocks.
12. Verify all sequences.

D. Chillers:

1. Record outside air temperature during test.
2. Record programmed setpoints (supply chilled water setpoint, minimal temperature differentials, minimal flow, safeties)
3. Verify chillers run smoothly and quietly under varying loads.

4. Verify voltages and amperages are within tolerance.
5. Verify chiller data in TA&B report versus design (condenser and evaporator side)
6. Verify compressor modulation to control supply chilled water temperature.
7. Verify low-flow (condenser and evaporator) shutdown and restart.
8. Verify high-condenser water alarm and shutdown
9. Verify loss of power restart
10. Verify all alarms and safeties.
11. Verify all interlocks
12. Verify all sequences.

E. HVAC Pumps:

1. Record outside air temperature during test.
2. Record programmed schedules
3. Verify pumps run smoothly and quietly.
4. Verify voltages and amperages are within tolerance.
5. Verify correct fan rotation (in VFD Auto, Hand, Manual, and Bypass positions).
6. Verify pump data in TA&B report versus design
7. Verify all alarms and safeties.
8. Verify all interlocks.
9. Verify all sequences.

F. Air Handling Units:

1. Record outside air temperature during test.
2. Record programmed setpoints (occ/unocc heating and cooling temps, coil discharge air temps, static pressure, economizer temp, CO2 setpoint, safeties and alarms)
3. Record programmed schedules
4. Verify fans run smoothly and quietly.
5. Verify voltages and amperages are within tolerance.
6. Verify correct fan rotation (in VFD Auto, Hand, Manual, and Bypass positions).
7. Verify AHU data in TA&B report versus design.
8. Verify chilled water control valve modulation to control supply air temperature.
9. Verify hot water control valve modulation to control discharge air temperature
10. Verify fan modulation to maintain duct static pressure setpoint.
11. Verify damper operation (Return, Outside and relief).
12. Verify Smoke detector operation.
13. Verify all alarms and safeties.
14. Verify all sequences.

G. Exhaust Fans

1. Record outside air temperature during test.
2. Record programmed schedules and interlocks
3. Verify fans run smoothly and quietly.
4. Verify voltages and amperages are within tolerance.
5. Verify fan data in TA&B report versus design
6. Verify backdraft damper operation
7. Verify all alarms and safeties.
8. Verify all sequences.

H. Dx Single-Zone Units:

1. Record outside air temperature during test.
2. Record space temperature during test.
3. Record programmed setpoints (occ/unocc heating and cooling temps, runtime, safeties and alarms)
4. Record programmed schedules and interlocks
5. Verify fans run smoothly and quietly.
6. Verify voltages and amperages are within tolerance.
7. Verify unit data in TA&B report versus design.
8. Verify compressor cycling to control space temperature.
9. Verify Smoke detector operation.
10. Verify all alarms and safeties.
11. Verify all sequences.

I. Testing Adjusting and Balancing (TAB).

1. Review TAB report for accuracy and completeness.
2. Take random sample of air flow from supply air diffusers and compare to TAB report / design drawings.
3. Take pressure readings at inlets and outlets of hydronic pumps and compare to TAB report and pump curves.

J. Direct Digital Controls (DDC) for HVAC –Refer to Section 230926c BUILDING AUTOMATION SYSTEM COMMISSIONING REQUIREMENTS.

3.9 TRAINING

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

3.10 O&M MANUALS

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS and section 017800 CLOSEOUT SUBMITTALS.

END OF SECTION

SECTION 23 02 00 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect/Engineer for review as soon as practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is the equivalent of that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Mechanical (HVAC) items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least 7 working days prior to bid; the greater or more costly of the

discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the commissioning process as required; including, but not limited to, meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The Contract Documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed shop drawings.

B. All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the Owner.

D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. 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 therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting are included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) systems.

C. Furnishing and installing all required Mechanical (HVAC) equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF SUBSTANTIAL COMPLETION

A. The date of final acceptance shall be the date of substantial completion. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct - properly protected from incidental damage and weather damage.

C. Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe or duct shall be installed in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

A. The heating, ventilating and air conditioning systems, and the component parts thereof, shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES AND STANDARDS

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements which includes and is not limited to the following nationally accepted codes and standards:

1. Air Moving & Conditioning Association, AMCA.
2. American Standards Association, ASA.
3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
4. American Society of Mechanical Engineers, ASME.
5. American Society of Plumbing Engineers, ASPE.
6. American Society of Testing Materials, ASTM.
7. American Water Works Association, AWWA.
8. National Bureau of Standards, NBS.
9. National Fire Protection Association, NFPA.
10. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.
11. Underwriters' Laboratories, Inc., UL.
12. International Energy Conservation Code, IECC.
13. International Building Code.
14. International Mechanical Code.
15. International Fire Code.
16. International Gas Code.
17. Uniform Mechanical Code

D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor, or its Subcontractor or Sub-subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor or, when so noted, by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract

Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by the latest ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the Work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is the equivalent of the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturer’s standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equivalent capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 calendar days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equivalent construction from the specified list of

manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUIVALENT" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUIVALENT" product, material or method may be used if it complies with the Specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) Design Documents and all other trades, including Division 26.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected Subcontractors shall be the responsibility of this bidder and not the Owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with the requirements listed above; and if accepted, will issue a letter allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades; and to pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty-day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing of all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this

submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating that the submittal meets all conditions of the Contract Documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified. The Contractor will automatically be required to furnish the product, material or method named in the Specifications. Contractor shall not order equipment when submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without submittal review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Contractor shall submit AISD Sustainability Submittal Sheets as found in the AISD Project Development Manual and comply with sustainability requirements.

H.

I. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

J. Submittals are required for, but not limited to, the following items subject to project requirements:

1. Coordination Drawings
2. Common Motor Requirements for HVAC Equipment
3. Expansion Fittings and Loops for HVAC Piping
4. Variable Frequency Motor Speed Control for HVAC Equipment
5. Hangers and Support for Piping and Equipment HVAC
6. Vibration and Seismic Controls for HVAC Piping and Equipment
7. Testing, Adjusting, and Balancing
8. Duct Insulation

9. HVAC Equipment Insulation
10. HVAC Piping Insulation
11. Refrigerant Monitor System
12. Energy Management and Control System
13. Above Ground Hydronic Piping
14. Hydronic Specialties
15. Hydronic Pumps
16. Refrigerant Piping
17. Metal Ductwork
18. Ductwork Accessories
19. HVAC Fans
20. Air Distribution Devices
21. Air Filters
22. Centrifugal Liquid Chiller
23.
24. Modular Indoor Central Station Air Handling Units
25. Packaged Air Handling Unit
26.
27. Rooftop Heating and Cooling Units Electric Cooling-Gas Heating
28.

K. Refer to other Division 23 sections for additional submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:

    a. Wall and type locations.
    b. Clearances for installing and maintaining insulation.
    c. Locations of light fixtures and sprinkler heads.
    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
    e. Equipment connections and support details.
    f. Exterior wall and foundation penetrations.
    g. Routing of storm and sanitary sewer piping.
    h. Fire-rated wall and floor penetrations.
    i. Sizes and location of required concrete pads and bases.
    j. Valve stem movement.
    k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air

distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting coordination drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements in Special Project Requirements, in addition to the requirements specified in Division 23, indicate the following installed conditions:

1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, fuel fired heaters, fan coils, condensing units, and roof-top A/C units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
5. Contract Modifications, actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

C. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

D. Refer to Division 00 and Division 01 for additional requirements concerning Record Drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and re-producibles is a condition of substantial completion.

E. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

F. Submit three prints of the tracings for review. Make corrections to tracings as directed and deliver "Auto Positive Tracings" to the Architect. "As-Built" drawings shall be furnished in addition to submittals.

G. When the option described in paragraph F above is not exercised, then upon completion of the Work, the Contractor shall transfer all marks from the tracings and submit a set of clear concise reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the Work. The reproducible record "AS-BUILT" drawings shall have the Engineer's Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____
(SIGNATURE)

1.16 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with Division 00 and Division 01 and, in addition to the requirements specified in those Divisions, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.17 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled date for each test. This detailed completion and test schedule shall be submitted at least 90 days before the projected substantial completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review

adequately in advance of substantial completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to, those items outlined in Section 23 02 00.

1.18 OPERATING AND MAINTENANCE MANUALS

A. Coordinate with Division 00 and Division 01 for operating and maintenance manual requirements. Unless noted otherwise, bind together in “D ring type” binders (National model no. 79-883 or equal). Binders shall be large enough to allow ¼” of spare capacity. Three (3) sets of all reviewed submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under these Specifications. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 23 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions. In addition to the requirements specified in Division 23, include the following information for equipment items:

1. Identifying names, name tag designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable (i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts).
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
8. Equipment and motor name plate data.
9. Wiring diagrams.
10. Exploded parts views and parts lists for all equipment and devices.
11. Color coding charts for all painted equipment and piping.
12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 00 and Division 01 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of 14 working days prior to the beginning of the operator training

period.

1.19 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include a minimum of 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 23 Sections for additional Operator Training requirements.

1.20 FINAL COMPLETION

A. At the completion of the Work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 23 for additional requirements.

B. Clean and adjust all air distribution devices and replace all air filters immediately prior to Substantial Completion.

C. Touch up and/or refinish all scratched equipment and devices immediately prior to Substantial Completion.

1.21 CONTRACTOR'S GUARANTEE

A. Use of the HVAC systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing; and, if granted, shall not cause the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one year after the date of the Substantial Completion, and shall furnish (free of additional cost to the Owner) all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air conditioning compressors shall have parts and labor guarantees for a period of not less than 5 years beyond the date of Substantial Completion.

E. Refer to Sections in Division 23 for additional guarantee or warranty requirements.

1.22 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as

appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently, or otherwise, without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be at the Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. SUSTAINABILITY REQUIREMENTS: Low-Emitting Materials are required and must conform to VOC limits, TVOC content, meet CPDH Standard Method v1.1-210, meet SCAQMD Rule @1113 or CARB 2007 SCM, list Green Seal GS-11 VOC limits and confirm that there is no methylene chloride/perchloroethylene.

B. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government

projects. These materials and equipment shall comply with “Buy American Act.”

C. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.

D. All access doors located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

E. Access Doors: shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surface: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install doors only in locations approved by the Architect.

2.2 EQUIPMENT PADS (See 2.4 in Section 26 02 00)

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in Divisions 2 through 48 for additional rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements,

resolve conflicts and submit proposed solution to the Architect for review.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as possible, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access doors where units are concealed behind finished surfaces. Refer to paragraph 2.1 in this section and architect for access doors specifications and location.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curbs which match the roof slope and provides a level top for equipment installation. Refer to Architectural drawings and details.
14. The equipment to be furnished under these Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The Architectural and Structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Mechanical Equipment:

    a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.

19. Provide construction filters for all air handling units, fan coil unit, VAV boxes, and all other air handling equipment during the entire construction period.
20. Provide temporary construction strains for all strainers in the hydronic systems during the initial flushing of the systems.

3.3 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.

2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Paragraph 1.11 I for definition of "Installer."

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC units, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.
3. Contractor shall not start-up any of the HVAC equipment unless the Owner, Architect and Engineer are signed off.
4. Start-up for major HVAC equipment such as chillers, cooling towers, variable frequency drives and hot water boilers shall be performed by a factory technician. The start-up shall include a written report signed off by Contractor, Engineer and Owner.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to, the existing piping, duct, equipment and other apparatus related to this phase of the Work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission

of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by the contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe and duct, pipe and duct hangers and/or line supports. Where duct or pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. During construction and remodeling, portions of the Project shall remain in service. Construction equipment, material, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility; or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

E. Certain work during the demolition and construction phases may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

H. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

I. Include in the contract price all rerouting of existing pipe, duct, etc., and the reconnecting of the existing equipment as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, and ventilation services for the existing areas with a minimum of interruption.

J. All existing pipe, duct, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

K. Pipe, duct, equipment and controls serving mechanical and other Owner's equipment,

etc., which is to remain but is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

L. No portion of the **fire protection systems** shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.

M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

N. Refer to Architectural Demolition and/or Alteration plans for actual location of walls, ceilings, etc., being removed and/or remodeled.

END OF SECTION

SECTION 23 05 26 - VARIABLE FREQUENCY MOTOR SPEED CONTROL FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Section 1.1 A in Section 23 05 13

B. Section 1.1 B in Section 23 05 13

C. Furnish and install a complete adjustable frequency motor speed control for the following items:

1. Variable volume air handling units.
2. Chilled water pumps
3. Condenser water pumps
4. Hot water pumps
5. Cooling tower fans.
6. Variable volume ventilation fans.

1.2 RELATED SECTIONS

A. Section 23 02 00 – Basic Materials and Methods

B. Section 23 05 13 – Common Motor Requirements for HVAC Equipment

C. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment

D. Section 23 05 93 – Testing, Adjusting and Balancing

E. Section 23 09 00 – Energy Management and Controls System

F. Section 23 21 23 – Hydronic Pumps

G. Section 23 65 36 – Cooling Tower Vertical Discharge Cross Flow

H. Section 23 73 13 – Modular Indoor Central Station Air Handling Units

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Certified noise data shall be submitted by drive manufacturer. Noise generated by variable frequency motor speed control drive shall not exceed preferred “RC” as listed in 2015 ASHRAE HVAC Applications, Chapter 48 Noise and Vibration Control, Table 2 Criteria for Acceptable HVAC Noise in Unoccupied Rooms.

1.4 WARRANTY

A. Warranty shall be 3years from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll-free phone number.

1.5 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be stored and handled per manufacturer's instructions.

1.6 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Yaskawa/Magnetek

B. ABB

2.2 ADJUSTABLE FREQUENCY INVERTER

A. The AFD package as specified herein shall be enclosed in a NEMA 12 enclosure for interior applications, a NEMA 3R enclosure for exterior locations and a NEMA 4X enclosure where located in a cooling tower yard or within 20 feet from cooling tower. All enclosures shall be completely assembled and tested by the manufacturer in an ISO9001 facility. The AFD shall operate from a line of +30% over nominal and the under-voltage trip level shall be 35% under the nominal voltage as a minimum.

B. The fused input shall utilize fast acting current limiting type per manufacturer recommendations.

C. The variable frequency power and logic unit shall be completely solid state. The unit shall transform 480 Volt or 208 Volt (as indicated on plans), 3 phase, 60 hertz input power into frequency and voltage controlled, 3 phase output power suitable to provide positive speed and torque control to the fan motor. The speed control shall be step-less throughout the speed range under variable torque load on a continuous basis. The adjustable frequency control shall be of a pulse width modulated type utilizing a full wave diode bridge rectifier; and shall have a power factor of 0.95 or better at all motor loads.

D. All AFD's shall have the same customer interface, including a backlit LCD two-line digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have its own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for the start-up of multiple AFD's. The keypad shall include Hand-Off-Auto membrane selections. When in "Hand", the AFD will be started and the speed will be controlled from the up/down arrows. When in "Off", the AFD will be stopped. When in "Auto", the AFD will start via an external contact closure and the AFD speed will be controlled via an external speed reference.

E. The adjustable frequency inverter shall conduct no radio frequency interference (RFI) back to the input power line.

F. The AFD shall have an integral 5% impedance line reactor to reduce the harmonics to the power line and to add protection from AC line transients. The inverter/reactor shall be a single wiring point.

2.3 SELF PROTECTION

A. The following features for self-protection shall be included:

1. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes. The minimum FLA rating shall meet or exceed the values in the NEC/UL Table 430-150 for 4-pole motors.
2. Limit the output current in under 50 microseconds due to phase to phase short circuits or severe overload conditions.
3. Protect the inverter due to non-momentary power or phase loss. The undervoltage trip shall activate automatically when the line voltage drops 15% below rated input voltage.
4. Protect the inverter due to voltage levels in excess of its rating. The overvoltage trip shall activate automatically when the DC bus in the controller exceeds 1000 VDC.
5. Protect the inverter from elevated temperatures in excess of its rating. An indicating light that begins flashing within 10 degrees C of the trip shall be provided to alert the operator to the increasing temperature condition. When the over temperature trip point is reached, this light shall be continuously illuminated.
6. The inverter shall be equipped such that a trip condition resulting from overcurrent, undervoltage, overvoltage or overtemperature shall be automatically reset, and the inverter shall be automatically reset, and the inverter shall automatically restart upon removal, or correction of the faulty condition.
7. Status lights for indication of conditions described above shall be provided. A SPDT contact for remote indication shall be provided. Additionally, status lights to show power on, zero speed, and drive enabled shall be provided. All status lights shall be self-contained in the front panel of the unit and shall be duplicated for ease of troubleshooting on the inside of the unit.
8. Current and voltage signals shall be isolated from logic circuitry.
9. Drive logic shall be microprocessor based.
10. In the event of a sustained power loss, the control shall shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation if the start is in the “On” condition.
11. In the event of a momentary power loss, the control shall be shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation (if the start is in the “On” position) being able to restart into a rotating motor regaining positive speed control without shutdown or component failure.
12. In the event of a phase to phase short circuit, the control shall shut down safely without component failure.
13. In the event that an input power contactor is opened or closed while the control is activated, no damage shall result.
14. To facilitate startup and troubleshooting, the control shall operate without a motor or any other equipment connected to the inverter output.

2.4 ELECTRICAL CONSTANT SPEED BYPASS

A. Provide all components and circuitry necessary to provide manual full bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and

shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the “bypass” mode. Fast-acting semi-conductor with a fuse block shall be provided to isolate the drive for service. Bypass designs that have no such fuses must have a lockable disconnect that isolates the drive while running in bypass mode. The Contractor device shall be NEC approved. A common start/stop signal shall be used for both the variable frequency drive mode and bypass mode. Manual bypass shall contain the following:

1. Two contactors mechanically interlocked via a three position through the door selector switch or keypad to provide the following controls:

    a. “Inverter” mode connects the motor to the output of the inverter.
    b. “Bypass” mode connects the motor to the input since wave power. Transfer must occur with input disconnect open. Motor is protected via electronic overload.
    c. “Off” mode disconnects motor from all input power.
    d. A molded case circuit breaker with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
    e. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is Hand, Auto, or Bypass mode. The remote start/stop contact shall operate in AFD and bypass modes.
    f. An electronic overload selectable for class 20 or 30 shall provide protection of the motor in Bypass mode.

2. The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.

    a. Power on
    b. External fault
    c. Drive mode selected
    d. Bypass mode selected
    e. Drive running
    f. Bypass running
    g. Drive fault
    h. Bypass fault
    i. Bypass-H-O-A mode
    j. Automatic transfer to bypass selected

3. The following relay (form C) outputs from the bypass shall be provided:

    a. System started
    b. System running
    c. Bypass override enabled
    d. Drive fault
    e. Bypass fault (motor overload or underload (broken belt))
    f. Bypass H-O-A position

4. The AFD shall include a “run permissive circuit” that will provide a normally open contact any time a run command is provided (local or remote start command in AFD or bypass mode). The AFD system (AFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch). When the AFD systems safety interlock (fire detector, freezestat, high static pressure switch, etc.) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.

5. There shall be an internal switch to select manual or automatic bypass.
6. There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication when in the bypass mode.
7. The bypass mode must include an undervoltage and phase loss relay to protect the motor from single phase power and undervoltage conditions.

    a. Bypass shall be UL listed.
    b. Bypass shall carry a UL 508 label.

2.5 FEATURES AND SPECIFICATIONS

A. Output frequency shall neither vary with load nor with any input frequency variations. Output frequency shall not vary within +/-10% input voltage changes. Output frequency shall not vary with temperature changes within the ambient specification.

B. No auxiliary equipment shall be required. The output frequency shall be adjusted in proportion to 4-20 mA signal.

C. A 0 to 10 Volt DC signal shall be provided for remote indication. This 0 to 10 Volt DC signal shall vary in direct proportion to the controller speed.

D. The controller shall be started or stopped by a contact closure or through serial communications.

E. A single pole, double throw contact shall be provided for remote indication. Contact will change state when any trip condition has occurred. (contact rated for 12-250 VAC-2 AMPS).

F. A second single pole, double throw contact shall be provided for remote indication. Contact will state when the VFD receives a run command (contact rated for 12-250 VAC-24 AMPS).

G. PID Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus.

H. Unit to operate from a 4 to 20 mA input signal and shall have hand-off-auto switch and door mounted potentiometer controls for manual speed selection.

I. Acceleration and deceleration times shall be adjustable from 30 to 300 seconds.

J. The drive shall have the ability to invert the speed signal input, as well as having offset and gain controls for speed signal conditioning.

K. Minimum and maximum speeds shall be adjustable in automatic and manual modes.

L. Hazard inputs shall be provided, capable of up to two inputs (fire, freeze). These shall each be capable of safely shutting down the inverter and illuminating a front panel hazard light depicting that a hazard condition turned the inverter off.

M. The inverter shall be a starter, containing a door interlocked input disconnect switch and manual reset motor electronic overloads, with accessible reset on front door, and manual bypass switch.

N. Solid state ground fault interrupt circuit.

O. The LED display shall monitor and display four parameters on a single display (i.e. frequency command, output frequency, output current, and torque).

P. A N.O. auxiliary run-time contact shall be provided for control signaling to auxiliary equipment. Contact shall close when the pump is brought on line and open when the pump is taken off line. Contact shall be rated 20 amps at 120 volts.

Q. Inverter shall be UL listed.

R. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the Owner, and a copy kept on file at the manufacturer

S. Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.

T. A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the Owner at the time of Substantial Completion. The training shall include installation, programming and operation of the AFD, bypass and serial communication.

U. Provide a motor end surge control voltage suppressive filter if the VFD manufacturer cannot limit their voltage surges to under 1000 volt at 100 feet.

V. Provide a motor acoustic noise reduction filter capable of approximately 12 dBA attenuation, if the VFD raises the dBa level above 3 dBa at a distance of 3 feet from the motor.

W. Provide each unit with a 3% reactor which is mounted on both the positive and negative DC bus. The reactor shall be a single wiring point and mounted internally to the drive.

X. Adjustable frequency inverters shall have native BACnet protocol for integration with EMCS. If the in inverter does not have native BACnet protocol, a BACnet interface card shall be provided.

PART 3 - INSTALLATION

3.1 Install units in accordance with manufacturer’s published installation instructions. Variable frequency speed control shall be located so that wiring to motor does not exceed 100 feet.

END OF SECTION

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 Refer to Architectural Sections for additional requirements.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

A. Valves:

1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.
2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.
3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.
4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B. Pipe Marking:

1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.
2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton (Name plate Company Factory location 20 Thompson Road, Branford, Connecticut) or approved equal.
3. Generally, markers shall be located on each side of each and every partition, on each side of every tee, on each side of every valve and/or valve group, on each side of every piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.
4. Markers shall be installed after final painting of all piping and equipment and in

such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.

5. Markers shall be colored as indicated below per ANSI/OSHA Standards:

SYSTEM	COLOR	LEGEND
Chilled Water	Green	Chilled Water Supply Chilled Water Return
Hot Water	Reddish Orange	Hot Water Supply Return
Condenser Water	Green	Condenser Water Supply Condenser Water Return

C. Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.
2. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

System	Color
Condenser Water Supply and Return	Light Green
Chilled Water Supply and Return	Light Blue
Heating Hot Water Supply and Return	Reddish Orange

2.2 EQUIPMENT IDENTIFICATION

A. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.1 All labeling equipment shall be installed as per manufacturer’s printed installation instructions.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors price shall include all items required as per manufacturer’s requirements.

3.3 All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Refer to Division 9 for Architect’s required paint system(s).

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 RELATED DOCUMENTS

Approved submittal date on equipment installed, to accomplish the test procedures, outlined under paragraph 3.1 of this Section, will be provided by the Contractor.

1.3 DESCRIPTION

A. The TAB of the air conditioning systems shall be performed by an impartial technical firm hired by Owner (AISD) whose operations are limited only to the field of professional TAB. The TAB work will be done under the direct supervision of a qualified engineer employed by the TAB firm.

B. Prior to construction/renovation, the TAB firm will be provided with the available existing .TIF files of the school by the engineer or architect. The TAB firm shall conduct a review of the design documents and issue a report identifying items required for TAB scope.

C. When construction is 95% complete, the TAB firm will be responsible for inspecting, adjusting, balancing, and logging the date on the performance of fans, dampers in the duct system, and air distribution devices. The Contractor and the various Subcontractors of the equipment installed shall cooperate with the TAB firm to furnish necessary data on the design and proper applications of the system components and provide labor and material required to eliminate deficiencies or malperformance.

1.4 QUALITY ASSURANCE

A. QUALIFICATIONS OF CONTRACTOR PERSONNEL: Submit evidence to show that the personnel who shall be in charge of correcting deficiencies for balancing the systems are qualified. The Owner and Engineer reserve the right to require that the originally approved personnel be replaced with other qualified personnel if, in the Owner and Engineer's opinion, the original personnel are not qualified to properly place the system in condition for balancing.

B. QUALIFICATIONS OF TAB FIRM PERSONNEL:

1. A minimum of one registered Professional Engineer licensed in the State, is required to be in permanent employment of the firm.
2. Personnel used on the jobsite shall be either Professional Engineers or technicians, who shall have been permanent, full time employees of the firm for a minimum of six months prior to the start of Work for that specified project.
3. Evidence shall be submitted to show that the personnel who actually balance the systems are qualified. Evidence showing that the personnel have passed the tests required by the Associated Air Balance Council (AABC) shall be required.

C. CALIBRATION LIST: Submit to the Engineer for approval, a list of the gauges,

thermometers, velometer, and other balancing devices to be used in balancing the system. Submit evidence to show that the balancing devices are properly calibrated before proceeding with system balancing.

1.5 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SERVICES OF THE CONTRACTOR

A. The Drawings and Specifications have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions. Install these devices in a manner that leaves them accessible, and provide access as requested by the TAB firm.

B. Have systems complete and in operational readiness prior to notifying the TAB firm that the project is ready for their services, and certify in writing to the Architect and Owner that such a condition exists.

C. As a part of the Work of this Section, make changes in the sheaves, belts, and dampers or the addition of dampers required for correct balance of the new work as required by the TAB firm, at no additional cost to the Owner.

D. Fully examine the existing system to be balanced, to determine whether or not sufficient volume dampers, balancing valves, thermometers, gauges, pressure and temperature taps, means of reading static pressure and total pressure in duct systems, means of determining water flow, and other means of taking data needed for proper water and air balancing are existing. Submit to the Engineer in writing a listing of omitted items considered necessary to balance existing systems. Submit the list and proposal as a cost add item.

E. Verify that fresh air louvers are free of blockage, coils are clean and fresh air ducts to each air handling unit have individually adjustable volume regulating dampers.

F. Provide, correct, repair, or replace deficient items or conditions found during the testing, adjusting, and balancing period.

G. In order that systems may be properly tested, balanced, and adjusted as specified, operate the systems at no expense to the Owner for the length of time necessary to properly verify their completion and readiness for TAB period.

H. Project construction schedules shall provide time to permit the successful completion of

TAB services prior to Substantial Completion. Complete, operational readiness, prior to commencement of TAB services, shall include the following services of the Contractor:

1. Construction status of building shall permit the closing of doors, windows, ceilings installed and penetrations complete, to obtain project operating conditions.
2. AIR DISTRIBUTION SYSTEMS:
    a. Verify installation for conformity to design. Supply, return, and exhaust ducts terminated and pressure tested for leakage as specified.
    b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief shall provide tight closure and full opening, smooth and free operation.
    c. Supply, return, exhaust and transfer grilles, registers and diffusers shall be installed.
    d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and sealed to eliminate excessive bypass or leakage of air.
    e. Fans (supply and exhaust) operating and verified for freedom from vibrations, proper fan rotation and belt tension; overload heater elements shall be of proper size and rating; record motor amperage and voltage and verify that these functions do not exceed nameplate ratings.
    f. Furnish or revise fan drives or motors as necessary to attain the specified air volumes.
3. WATER CIRCULATING SYSTEMS:
    a. Position valves pertinent to system design and require operation to permit full flow of water through system components. Operate hydronic systems under full flow conditions until circulating water is clean. Remove and clean strainers as required during this cycle of operation.
    b. For retrofit projects, record each existing pump motor amperage and voltage. Readings shall not exceed nameplate rating.
    c. Verify, on new equipment, electrical starter overload heater elements to be of proper size and rating.
    d. Ensure that water circulating systems shall be full of water and free of air; expansion tanks set for proper water level, and air vents installed at high points of systems and operating freely. Advise Engineer of deficiencies.
    e. Check and set operating temperatures of heat exchangers to design requirements.
    f. The various existing water circulating systems shall be cleaned, filled, purged of air, and put into operation before hydronic balancing.
4. AUTOMATIC CONTROLS:
    a. Verify that control components are installed in accordance with project documents and functional, electrical interlocks, damper sequences, air and water resets, fire and freeze stats.
    b. Controlling instruments shall be functional and set for design operating conditions. Factory precalibration of room thermostats and pneumatic equipment will not be acceptable.
    c. The temperature regulation shall be adjusted for proper relationship between the controlling instruments and calibrated by the TAB Contractor. Advise Engineer of deficiencies or malfunctions.

I. Contractor shall repair any insulation removed from piping system by TAB Contractor during water balancing.

3.2 SERVICES OF THE TAB FIRM

A. The TAB firm will act as liaison between the Owner, Engineer, and the Contractor and

inspect the installation of mechanical piping system, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems being retrofitted, repaired, or added under this Contract. The reinspection of the Work will cover that part related to proper arrangement and adequate provision for the testing and balancing and will be done when the Work is 80 percent complete.

B. Upon completion of the installation and start-up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building. Prepare and submit to the Engineer complete reports on the balance and operations of the systems.

C. Measurements and recorded readings of air, water, and electricity that appear in the reports will be done by the permanently employed technicians or engineers of the TAB firm.

D. Make an inspection in the building during the opposite season from that in which the initial adjustments were made. At the time, make necessary modifications to the initial adjustments required to produce optimum operation of system components to affect the proper conditions as indicated on the Drawings. At time of opposite season check-out, the Owner's representative will be notified before readings or adjustments are made.

E. In fan systems, the air quantities indicated on the Drawings may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the Contractor to furnish or revise fan drive and motors if necessary, without cost to the Owner, to attain the specified air volumes.

F. Contractor shall utilize ultrasonic flow meter to balance water flow of existing water system if the original pressure drop data is not available. Contractor shall remove insulation as necessary to use flow meter.

3.3 PROFESSIONAL REPORT

A. Before the final acceptance of the report is made, the TAB firm will furnish the Engineer the following data to be approved by the Owner and Engineer:

1. Summary of main supply, return and exhaust duct pitot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.
2. A listing of the measured air quantities at each outlet corresponding to the temperature tabulation as developed by the Engineer and TAB firm.
3. Air quantities at each return and exhaust air handling device.
4. Static pressure readings entering and leaving each supply fan, exhaust fan, filter, coil, balancing dampers and other components of the systems. Including the retrofit Work. These readings will be related to performance curves in terms of the CFM handled if available.
5. Motor current readings at each equipment motor on load side of capacitors. The voltages at the time of the reading shall be listed.
6. The final report shall certify test methods and instrumentation used, final velocity reading obtained, temperatures, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items. The test results will be recorded on standard forms.
7. A summary of actual operating conditions shall be included with each system outlining normal and ventilation cycles of operation. the final report will act as a reference of actual operating conditions for the Owner's operating personnel.

3.4 BALANCING AIR CONDITIONING SYSTEM

A. GENERAL:

1. Place all equipment into full operation, and continue operating during each working day of balancing and testing. If the air conditioning system is balanced during Off-Peak cooling season Contractor shall return to rebalance air side system as required to put system in proper balance at that season.
2. The Contractor shall submit detailed balancing and recording forms for approval. After approval by the Engineer, prepare complete set of forms for recording test data on each system. All Work shall be done under the supervision of a Registered Professional Engineer. All instruments used shall be accurately calibrated to within 1% of scale and maintained in good working order.
3. Upon completion of the balancing and testing, the TAB Contractor shall compile the test data in report forms, and forward five copies to the Engineer for evaluation.
4. The final report shall contain logged results of all tests, including such data as:
   a. Tabulation of air volume at each outlet.
   b. Outside dry bulb and wet bulb temperature.
   c. Inside dry bulb and wet bulb temperatures in each conditioned space room or area.
   d. Actual fan capacities and static pressures. Motor current and voltage readings at each fan.

B. AIR SYSTEMS: Perform the following operations as applicable to balance and test systems:

1. Check fan rotation.
2. Check filters (balancing shall be done with clean filters).
3. Test and adjust blower rpm to design requirements.
4. Test and record motor full load amperes.
5. Test and record system static pressures, suction and discharge.
6. Test and adjust system for design cfm, return air and outside air (±2%). Change-out fan sheaves as required to balance system.
7. Test and record entering air temperatures, db and wb.
8. Test and record leaving air temperatures, db and wb.
9. Adjust all zones to design cfm (±2%).
10. Test and adjust each diffuser, grille, and register to within 5% of design.

C. AIR DUCT LEAKAGE: (From SMACNA Duct Standards latest edition) Test all ductwork (designed to handle over 1000 CFM) as follows:

1. Test apparatus
   The test apparatus shall consist of:
   a. A source of high pressure air--a portable rotary blower or a tank type vacuum cleaner.
   b. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.
2. Test Procedures
   a. Test for audible leaks as follows:
      1) Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
      2) Start the blower with its control damper closed.
      3) Gradually open the inlet damper until the duct pressure reaches

1.2 times the standard designed duct operating pressure.

4) Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

b. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:

1) Start blower and open damper until pressure in duct reaches 25% in excess of designed duct operating pressure.

2) Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.

3) Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

4) Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which must be corrected.

D. DX SYSTEMS:

1. Test and record suction and discharge pressures at each compressor and record ambient air temperature entering the condensing coils.
2. Test and record unit full load amps and voltage.
3. Test and record staging and unloading of unit required by sequence of operation or drawing schedule.

E. Automatic temperature controls shall be calibrated; and all thermostats and dampers adjusted so that the control system is in proper operating condition, subject to the approval of the Engineer/Owner.

F. The TAB Contractor shall report to Engineer all air distribution devices or other equipment that operate noisily so that corrective measures may be implemented by the Contractor at no additional cost to the Owner or Architect/Engineer.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Ductwork system insulation.

1.3 RELATED SECTIONS

A. Section 23 05 29 - Hangers and Support for HVAC Piping and Equipment

B. Section 23 05 53 – Identification for HVAC Piping and Equipment

C. Section 23 31 13 – Metal Ductwork

1.4 REFERENCE STANDARDS

A. ASTM International. (ASTM)

B. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).

C. North American Insulation Manufacturers Association (NAIMA).

D. National Fire Protection Association (NFPA).

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

F. Underwriter's Laboratories (UL).

G. Underwriter's Laboratories Environmental (UL Environment).

1.5 QUALITY ASSURANCE

A. Installer’s Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) that is UL Classified per UL 723 or with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

C. Duct and plenum insulation shall comply with minimum R-value requirements of 2015 International Energy Conservation Code and ASHRAE 90.1 - 2013.

D. Adhesive and other material shall comply with NFPA and NBFU Standards No. 90A and 90B.

1.6 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.7 SUBMITTALS

A. Contractor shall submit AISD Sustainability Submittal Sheets as found in the AISD Project Development Manual and comply with sustainability requirements.

B.

C. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

D. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

A. SUSTAINABILITY REQUIREMENTS: Low-Emitting Materials are required and must conform to VOC limits, TVOC content, meet CPDH Standard Method v1.1-210, meet SCAQMD Rule @1113 or CARB 2007 SCM, list Green Seal GS-11 VOC limits and confirm that there is no methylene chloride/perchloroethylene.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

C. A sample quantity of each type of insulation and each type of application shall be installed and approval secured prior to proceeding with the main body of the Work.

2.2 ACCEPTABLE MANUFACTURERS

A. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Certain-

Teed, Johns-Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

B. Adhesives shall be as manufactured by Minnesota Mining, Arabol, Benjamin-Foster, Armstrong or Insulmastic, Inc., and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Ceramic fiber materials shall be as manufactured by Primer Refractories, A.P. Green Refractories or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.2 EXTERNAL DUCT INSULATION

A. Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

B. Seal all joints, fastener penetrations and other breaks in vapor barrier with 3-inch wide strips of white glass fabric embedded between two coats of vapor barrier mastic, Childers CP-30 or approved equal.

C. All external duct insulation shall be Knauf Insulation Atmosphere Duct Wrap with ECOSE Technology, Johns Manville Microlite EQ duct wrap insulation with reinforced aluminum facing or approved equal.

D. External duct wrap is required on all outside air ducts, supply and return air ducts that are not internally insulated. External duct wrap is also required on all exhaust and relief air ducts that are used in airside energy recovery systems. Any exhaust ductwork located in an unconditioned space shall also be provided with external duct wrap. Duct wrap shall be provided as follows:

1. 1½” thick, 1.0 PCF density minimum; minimum installed R-value of 4.2 when ducts are located in conditioned spaces.
2. 2” thick with a minimum installed R-value of 6 when ducts are located in unconditioned spaces, such as ceiling plenum space.

E. Any ductwork located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E 84 testing requirements shall be provided with a single layer of duct wrap to establish a noncombustible rating per ASTM E 136. Duct wrap products which are approved for such non-compliant combustible duct materials located in air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

3.3 DUCT LINER (MUST OBTAIN AISD PM APPROVAL FOR USE)

A. Duct liner shall be kept clean and dry during transportation, storage, installation, and throughout the construction process care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.

B. All portions of duct designed to receive duct liner shall be completely covered with liner as specified. The smooth, black, mat facing or acrylic-coated surfaces with flexible glass cloth reinforcement shall face the airstream. All duct liner shall be cut to assure tight, overlapped corner joints. The top pieces shall be supported by the sidepieces. Duct liner shall be installed following the guidelines in the NAIMA “Duct Liner Installation Standard”.

C. The duct liner shall be tested according to erosion test method in ASTM C 1071 and shall be guaranteed to withstand velocities in the duct system up to 6000 fpm without surface erosion.

D. Duct liner shall be adhered to the sheet metal with full coverage of an approved adhesive that conforms to ASTM C 916, and all exposed leading edges and transverse joints shall be coated with Permacote factory-applied or field-applied edge coating and shall be neatly butted without gaps. Shop or field cuts shall be liberally coated with Johns Manville SuperSeal® duct butter and Edge Treatment or approved adhesive.

E. Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at forward discharge and at any point where lined duct is preceded by unlined duct.

F. When velocity exceeds 4000 fpm (20.3 m/sec), use metal nosing on every leading edge. Nosing may be formed on duct or be channel or zee attached by screws, rivets or welds.

G. The liner shall further be secured with Graham welding pins and washers on not more than 18 inch centers both vertical and horizontal surfaces, and the pins and washers shall be pointed up with adhesive.

H. Duct liner shall be Knauf Insulation Atmosphere Duct Liner with ECOSE Technology, Johns Manville Linacoustic RC duct liner with factory-applied edge coating and acrylic coating on the mat surface of airstream side or approved equal. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the air stream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071, UL 2824, with an NRC not less than .70 as tested per ASTM C 423 using a Type “A” mounting, and a thermal conductivity no higher than 0.24 BTU•in/(hr•ft^2•°F) at 75°F mean temperature.

I. Line supply and return ductwork at connection of HVAC unit to a point of 15 feet upstream and downstream of the equipment and in return air boots. Attach with full cover coat of cement, duct dimensions up to 16 inches; provide stick clips or screws and cap for dimensions over 16 inches, spaced 16 inches o.c. maximum. Provide sheet metal liner cap over all leading edges of internal insulation exposed to air stream.

J. Duct liner shall be provided as follows:

1. 1” Thick, 1.5 PCF density minimum; minimum installed R-value of 4.2 when ducts are located in conditioned spaces.
2. 1 ½” Thick with a minimum installed R-value of 6 when ducts are located in unconditioned spaces, such as ceiling plenum space.
3. 2” Thick with a minimum installed R-value of 8 when ducts are located outdoors.

3.4 EXPOSED DUCTWORK LOCATED INDOORS

A. Duct routed exposed in occupied spaces shall be double wall.

B. Round and flat oval duct routed exposed shall be double wall with perforated inner liner and 1'' thick layer of glass mineral wool insulation as manufactured by United McGill Company model no. Acousti-27 or approved equal. Insulation density shall be a minimum of 1.0 PCF.

3.5 EXPOSED DUCT LOCATED OUTDOORS

A. All duct located outdoors shall be internally lined as specified and shall have a 2" thick, 6 lb. density rigid board external duct insulation, finished with aluminum jacketing.

B. Paint non-insulated duct. Coordinate color with Architect.

3.6 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

A. The backside of all supply air devices shall be insulated with taped and sealed 1½ inch thick external duct wrap.

B. The contractor shall install an additional layer of 1-½ inch thick external glass mineral wool duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and vapor-sealed and located until all evidence of the condensation has been eliminated, at no additional cost to the Owner.

A.

END OF SECTION

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Work specified elsewhere.

1. Basic materials and methods.
2. Piping systems.
3. Air distribution equipment.

1.3 REFERENCE STANDARDS

A. ASTM International. (ASTM)

B. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).

C. North American Insulation Manufacturers Association (NAIMA).

D. National Fire Protection Association (NFPA).

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

F. Underwriter's Laboratories (UL).

G. Underwriter's Laboratories Environmental (UL Environment).

1.4 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.5 SUBMITTALS

A. Contractor shall submit AISD Sustainability Submittal Sheets as found in the AISD Project Development Manual and comply with sustainability requirements.

B. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

C. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.6 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer's stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 – PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS: Low-Emitting Materials are required and must conform to VOC limits, TVOC content, meet CPDH Standard Method v1.1-210, meet SCAQMD Rule @1113 or CARB 2007 SCM, list Green Seal GS-11 VOC limits and confirm that there is no methylene chloride/perchloroethylene.

2.2

2.3 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.4 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed before any insulation is installed.

2.5 A sample quantity of each type of insulation and each type application shall be installed and reviewed prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.6 Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.

2.7 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.8 All HVAC equipment insulation shall comply with minimum requirements of 2015 International Energy Conservation Code and ASHRAE 90.1 - 2013.

2.9 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.10 All products or their shipping cartons shall have a label affixed, indicating flame and smoke

ratings do not exceed the above requirements.

PART 3 – EXECUTION

3.1 All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.3 CHILLED WATER PUMPS

A. Shall be insulated with Knauf Insulation Board with ECOSE Technology, Certain-Teed IB-600 or equal, rigid insulation board, 2" thick, cut and formed into a box and secured in place with 3/4" wide x .020 galvanized bands spaced on 9" centers. Bands shall be pulled snug over sheets of insulation board. All joints shall be well and neatly fitted and so arranged that the assembly may be dismantled with ease permitting access to the pump. All voids on the interior of box shall be filled with glass mineral wool blanket insulation. Exterior shall be finished with a trowel coat of Foster's 30-35 vapor barrier mastic, a layer of 1" mesh galvanized wire, and a coat of J.M. #352 cement. Final finish shall be an eight ounce canvas jacket, pasted and sealed in place with Foster's 30-36 Seafas.

B. Pipe insulation shall be extended over all cold parts of chilled water pumps not directly over drainage basin of pump base.

END OF SECTION

SECTION 23 07 19 – HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Furnish and install piping insulation to:

1. Chilled water and heating hot water piping.
2. Condensate drain piping.
3. Refrigerant piping.
4. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D. For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well, unions, reducing stations, and orifice assemblies.

1.3 RELATED SECTIONS

A. Section 23 05 29 - Hangers and Support for HVAC Piping and Equipment

B. Section 23 05 53 – Identification for HVAC Piping and Equipment

C. Section 23 21 13 - Above Ground Hydronic Piping

D. Section 23 21 16 - Underground Hydronic Piping

E. Section 23 23 00 - Refrigerant Piping

1.4 REFERENCE STANDARDS

A. ASTM International. (ASTM)

B. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).

C. North American Insulation Manufacturers Association (NAIMA).

D. National Fire Protection Association (NFPA).

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

F. Underwriter's Laboratories (UL).

G. Underwriter's Laboratories Environmental (UL Environment).

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. Contractor shall submit AISD Sustainability Submittal Sheets as found in the AISD Project Development Manual and comply with sustainability requirements.

B.

C. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

D. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS: Low-Emitting Materials are required and must conform to VOC limits, TVOC content, meet CPDH Standard Method v1.1-210, meet SCAQMD Rule @1113 or CARB 2007 SCM, list Green Seal GS-11 VOC limits and confirm that there is no methylene chloride/perchloroethylene.

2.2

2.3 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

2.4 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed prior to

installation.

2.5 A sample quantity of each type of insulation and each type application shall be installed and accepted prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

2.6 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E 84, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

2.7 All HVAC piping insulation shall comply with minimum requirements of 2015 International Energy Conservation Code and ASHRAE 90.1 - 2013.

2.8 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.

2.9 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

2.10 Any piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E 84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E 136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer's instructions.

2.11 APPROVED MANUFACTURERS

A. Calcium silicate materials shall be as manufactured by Johns Manville.

B. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

C. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

D. Flexible elastomeric cellular thermal insulation by Armacell.

E. Phenolic foam insulation shall be as manufactured by Kooltherm Insulation (Koolphen).

F. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.12 MATERIALS

A. CHILLED WATER: Provide Phenolic foam with aluminum jacket and all joints sealed for piping in the crawl space. ASJ jacket will be acceptable in spaces above the crawl space and within the building.

B. HEATING HOT WATER PIPE: Provide glass mineral wool pipe insulation with aluminum

jacket and all joints sealed for piping in the crawl space. ASJ jacket will be acceptable in the spaces above the crawl space and within the building.

C. CONDENSATE DRAINAGE PIPING: Flexible elastomeric cellular thermal insulation, model "AP-2000", fire rated for use in environmental air plenums; insulation not required when piping is exposed on roof.

D. REFRIGERANT PIPING: Flexible elastomeric cellular thermal insulation, model "AP-2000", fire rated for use in environmental air plenums. Apply manufacturers recommended finish and sealant for exterior applications.

E. ALUMINUM METAL JACKETING: Utilize Childers “Strap-On” jacketing (alloy 3003). Provide preformed fitting covers for all elbows and tees.

PART 3 - EXECUTION

3.1 All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

3.2 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

3.3 All heat recovery piping between air conditioning equipment and hydronic or domestic hot water piping shall be insulated per the High Temperature Surfaces Schedule in Part 4.

3.4 All condenser water piping located in a ceiling plenum shall be insulated per the Low Temperature Surfaces Schedule in Part 4.

3.5 Pipes located outdoors or in tunnels and in the crawl space shall be insulated same as concealed piping and shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All insulation butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

3.6 All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

3.7 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, an isolating seal shall be formed between the vapor barrier jacket and the bare pipe. The seal shall be by the applications of adhesive to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass mineral wool covers finished with two brush coats of vapor barrier mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the Joint is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor barrier jacket.

3.8 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe.

B. The penetration shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

PART 4 - SCHEDULES

4.1 Provide all HVAC piping insulation to comply with the ASHRAE 90.1 Minimum Thickness Schedule.

4.2 LOW TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS
A. Condensate drain lines:	1 ½ inch
B. Chilled Water Piping:	
1. Located outdoors:	2 inch
2. Located indoors:	
a. 4 inch and smaller:	2 inch
b. Larger than 4 inch:	2 inch
C. Refrigerant Piping	
1. 1½“ and smaller	1 inch
2. Larger than 1½ inch	1 ½ inch

4.3 HIGH TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS
A. Hot Water Piping:	
1. Operating temperature 105°F or less:	1 inch
2. Operating temperature higher than 105°F and pipe size 1¼ inch or smaller	1 ½ inch
3. Operating temperature higher than 105°F and pipe size greater than 1¼ inch	2 inch

END OF SECTION

DIRECT DIGITAL CONTROLS FOR LOCAL BUILDING AUTOMATION SYSTEMS TRIDIUM-BACNET WEB-BASED –SECTION 230926a

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 23

1. General Mechanical Requirements
2. Mechanical equipment
3. Piping
4. Variable Frequency Drives (VFDs)
5. Building Automation System Commissioning Requirements

C. Division 26

1. General Electrical Requirements
2. Raceways
3. Disconnect Switches
4. Wiring

D. Division 27

1. Telecommunications cabling

E. Division 28

1. Fire Alarm Systems.

F. Mechanical and electrical drawings: Specifications and drawings are complementary to each other and binding. What is called for by one shall be binding as if called for by both. Should there be a conflict between drawings and specifications regarding a material shown of work described or detailed then the material of work having the greater value shall be provided.

1.2 SUMMARY

A. Provide all hardware, software, materials, labor, and programming for the implementation of a complete standalone Local Building Automation System (BAS) for control of HVAC systems and components.

B. The system shall consist of a network of microprocessor-based, peer-to-peer, networked, distributed devices utilizing the BACnet communication protocol in an open, interoperable system. The system shall include all wiring and control devices, sensors, actuators, valves, dampers, and hardware required for a complete operational system that will achieve the control sequences specified.

C. Provide all programming to achieve specified operational sequences, and development of graphical screens, setup of schedules, trends, logs, alarms, network management, and operational connection of the Network Control Unit (NCU) to the local area network.

D. Access to the Building Automation System for configuration and monitoring shall be performed via a Network Control Unit (NCU) connected to the LAN or WAN.

E. All components of the system shall be BACnet Testing Laboratories (BTL) Certified.

F. System design shall follow pertinent and applicable BACnet guidelines. Controllers that require a master computer or controller to perform basic functions are not acceptable. In the event of a network communication failure, or the loss of any other controller on the BACnet network, the control system shall continue to independently operate under control of the resident program stored in nonvolatile memory as detailed herein.

G. The network infrastructure shall conform to the BACnet published guidelines for network wiring and system architecture. Wire type, distance, termination, and use of routers shall strictly conform to the BACnet wiring standards. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system enhancement with minimal infrastructure modifications.

H. Mechanical equipment controllers shall include all control points and achieve all control sequences specified while operating under stand-alone control, independently of connection to the network manager.

I. Provide DDC system shop drawings and submittals, participate in submittal review meetings, and obtain final approval of submittal from Owner and Engineer prior to installation of system.

J. Fully test system prior to requesting installation inspection and pre-functional testing by Owner, Engineer, and Commissioning Authority.

K. Schedule competent technical personnel to participate in Commissioning activities.

L. Provide a Schedule of Values for work of this section, that includes the following:

1. Submittals (5%)
2. Materials (35%)
3. Installation (35%)
4. Installation Verification with Owner’s CxA (5%)
5. Programming & Graphics (10%)
6. Point check out and Commissioning with Owner’s CxA (5%)
7. Final O&Ms and As-Built Documentation (5%)

1.3 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than ten seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within eight to ten seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.

7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.

1.4 ACCEPTABLE CONTRACTORS

A. Pending compliance with this specification, the following firms have been deemed acceptable contractors for the products and services herein specified:

1. Trane US Inc.
2. Tempset Controls Inc.
3. Johnson Controls
4. Goto Automation

B. Contractor responsible for work under this Section shall be a local factory certified office of the manufacturer of control systems located within 75-mile radius from the job site. Experience requirements below apply only to the local factory certified office.

C. Contractor shall have, as a minimum, five (5) years of documented continuous business experience in the installation of controls, instrumentation and Energy Management Systems.

D. Contractor's local personnel conducting work of this section shall have a minimum of three (3) years of experience in the installation of BACnet systems. Personnel conducting work shall be:

1. Tridium Niagara N4 Certified
2. BACnet Certified Professional

Contractor shall provide evidence of certifications upon request.

E. The installing office shall provide a list of completed and accepted BACnet job references. The references shall include one job from each of the Three (3) years required.

F. Each reference shall include the following: the job name, the job size, the owner with address, contact name and phone number, the general contractor, the mechanical contractor, and the contracting company's system programmer name(s).

G. The Contractor's BACnet Certified personnel shall be directly responsible for all work related to:

1. System design
2. Submittals
3. Programming
4. Installation Supervision
5. Calibration
6. Checkout
7. Commissioning.

1.5 SUBMITTALS

A. Refer to Division-1 Submittals and Division-23 General Mechanical Work for additional submittal requirements.

B. Scope of Work Summary: Include in submittal package a clear written summary of the scope of control work, including but not limited to the following:

1. Integration with the existing systems (if any) at the facility.
2. Scope of demolition work (if any)

3. Systems to be controlled as part of this work, clearly stating which systems will receive full DDC systems, and which (if any) will receive only timeclock control.
4. Evidence of coordination with manufacturers of equipment provided under the mechanical and electrical scope of work to verify that all required control points and sequences will be implemented, regardless of whether the DDC controls reside in a controller provided by the equipment manufacturer or the controls contractor.

C. Product Data:

1. DDC System Hardware:
   a. Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
   b. Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
2. Network Control Devices and System Software:
   a. Include technical data for operating system software, service maintenance agreement and device/point count license details.
   b. Provide legally licensed copies of all software tools, configuration tools, management tools, and utilities used during system installation and commissioning.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram. Network Control Devices and System Software:
4. Cabling: Technical data sheets for all cables.

D. Shop Drawings:

1. Include AISD Project Number on Cover Page.
2. Include specification section and revision on Cover Page.
3. Single-line schematic diagram, top-level subsystem, depicting the network architecture. The top-level subsystem shall illustrate the network media, channel transceiver types, subsystems, network interfaces, Human Machine Interfaces (HMI), repeaters, and terminators if utilized.
4. Floor plan diagrams of the building shall indicate unit and unit controller locations, room numbers or area names and space sensor locations and a diagram of how the BACnet Network wiring is routed from the Building Controller to all of the BACnet controllers.
5. System diagrams for each system and subsystem, including power supply through starters and motors; motor starting and interlock wiring; pushbuttons; all control wiring; interior electrical circuits of control instruments with terminal designations; control motors; colors of wires; wire tags and tag numbers, location of router, controllers, instruments and remote elements; horsepower of motors; normal position of valves, dampers, and relays. A detailed description of the operation of the control system, including control device designation, shall accompany the drawings. The drawings shall include a floor plan and riser diagram of the school indicating unit locations, sensor

locations, areas served by each piece of equipment and BACnet Network and Sub-network wiring details with routing of all communication cables.

6. Bill of materials of equipment indicating quantity, manufacturer, and model number.
7. Details of control panel faces, including controls, instruments, and labeling.
8. Schedule of dampers including size, leakage, and flow characteristics.
9. Schedule of valves including flow characteristics.
10. DDC System Hardware:
    a. Wiring diagrams for control units with termination numbers.
    b. Schematic diagrams and floor plans for field sensors and control hardware.
    c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
11. Controlled Systems:
    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram. In the event the sequences proposed by Engineer are unclear, incomplete, or known to be non-compliant with Owner's requirements, Contractor shall issue a Request For Information (RFI) document prior to preparing submittals.
    d. Points list: Provide a complete list of all input and output points, alarms, setpoints and schedules that will be transmitted to and from the Web Server. This point list shall include points to be obtained from BACnet Controllers provided by equipment manufacturers.

E. Preliminary Submittal (Shop Drawings and Product Data)

1. Prepare a Preliminary Submittal for review by Owner, Engineer, and Commissioning Authority.
2. Make arrangements with General and Mechanical Contractors to transmit Preliminary Submittal electronically to all recipients simultaneously, with no paper copy to follow.
3. Shop Drawings and Product Data shall be submitted at the same time but as separate files.
4. Request a Preliminary Submittal Review meeting with General Contractor, Mechanical Contractor, Owner, Engineer, and Commissioning Authority no less than six (6) days after transmittal. This time is required for review by all parties.
5. Contractor shall lead the Preliminary Submittal Review Meeting to address at least the following:
    a. Owner, Engineer, and Commissioning Authority comments
    b. Resolution to any pending RFI's related to control work
    c. Final coordination of any controls provided by equipment manufacturers (in which case manufacturers should be asked to attend meeting as well)
    d. Review Submittal Checklist
    e. Timeline for final submittal

F. Final Submittal (Shop Drawings and Product Data)

1. Prepare Final Submittal after addressing all issues discussed during Preliminary Submittal Review Meeting.
2. Allow six (6) days for review by Owner, Engineer and Commissioning Authority.
3. Do not proceed with installation prior to receiving notification of submittal approval.

1.6 OPERATION AND MAINTENANCE DATA

A. At the time of Functional Testing, update submittal data to reflect condition of systems as installed and programmed.

B. Make any final revisions made during Functional Testing with Owner and Commissioning Authority.

C. Submit ALL requirements listed under Paragraph 1.6 Submittals, as part of the Operation and Maintenance Manual. Include warranty start date.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Refer to Paragraph 1.5.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Installation in accordance with all codes and local ordinances. Refer to Part 3 of this specification for additional installation requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.9 COORDINATION

A. Prior to preparing submittals, coordinate location of control devices and routing of wiring with plans and room and equipment details. For retrofit applications, conduct a detailed inspection of the site and equipment to receive controls in order to identify optimal locations for devices, mounting of controllers, and routing of wiring.

B. It is the intent of this specification that the Section 230926 Contractor shall be responsible for all power and control wiring and raceways associated with the turnkey operational installation of the DDC system. Prior to submittals, coordinate with any additional power requirements that require the involvement of the Division 26 Contractor.

C. Coordinate with other Division 23 Contractors and equipment suppliers for control of mechanical equipment. It is the intent of this specification that the Section 230926 Contractor shall assume responsibility for a turnkey fully operational control system that includes interfacing with controls integral to equipment –whether via conventional electro-mechanical control or BACnet interfaces.

D. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.

E. Coordinate equipment with Division 26 Section "Motor-Control Centers" and “Variable Frequency Controllers” to achieve compatibility with motor starters and annunciation devices.

1.10 WARRANTY

A. The entire BACnet network controls system including wiring, controllers, controlling devices, sensing devices, integral components, service and labor will be warranted for one (1) year from date of system acceptance date unless the manufactures warranty extends beyond the one (1) year warranty. The warranty will then be as indicated by the manufacture of the product.

B. System acceptance date starts upon successful completion of Functional Testing, as determined by Commissioning Authority.

C. If corrective software and/or hardware modifications are made during the warranty period, the BAS controls contractor shall update all user documentation, user and manufacturer archived CD ROM and software disks.

1.11 TRAINING

A. Provide a minimum of **16 hours** of training to AISD personnel. The number of individuals selected for training shall be at the sole discretion of AISD.

B. Training shall cover all aspects of the specified controls system from system overview and operation to basic troubleshooting. Training shall include a mix of classroom and actual hands on instruction to include but not limited to training during commissioning of BACnet nodes on site and application specific at the BAS system contractor's local office. Training shall include a minimum of eight (8) hours of classroom and eight (8) hours of field training on the newly installed control system. At AISD's discretion, the training may be mixed to allow for more or less time in the classroom or field training areas.

C. The BAS System Contractor shall create an agenda for the training class and submit it for approval by AISD Energy Management Department before training classes are scheduled.

D. Provide all training manuals, materials, and operator and maintenance manuals as required.

1.12 CODES AND STANDARDS

A. The completed and operational BAS shall be in compliance with and meet the requirements of all governing bodies, Authorities Having Jurisdiction (AHJ), applicable local or national standards and codes, except where more stringent or detailed requirements are indicated by the Contract Documents, including the requirements set forth in this Specification and the following:

1. ASHRAE 135-2016: BACnet -Building and Air Conditioning Engineers (ASHRAE)
2. Underwriters Laboratories UL-916: Energy Management Systems (EMS)
3. NIST IR 6392 Annex B: Profiles of Standard BACnet Devices
4. EIA-485: Standard for Electrical Characteristics of Generator and Receivers for Use in Balanced Digital Multi-Point System.

PART 2 - PRODUCTS

2.1 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, distributed control system using ANSI/ASHRAE Standard 135-2016, BACnet technology communication protocols, in an open, interoperable system. The direct digital control (DDC) system shall consist of BACnet based microprocessor-based controllers, plus instrumentation, control valves, dampers, operators, control devices, interface equipment, network manager, BACnet communication interfaces, and other apparatus required to operate systems and perform functions specified. The DDC system shall be capable of providing total integration of the facility infrastructure systems with user access to all system data via Human Machine Interface (HMI) using a Web Browser such as Internet Explorer™, Mozilla Firefox™ or Google Chrome™ connected to the system network using the LAN or WAN.

2.2 NETWORKS

A. The system architecture shall support the following levels.

1. Master Slave/Token Passing (MS/TP)
2. BACnet IP (B/IP)

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3u
2. Cable; 100 Base-T, UTP-8 wire, Category 5e
3. Minimum throughput; 100 Mbps

2.3 GRAPHICAL USER INTERFACE (GUI) SOFTWARE

A. Graphical User Interface: Provide a software tool that allows for the development and management of the end users' Graphical User Interface (GUI) and as the primary point of access to the BAS for the end user.

B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, log-off button and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

C. Real Time Displays: The GUI shall at a minimum support the following features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating or assembling objects from a GIF, JPG, PNG or ICO file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.

3. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
4. Schedule and holiday times shall be adjusted using a graphical calendar.
5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu.
6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value.

D. System Configuration: At a minimum the GUI shall permit the operator to perform the following tasks with proper password access:

1. Create, delete or modify control strategies
2. Add/delete objects to the system
3. Tune control loops through the adjustment of control parameters
4. Enable or disable control strategies
5. Override inputs and outputs (permanent and timed)
6. Generate hard copy records or control strategies on a printer
7. Select point to be trended over a period of time and initiate the recording of values automatically.

E. On-Line Help: Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

F. Security: Each operator shall be required to log on to that system with a username and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

G. System Diagnostics: The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. Alarm Console:

1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.4 WEB BROWSER CLIENTS

A. A web browser shall be the primary means of access to the BAS for day to day operation from any PC connected to the LAN and remote via internet without the need for any proprietary software.

B. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Mozilla Firefox™ or Google Chrome™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
3. HTML programming shall not be required to display system graphics or data on a Web page.
4. Storage of the graphical screens shall be in the Network Control Unit (NCU), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
6. User shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
    a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
    b. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
    c. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
    d. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
    e. View logs and charts.
    f. View and acknowledge alarms.
    g. The system shall provide the capability to specify a user’s (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
    h. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.5 NETWORK CONTROL UNITS

A. The Network Control Unit (NCU) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NCU.

B. The NCU shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of BACnet controller data
7. Network management functions for all BACnet based devices.

C. The NCU must provide the following hardware features as a minimum:

1. 1000Mhz Processor
2. 1GB DDR-3 SDRAM
3. 4GB Flash Memory
4. Wi-Fi Connectivity IEEE802.11a/b/g/n
5. Two 10/100MB Ethernet Ports
6. Two Isolated RS-485 Ports
7. One USB Type A Connector
8. Real Time Clock
9. Support of up to Four IO/Communication Expansion Modules

D. The NCU shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NCU shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

E. The Network Control Unit will provide all scheduling, alarming, trending, and network management for the all BACnet devices.

F. Provide multiple Network Control Units as necessary. The NCU shall support a minimum of 128 BACnet controllers. In order to maintain peak performance of the network, no more than 110 BACnet controllers may be connected to a single NCU and no more than 64 BACnet controllers per NCU Communication Trunk. In any event, no more than 70% of the available resources of the NCU (as indicated by the resource meter of the programming tools for the NCU) shall be committed. In the event that the available resources are less than 30%, the number of nodes connected to the NCU shall be reduced in order to maintain a 30% or greater buffer of resources within the NCU.

G. The NCU shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 5 simultaneous users.

H. Event Alarm Notification and actions - The NCU shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers. The NCU shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.

1. Alarm generation shall be selectable for annunciation type and acknowledgement; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers. The NCU shall be able to route any

alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
   a. To Alarm
   b. Return to normal
   c. To fault

2. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
3. Provide timed (schedule) routing of alarms by class, object, group, or node.
4. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control. Control equipment and network failures shall be treated as alarms and annunciated.
5. Alarms shall be annunciated in any of the following manners as defined by the user, but implemented by this contractor:
   a. Screen message on screen
   b. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
      1) Day of week
      2) Time of day
      3) Recipient
   c. Pagers via paging services that initiate a page on receipt of email message.
   d. Graphic with flashing alarm object(s).
   e. Printed message, routed directly to a dedicated alarm printer.
6. The following shall be recorded by the NCU for each alarm (at a minimum):
   a. Time and date
   b. Equipment (Air handler #, pump, etc.)
   c. Acknowledge time, date and user who acknowledged
   d. Number of occurrences since last acknowledgement
7. Alarm actions may be initiated by user defined programmable objects created for that purpose.
8. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
9. A log of all alarms shall be maintained by the NCU and/or a server (if configured in the system) and shall be available for review by the user.
10. Provide a "query" feature to allow review of specific alarms by user defined parameters.
11. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
12. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

I. Acceptable Products:

1. JACE-8000:
   a. Niagara N4 Version 4.7 (Consult with Owner if a newer version is available)
   b. Open License NiCS (Vendor Neutral, No Vendor Locking)
   c. Embedded Workbench
   d. 25% Minimum Spare Capacity (Devices & Points)
   e. 5-Year SMA (Software Maintenance Agreement)

J. Data Collection and Storage

1. The NCU shall have the ability to collect data for any property of any object and store this data for future use.
2. The data collection shall be performed by log objects, resident in the NCU that shall have, at a minimum, the following configurable properties:
   a. Designating the log as interval or deviation.
   b. For interval logs, the object shall be configured for time of day, day of weeks and the sample collection interval.
   c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
   d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
   e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
3. All log data shall be stored in a relational database in the NCU and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements. All log data shall be available to the user in the following data formats:
   a. HTML
   b. XML
   c. Plain Text
   d. Comma or tab separated value
4. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
5. The NCU shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NCU on the network. Provide the ability to configure the following archiving properties, at a minimum:
   a. Archive when the log has reached its user-defined capacity of data stores
   b. Archive on time of day
   c. Archive on user-defined number of data stores in the log (buffer size)
   d. Provide ability to clear logs once archived
6. Provide and maintain an Audit Log that tracks all activities performed on the NCU. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NCU), to another NCU on the network, or to a server. For each log entry, provide the following data:
   a. Time and date
   b. User ID
   c. Change or activity; i.e. change setpoint, add or delete objects, commands, etc.

K. Database Backup and Storage

1. The NCU as provided shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Copies of the current database and, at the most recently saved database shall be stored in the NCU. The age of the most recently saved database is dependent on the user-defined database save interval. The NCU database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2. Provide all tools necessary for the development, maintenance, expansion and use of the BAS described within these specifications. All software tools shall be compatible with the network management tool (workbench) that is provided as part of this project. For the purpose of this specification software tools shall be divided into the following categories and meet these specified requirements.

L. NCU Programming Wizards for LCU/TCU Controllers

1. Provide Wizards or objects that facilitate the programming and configuration of the local Control Unit (LCU) and terminal Control Unit (TCU) Controllers sequence of operation through a menu driven wizard. All software tools (including Wizards) shall be compatible with the network management tool (workbench) that is provided as part of this project. The programming and configuration tools shall perform the following functions:
   a. LCU Controllers programming shall be accomplished by Graphical programming language (GPL) where objects are used to define different portions of the control sequence. All control sequences programmed into the controller shall be stored in non-volatile memory. Systems that only allow selection of sequences from a library or table are not acceptable. All code must be exportable to a library for future use.
   b. TCU Controllers – Provide for the programming of the required sequence of operation through an intuitive menu driven selection process. The configuration tools menu shall define items such as I/O configurations, set point, delays, PID loops, optimum start stops, and network variables settings. The configuration tool must indicate the device status and allows system override. Or, provide for the programming of the required sequence of operation through Graphical programming language (GPL) where objects are used to define different portions of the control sequence. All control sequences programmed into the controller shall be stored in non-volatile memory. Systems that only allow selection of sequences from a library or table are not acceptable. All code must be exportable to a library for future use.

M. NCU Network Management Software Tools

1. Provide a complete set of Network Management tools that provides for the development and management of BACnet networks.
2. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
3. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
4. These tools shall provide the ability to “discover” existing BACnet networks, regardless of what network management tool(s) were used to install the existing network, so that existing BACnet devices and newly added devices are part of a single network management database.
5. The network management database shall be resident in the NCU and with proper authorization, shall allow access to the network management database. Systems employing network management databases that are not resident in the NCU, shall not be accepted.
6. System shall allow access to all of the Network Management tool functions including controller programming from a Web Browser.

N. NCU Programming Software

1. Provide programming software for the Network Control Unit that allows for the development of the NCU control logic, point management, global properties such as alarm, trend and scheduling.
2. All library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Access to these functions shall be provided through Graphical User Interface software (GUI). Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.
3. Programming Methods – Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
    a. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
    b. The software shall provide the ability to view the logic in an off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
    c. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
    d. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

O. NCU Object Library

1. A standard library of software objects that represent functions and applications for the development and setup of application logic, user interface displays, system services, and communication networks.
2. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
3. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

2.6 LOCAL CONTROL UNITS, TERMINAL CONTROL UNITS, INTEGRATED SPACE SENSORS

A. General

1. All controllers provided as part of this system and used for indoor applications shall operate under ambient environmental conditions of 32 degF (0 degC) to 122 degF (50 degC) dry bulb and 5% to 90% relative humidity, non-condensing as a minimum.
2. All controllers provided as part of this system and used for outdoor applications shall operate under ambient environmental conditions of -40 degF (-40 degC) to 158 degF (70 degC) dry bulb and 5% to 90% relative humidity, non-condensing as a minimum.

B. System Design

1. Local Control Units (LCU) shall be utilized for primary mechanical and electrical systems such as Air handling equipment, Make-up Air Unit, Boiler System Control, and Chiller System Control type of applications.
2. Terminal Control Units (TCU) shall be utilized for terminal equipment, such as Variable Air Volume, Fan Coil, Heat Pump, Roof Top applications.
3. Each LCU and TCU controller shall have a minimum of 10% spare capacity of each point type for future points. As a minimum, each controller shall have one spare of each point type available on the controller.
4. The LCU and TCU controller programming or configuration tools shall be fully accessible through the Operator Workstation and Web Browser Client through the use of Wizards. Provide Wizards or objects as specified in NCU paragraph that facilitate the programming and configuration of the LCU and TCU through a menu driven wizard.

C. Controller Local Area Network (BAS sub-LAN)

1. Provide a network of stand-alone, distributed direct digital controller that operate on ANSI/ASHRAE Standard 135-2016 BACnet communication protocol.
2. Provide BAS Controllers that utilize BACnet technology and are BTL certified. Controllers using proprietary protocols are unacceptable.
3. The design of the BAS sub-LAN shall network Local Control Unit (LCU) and Terminal Control Unit (TCU) to a Network Control Unit (NCU).
4. This level of communication shall support a family of application specific controllers and shall communicate bi-directionally with the network through DDC Controllers for transmission of global data.
5. Terminal Control Unit (TCU) shall be arranged on the BAS sub-LAN's in a functional relationship manner with Local Control Unit (LCU). Ensure that a Variable Air Volume (VAV) Terminal Control Unit (TCU) is logically on the same LAN or segment as the Local Control Unit (LCU) that is controlling its corresponding Air Handling Unit (AHU).

D. Programming Software (LCUs and TCUs)

1. Provide programing software that allows for the development of the control logic and point management.
2. Main programming method shall be Object-Oriented-Programming. Conditional programming (If, Then, Else) as the main programming method is not permitted.
3. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Access to these functions shall be provided through Graphical User Interface software (GUI). Applications are to be created by selecting the desired control objects from the library, dragging or pasting

them on the screen, and linking them together using a built-in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

4. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification.
5. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
6. The software shall provide the ability to view the logic with value being inputted/outputted of the graphical blocks (debug mode).
7. The software shall allow for controllers to be programmed and debugged remotely without the need for direct-connecting to the controller needing reprogramming or debugging.
8. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

E. TCU Configuration Software

1. Configuration of the TCU controller shall be done through the configuration tool using fill-in the blank fields, list boxes, and selection buttons.
2. The configuration tool menu shall define items such as I/O configurations, set point, delays, PID loops, optimum start stops, and network variables/object settings. The configuration tool shall indicate the device status and allows system override.
3. The Configurable Controller shall allow the use of its spare I/O as dumb I/O to be shared over the network to other Controllers such as Programmable Controllers, where a sequence of operation can be applied to the I/O. Such applications shall include but not be limited to exhaust fan control, heaters, lighting control, etc.

F. Local Control Units (LCU)

1. The Local Control Units (LCU) shall be 32-bits microprocessor-based. They shall also be multi-tasking, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the project point list.
2. Each LCU shall have sufficient memory, to support its own operating system and databases, including:
   a. Control processes
   b. Energy management applications
   c. Alarm management applications

d. Historical/trend data for points specified
e. Maintenance support applications
f. Custom processes
g. Manual override monitoring

3. Each LCU shall support:
   a. Analog inputs of 4-20 mA, 0-10 Vdc, 10,000 ohm thermistor or 1000 ohm RTD.
   b. Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
   c. Each LCU shall be capable of providing the following control outputs without the addition of equipment outside the DDC controller cabinet:
      1) Digital outputs (contact closure for motor starters up to size 4)
      2) Analog outputs of 4-20 mA or 0-10 VDC
   d. The LCU analog or universal input shall use a 16-bit A/D converter.
   e. The LCU analog or universal output shall use a 10-bit D/A converter.
   f. Each output shall have supervised manual override switch and a potentiometer or integrated LCD operator interface (preferred).
   g. Each LCU shall have a minimum of 10% spare capacity for each point type for future point connection. Provide all processors, power supplies and communication controllers complete so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring. As a minimum, provide one of each type of point available on the controller.
   h. Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.
   i. Each controller shall perform its primary control function independent of other NCU controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the NCU controller time clock to ensure LAN continuity. Each controller shall include algorithms incorporating proportional, integral, and derivative (PID) gains for all applications. All programmed PID gains and biases shall be available for adjustment via the NCU field-adjustable by the user via terminals as specified herein.
   j. The LCU shall provide local status indication for each output for constant, up-to-date verification of all point conditions via dedicated LEDs or built-in LCD operator interface without the need for an operator handheld device.
   k. The LCU shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
   l. Should the LCU memory be lost for any reason, the user shall have the capability of reloading the controller software via the NCU Controller. Direct connection to LCU controller for reloading controller software is not acceptable.
   m. Multiplexer boards that convert an analog input into several digital inputs such as the DUIC-5P board are not permitted and shall not be used without explicit authorization from the AISD Energy Management Department.

G. Terminal Control Units (TCU)

1. Provide Terminal Control Units (TCU) for control of each piece of terminal equipment.
2. The Terminal Control Units (TCU) shall be 32-bit microprocessor-based. They shall also be multi-tasking, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the project point list.
3. Each TCU shall have sufficient memory, to support its own operating system and databases, including:
    a. Control processes
    b. Maintenance support applications
    c. Custom processes
    d. Manual override monitoring
4. Each TCU shall support:
    a. Analog inputs of 4-20 mA, 0-10 Vdc, 10,000 ohm thermistor or 1000 ohm RTD
    b. Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
    c. Each TCU shall be capable of providing the following control outputs without the addition of equipment:
        1) Digital outputs (contact closure for motor starters up to size 4)
        2) Analog outputs of 4-20 mA or 0-10 VDC
5. The TCU analog or universal input shall use a 16-bit A/D converter.
6. The TCU analog or universal output shall use a 10-bit D/A converter.
7. Controllers shall include all point inputs and outputs necessary to perform the specific control sequences. As a minimum, 25% of the point outputs shall be of the universal type; that is, the outputs may be utilized either as modulating or two-state, allowing for additional system flexibility. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators.
8. Each TCU controller performing space temperature control shall be provided with a matching room temperature sensor.
9. Each controller shall perform its primary control function independent of other NCU controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the NCU controller time clock to ensure LAN continuity. Each controller shall include algorithms incorporating proportional, integral, and derivative (PID) gains for all applications. All programmed PID gains and biases shall be available for adjustment via the NCU field-adjustable by the user via terminals as specified herein.
10. Provide each TCU with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Operating programs shall be field selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.
11. VAV Terminal Control Units:
    a. The VAV box TCU controllers shall be powered from a 24 VAC source and shall function normally under an operating range of 20 to 28 VAC (±15%), allowing for power source fluctuations and voltage drops. The BAS contractor

shall provide a dedicated power source and separate isolation transformer for each controller unable to function normally under the specified operating range. The controllers shall also function normally under ambient conditions of 32 degF to 122 degF (0 degC to 50 degC) and 5% to 90% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.

b. The Variable Air Volume (VAV) Terminal Control Unit (TCU) shall include a built-in differential pressure transducer that shall connect to the VAV terminal unit manufacturer's standard differential pressure sensor to measure the average and amplify differential pressure in the duct. The controller shall convert this value to actual air flow. Single point differential pressure sensing device is not acceptable. The VAV TCU differential pressure transducer shall have a measurement range of 0 to 1 in. W.C. (0 to 250 Pa) and measurement accuracy of "5% at 0.1 to 1 in. W.C. (25 to 250 Pa) and a minimum resolution of 0.0001 in. W.C. (0.025 Pa), ensuring primary air flow conditions shall be controlled and maintained to within 5% of setpoint at the specified minimum and maximum air flow parameters. The VAV TCU differential pressure transducer shall have a zero value air flow measurement repeatability of 0.001 in. W.C. (0.25 Pa), VAV TCU differential pressure transducer requiring periodic zero value air flow calibration is not acceptable. The BAS contractor shall verify the type of differential pressure sensors used in the existing boxes, and ensure compatibility with the VAV TCU controllers.

c. The Variable Air Volume (VAV) Terminal Control Unit (TCU) shall include provision for air flow balancing using a local air flow balancing interface. A portable air flow balancing interface or an Intelligent Space Sensor (ISS) capable of balancing air flow is acceptable. The portable air flow balancing interface shall connect to the VAV TCU or the matching room temperature sensor.

d. The Variable Air Volume (VAV) Terminal Control Unit (TCU) shall also provide a web browser based air flow balancing tool. This tool shall allow the air balancer to manually control the action of the actuator including the following function: open VAV damper, close VAV damper, open all VAV dampers, close all VAV dampers.

e. The VAV box controller shall interface to a matching room temperature sensor as previously specified. The controller shall function to maintain space temperature to within "1.5 degF (0.9 degC) of setpoint at the room sensor location. Each controller shall also incorporate an algorithm that allows for resetting of the associated air handling unit discharge temperature if required to satisfy space requirements. This algorithm shall function to signal the respective DDC controller to perform the required discharge temperature reset in order to maintain space temperature setpoint.

f. It shall be possible to view and reset the space temperature, temperature setpoint, maximum airflow setting, minimum airflow setting, and actual airflow, through the BAS LAN.

12. TCU Thermostat

a. Provide Terminal Control Unit (TCU) Thermostat controllers designed with unique functions and featues particular to a specific type of mechanical equipment or applications that may be less common and or standarizied in its use and application.

b. TCU Thermostat – A self-contained controller with a built-in user interface that is intended for installation in the occupied space of the building. The TCU Thermostat shall have the following features:
   1) The FCU Thermostat shall be a microprocessor-based fully-programmable controller with all of its control logic, inputs and outputs, network communication and user interface provided within the manufacturer provided enclosure specific to the application. The enclosure shall be aesthetically appealing with a modern design that will fit in with the architecture of the building. A sample of the TCU Thermostat shall be provided as part of the submittal process.
   2) The TCU Thermostat shall be programmed through the user interface contained within the controller and through a software based configuration tool.
   3) The user interface display shall be provided with 3 levels of password protection: Level 1 – Lockout with view only and time adjustment; Level 2 - schedule override and mode settings; Level 3 – full access to all parameters. Where required in the sequence of operation provide for within Level 2 access the ability to change the units of measure displayed for temperature from Fahrenheit to Celsius. The display shall be back lighted for easy viewing.
   4) If required within the sequence of operation, provide for a control schedule and time clock within the TCU Thermostat. The control schedule shall provide for a separate schedule for each day of the week with 4 events per day. The real time clock will have a six-hour power reserve time.
   5) The TCU Thermostat shall utilize a PI (proportional and integral) control algorithm. Upon power failure, all programmed schedules and parameters must be retained in non-volatile flash memory.
   6) Each TCU Thermostat shall be capable of providing the following control inputs and outputs without the addition of equipment:
      a) One (1) on-board thermistor
      b) Four (4) universal inputs (0-10VDC, thermistor, dry-contact)
      c) Five (5) universal outputs (0-10VDC or dry-contact N.O.)

13. Multiplexer boards that convert an analog input into several digital inputs such as the DUIC-5P board are not permitted and shall not be used without explicit authorization from the AISD Energy Management Department.

H. Acceptable Manufacturers/Products

1. Distech
2. Johnson Controls
3. Trane

2.7 ELECTRONIC INPUT/OUTPUT DEVICES

A. Sensors and Transmitters

1. Provide sensors and transmitters required as outlined in the input/output summary and sequence of operation, as required to achieve the specified accuracy as specified herein.

2. Temperature transmitters shall be equipped with individual zero and span adjustments. The zero and span adjustments shall be non-interactive to permit calibration without iterative operations. Provide a loop test signal to aid in sensor calibration.
3. Temperature transmitters shall be sized and constructed to be compatible with the medium to be monitored. Transmitters shall be equipped with a linearization circuit to compensate for non-linearity of the sensor and bridge and provide a true linear output signal.
4. Temperature sensors shall be of the resistance type and shall be either three-wire 100 ohm platinum RTD, or two-wire 1000 ohm platinum RTD.
5. Thermistors are acceptable provided the mathematical relationship of a thermistor with respect to resistance and temperature with the thermistor fitting constraints is contained with the Control Unit (CU) operating software and the listed accuracy's can be obtained. Submit proof of the software mathematical equation and thermistor manufacturer fitting constants used in the thermistor mathematical expressions. Thermistors shall be of the negative thermistor coefficient (NTC) type with a minimum of 100-Ohm/^{o}F resistance change versus temperature to insure good resolution and accuracy. BAPI or approved equal. AISD prefers 10K Type II Thermistors.
6. Combination Sensors or "Combo Sensors" such as Temperature and Humidity are only permitted with prior authorization from AISD Energy Management Department.
7. The following point type accuracies are required and include errors associated with the sensor, lead wire and A to D conversion.

Sensor Type	Range	Min. Accuracy
Duct/AHU Temperature	40 – 130°F	± 0.5 Degree F
Room Temperature	50 – 85°F	± 0.5 Degree F
Outside Air Temperature	-20 – 120°F	± 0.5 Degree F
Chilled Water Temperature	32 – 80°F	± 0.5 Degree F
Hot Water Temperature	80 – 220°F	± 0.5 Degree F
Humidity	0 – 100%	± 3% RH
Duct Static Pressure	0 – 3" w.c.	± 1% full scale per 50°F
Space Static Pressure	- 0.25" – 0.25" w.c.	± 1% full scale per 50°F
Current Sensor	Sized for application	± 1% full scale
Power (kWh)	Sized for application	± 2% full scale (at 1.0 PF)
Air Flow	700 – 4,000fpm	± 2% full scale
Water Flow	Sized for application	± 4% full scale
CO_2 Sensors	0 – 2,000 PPM	± 3% full scale

8. Sensors shall not drift more than 1% of full scale per year.
9. Sensors used in British Thermal Unit (BTU) or process calculations shall be accurate to ±0.10^{o}F over the process temperature range. Submit a manufacturer's calibration report indicating that the calibration certification is traceable to the National Institute of Standards and Technology (NIST).
10. Thermowells
    a. When thermowells are required, the sensor and well shall be supplied as a complete assembly.
    b. Thermowells shall be pressure rated and constructed in accordance with the system working pressure.

c. Thermowells and sensors shall be mounted in a threadlet or ½" NPT saddle and allow easy access to the sensor for repair or replacement.
d. Thermowells shall be constructed of the following materials:
    1) Chilled and Hot Water; 316 stainless steel
    2) Condenser Water and Steam; 316 stainless steel
    3) Brine (salt solutions); marine grade stainless steel
    4) Heat transfer grease shall be used on all thermowell applications.

11. Space Temperature Sensors
    a. Each room sensor shall include the following options:
        1) Style: Delta style (E.g. BAPI BA/-R)
        2) Setpoint Adjustment: The setpoint adjustment slider shall allow for modification of the temperature by the occupant. Each Setpoint Slider shall be adjustable for allowable range from the Graphic User Interface. Default [+/-3F].
        3) Setpoint Adjustment Slider Graduation: "COOL/WARM"
        4) Setpoint Adjust Slider Acting: Direct Acting
        5) Temperature Indicator: Do Not Provide.
        6) Override Switch: Required. In parallel with sensor.
        7) Foam-backing: Provide for sensors mounted on exterior walls, CMU walls, structure beams or if sensor is subjected to air draft from wall.

12. Outside air Temperature, Humidity and CO2 Sensors
    a. Sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall be provided with a solar shield.
    b. Transmitters shall be of NEMA-3R construction and rated for ambient temperatures.

13. Duct Type Sensors
    a. Duct mount sensors shall mount using a handy box through a hole in the duct and be position do as to be easily accessible for repair or replacement. A neoprene grommet (seal-tight fitting and mounting plate) shall be used on the sensor assembly to prevent air leaks.
    b. Duct sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. Sensor probes shall be constructed using 304-rated stainless steel.
    c. Duct sensor shall be of the appropriate length and mounted in a location on the duct to obtain the best representation of the actual air temperature.
    d. For outdoor air duct applications, use a weatherproof box with weatherproof cover and gasket.
    e. Sensor handy box shall not be used as a pull-box. Installation shall allow the replacement of sensor without the need for disconnecting/removing additional wiring or conduit.

14. Averaging Duct Type Sensors
    a. Provide capillary supports at the sides of the duct to support the sensing string. Support the middle of the span to prevent flopping of the capillary tube as required. No metal-to-metal contact shall be allowed.
    b. Where the capillary enters the equipment, it shall be protected from sharp edges using a poly tube sleeve.

15. Relative Humidity Sensors/Transmitters
    a. The sensor shall be a solid state, capacitive polymer type.

b. Humidity transmitter shall be equipped with a 2-wire 4-20mA or 3-wire 0-10VDC linear proportional output.
c. The humidity transmitter shall meet the following overall accuracy including lead loss and A to D conversion:
   1) Accuracy: ±3% RH from 10-90%
   2) Drift: 0.5% per year
   3) Response time: < 5 seconds in moving air
   4) Linearity: Negligible
   5) Hysteresis: < 1%
   6) Calibration: Factory calibrated.
d. Duct type sensing probes shall be constructed of 304 stainless steel and be equipped with a neoprene grommet, bushings and a mounting bracket.

16. Differential Pressure Transmitters and Accessories
   a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input.
   b. Pressure transmitters shall provide the option to transmit a 0-5 VDC, 0-10 VDC, or 4-20 mA output signals.
   c. Pressure transmitters shall be equipped with a LED display indicating the transmitter output signal.
   d. Differential pressure transmitters used for pressure or flow measurement shall be supplied with shutoff and bleed valves in the high and low sensing pick-up lines (5 valve manifold).
   e. Provide, at a minimum, a NEMA-1 housing for the transmitter. Locate transmitters in accessible local control panels wherever possible.
   f. Duct sensing pressure applications shall utilize a static pressure traverse probes.

17. Low Air Pressure Applications
   a. The pressure transmitter shall be capable of transmitting a linear electronic signal proportional to the differential of the room and reference static pressure input signals with the following minimum performance specifications.
      1) Span: No greater than two times the design space differential pressure
      2) Accuracy: ± 0.5% of full scale
      3) Dead Band: Less than 0.3% of output
      4) Repeatability: Within 0.2% of output
      5) Linearity: ± 0.2% of span
      6) Response: Less than one second for full span input
      7) Temperature Stability: Less than 0.01% output shift per degree change
   b. The transmitter shall utilize variable capacitance sensor technology and be immune to shock and vibration.
   c. Measuring of outside air pressure shall be accomplished by using a pressure pickup probe suitable for outdoor pressure sampling that stabilizes and reduces fluctuations from wind gusts.
   d. Measuring of indoor space pressure shall be accomplished by using a static pressure pickup probe either wall or ceiling mounted.

18. Medium to High Air Pressure Applications
   a. The pressure transmitter shall be similar to the low air pressure transmitter. Provide differential pressure transmitters, which meet the following performance requirements:

1) Zero & Span: (% full scale/degree): 0.041% including linearity, hysteresis and repeatability
2) Accuracy: 1% full scale (best straight line)
3) Static Pressure Effect: 0.5% full scale
4) Thermal Effects: <±0.03% full scale/degree

19. Wet-Media Differential Pressure Applications
    a. The differential pressure transmitter shall be of industrial grade and transmit a linear output signal in response to variation of differential pressure or water pressure sensing points.
    b. The differential pressure transmitter shall meet the following performance specifications:
        1) Die-cast NEMA-4 Enclosure with readout LCD display
        2) Suitable input differential pressure range
        3) Dual sensor design
        4) Microprocessor profiled with built-in noise rejection
        5) 0-10VDC, 0-5VDC or 4-20mA output
        6) Maintain accuracy up to 20 to 1 ratio turndown
        7) Reference Accuracy: ±0.2% of full span
        8) Push-button auto-zero
        9) Provide with bypass/test manifold
    c. Differential pressure transmitters with wired remote sensors are not to be used without the prior approval from AISD Energy Management Department.

B. Valve and Damper Actuators

1. Electronic Valve and Damper Actuators
    a. Electronic actuators shall be direct-coupled type capable of being mounted over the shaft of the damper or valve. They shall be approved by a suitable safety or regulatory agency. Power consumption shall not exceed 8 watts or 15 VA of transformer sizing capacity per high torque actuator nor 2 watts or 4 VA for VAV actuators. Sound level shall not exceed 45 dB for high torque or 35 dB for VAV actuators.
    b. Electronic overload protection shall protect actuator motor from damage. If damper jams actuator shall not burnout. Internal end switch type actuators are not acceptable. Actuators may be mechanically and electrically paralleled on the same shaft to multiply the available torque. A reversing switch shall be provided to change action from direct to reverse in relation to control signal as operation requires.
    c. All 120 VAC powered actuators shall be installed with a locking switch (key operated switch, Leviton 1221-2L) as a disconnecting means for servicing within reach of the actuator, but not on the actuator. Verify location with Architect, Engineer, and/or Owner prior to install.

2. Control Damper Actuators
    a. Outside air, return air, and exhaust air actuators shall be spring return type. Individual battery backup or capacitor return is not acceptable.
    b. The control circuit shall be fully modulating using 0-10VDC, 2-10VDC, 4-20 mA, or Pulse Width Modulation signals. A 0-10VDC, 2-10VDC, or 4-20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators paralleled off a master motor or to provide a feedback signal to the automation system indicating damper position. Accuracy shall be within ±2.5%.

c. Zone and Face and bypass dampers and other control dampers shall be modulating using the same control circuit detailed above but shall not be spring return.
d. Actuators serving Outside/Exhaust/Relief dampers shall provide position feedback to the control system.
e. Provide auxiliary switches on damper shaft or blade switch to prove damper has opened on all 100% outside air handling equipment.

3. Miscellaneous Damper Actuators
   a. Outside air combusting and ventilation air intake and exhaust damper actuators shall be 2 position (open/close) spring return, and close if any water piping, coils or other equipment in the space which the damper servers needs to be protected from freezing.

4. Air Terminals
   a. Air terminal actuators shall be fully modulating floating (drive open, drive closed) 3 wire control or use control circuit as detailed in control dampers depending on the controller's requirements.

5. Inlet Vanes Actuators
   a. Inlet vanes and actuators shall not be used for this job. Speed control of the fan motor shall use a variable frequency drive (VFD).

6. Combination Smoke and Fire Damper Actuators
   a. Actuators shall be factory mounted and connected to the damper section and conform to suitable safety or regulatory agency approved specifications.

7. Valve Actuators
   a. Actuators shall have a gear release button on all non-spring return models to allow manual setting. The actuator shall have either an insulating air gap between it and the linkage or a non-conducting thermoplastic linkage. Care shall be taken to maintain the actuator's operating temperatures and humidity within its specifications. Pipes shall be fully insulated and heat shields shall be installed if necessary. Mount actuators so condensation shall not form on actuators and be prevented by a combination of insulation, air gap, or other thermal break.
   b. The control circuit shall be fully modulating using 0-10VDC, 2-10VDC, 4-20 mA, or Pulse Width Modulation signals. A 0-10VDC, 2-10VDC, or 4-20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators paralleled off a master motor or to provide a feedback signal to the automation system indicating valve position.
   c. Valve body and actuators shall be equipped fully assembled and tested at the valve factory.
   d. Valve actuators serving bypass valves shall provide position feedback to the control system.
   e. All actuators shall be provided with means to accept a ½" conduit fitting.

8. Control Valve Actuators (4 inch and larger)
   a. The Valve actuator shall consist of a permanent split capacitor, reversible type electric motor that drives a compound epicycle gear. The electric actuator shall have visual mechanical position indication, readable from a distance, and show output shaft and valve position. Unit shall be mounted directly to the valves

without brackets and adapters, or readily adapted to suit all other types of quarter-turn valves.

b. The actuator shall have an integral terminal strip, which, through conduit entries, will ensure simple wiring to power supplies. Cable entries should be approved by a suitable safety or regulatory agency. Use recommended gland stops within the NPT hole to prevent glands from being screwed in too far and damaging cable.

c. The actuator shall be constructed to withstand high shock and vibrations without operations failure. The actuator cover shall have captive bolts to eliminate loss of bolts when removing the cover from the base. One copy of the wiring diagram shall be provided with the actuator.

d. The actuator shall have a self-locking gear train that is permanently lubricated at the factory. The gearing shall be run on ball and needle bearings. Actuators with high output torque shall have two adjustable factory calibrated mechanical torque limit single-pole double-throw switch type. The motor shall be fitted with thermal overload protection. The motor rotor shaft shall run in ball bearings at each end of motor.

e. The actuator housing shall be hard anodized aluminum for full environmental protection.

f. The actuator shall be provided with means for manual override.

g. The environmental temperature range of the actuator shall be from –30ºC to +60ºC (-20ºF to +140ºF).

h. For intermittent on/off service, the actuator shall be rated at a 20% duty cycle (i.e., 12 minutes extended duty in every hour, or alternatively; one complete cycle every 2 minutes). For more frequent cycling and modulating service, an actuator shall be rated for continuous duty. The actuator rated for continuous duty shall be capable of operating 100% of the time at an ambient temperature of 40ºC.

i. The actuator shall have an integral self-locking gear train. Motor brakes shall not be required to maintain desired valve position. Levers or latches shall not be required to engage or disengage the manual override. Mechanical travel stops, adjustable to 15º in each direction of 90º rotation shall be standard, as well as two adjustable travel limit switches with electrically isolated contacts. Additional adjustable switches shall be available as an option.

j. Single Phase Motor: The motor shall have Class B insulation capable of withstanding locked-rotor for 25 seconds without overheating. Wiring shall also be Class B insulation. An auto-reset thermal cutout protector shall be embedded in the motor windings to limit heat rise to 80ºC in a 40ºC ambient. All motors shall be capable of being replaced by simply disconnecting the wires and then removing mounting bolts. Disassembly of gears shall not be required to remove the motor.

k. Materials of Construction: The electric actuator shall have a pressure die-cast, hard-anodized aluminum base and cover. The compound gear shall be made of die-cast, hard-anodized aluminum or steel. An alloy steel worm gear shall be provided for manual override and torque limiting. Bearings for gears shall be of the ball and needle type; bronze bearings shall be used on the shafting parts.

l. Accessories: Potentiometer for providing continuous feedback of actuator position at the CU (for valves specified position feedback).

9. Acceptable Manufacturers/Products

a. Belimo

C. OTHER ACCESSORIES

1. Electric Low Limit Thermostat (Freeze-Stat)
   a. Heavy-duty, duct type, fixed differential, vapor-charged sensing element, manual reset, with test/reset button.
   b. Sensing element shall be a capillary tube responding to the lowest temperature sensed along any segment of bulb length. Switch shall be rated for 10 amps at full load DPDT (double-pole double-throw).
   c. The capillary tube shall be protected from damage at the location that it enters the AHU. Any exposed areas of the capillary tube shall be protected by covering with poly- tubing. Refer to Averaging sensors section above. Provide one 20-feet long bulb thermostat for every 20-sq.ft of coil area.
   d. Adjustable Range: 15 to 55 degree F.
   e. AISD prefers Johnson Controls A70 Series Low Limit Thermostats.

2. Water Flow Switches
   a. Suitable safety or regulatory agency approved device, suitable for all service application conditions. Body minimum working pressure rating shall equal or exceed service pressure. Unit shall have two single-pole double-throw switches. Actuating flow rated shall be field adjustable for the specified and indicated service. Switch location shall preclude exposure to turbulent or pulsating flow conditions. Flow switch shall not cause pressure drop at maximum system flow rate.

3. Strap-On Aqua stat
   a. Strap-on aqua stats are not to be used without the prior approval from AISD Energy Management Department.

4. Variable Frequency Drives (VFD)
   a. Refer to division 23 and 26 for approved list of VFDs and other requirements.
   b. The VFD shall communicate utilizing the BACnet protocol via manufacturer card to communicate and receive data through the DDC system. All VFDs shall have separate conduits for hi-voltage input circuits, hi-voltage output circuits and control circuits. In addition to the BACnet communications, each drive shall have two hard-wired points from the BAS system. The three points are as follows:
      1) VFD Start/Stop
      2) VFD Speed Reference
      3) VFD Run Status
   c. Remote mounted VFDs with service disconnects between the VFD and the load, shall be wired to the service disconnect early-break auxiliary switch for proper VFD shutdown upon disconnect operation.

5. Carbon Monoxide (CO) Sensor
   a. Wall mounted with electromechanical sensor and front panel LCD.
   b. Output Signal: 4-20mA, 0-10VDC
   c. Output Resolution: 10bit PWM (+/- 0.4ppm)
   d. Buzzer Alarm: 85db (minimum)
   e. Measurement Range: 0-100, 150, 300, 400, 500 PPM.
   f. Relay Output: Two Form-C Relays with programmable trip point.
   g. Preferred Manufacturer/Product: Greystone CMD5B4-110.

6. Network Switches

a. Gigabit Ethernet Managed Switch
b. Four (4) or Eight (8) Gigabit port configuration.
c. Web Interface with Password Protection
d. Built-in in Cable Integrity Tester.
e. Preferred Manufacturer/Product:
    1) Netgear 8-Port (GSS108E)
    2) Netgear 4-Port (GSS305E)

D. FLOW, PRESSURE AND ELECTRICAL MEASURING APPARATUS

1. Traverse Prove Air Flow Measuring Stations
    a. Traverse probes shall be a dual manifold, cylindrical, type constructed of 3003 extruded aluminum with an anodized finish to eliminate surface pitting and unnecessary air friction. The multiple total pressure manifold shall have sensors located along the stagnation plane of the approaching airflow and without the physical presence of forward projecting sensors into the air stream. The static pressure manifold shall incorporate dual offset static tips on opposing sides of the averaging manifold so as to be insensitive to flow-angle variations of as much as ±20^{o} in the approaching air stream.
    b. The airflow traverse probe shall not induce a measurable pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presences in the airstreams. Each airflow-measuring probe shall contain multiple total and static pressure sensors placed at equal distances along the probe length. The number of sensors on each probe and the quantity of probes utilized at each installation shall comply with the ASHRAE Standards for duct traversing.
    c. Traverse probes shall be accurate to ±2.5% of the measured airflow range and be installed in a duct section that meets manufacturer's installation specifications sheet. Allow adequate distance from elbows, junctions or other disturbances.

2. Thermal Dispersion Air Flow Measuring Stations
    a. Thermal dispersion air flow measuring stations are only permitted with prior approval from AISD Energy Management Department.

3. Shielded Static Pressure Sensor
    a. Provide for each zone where required a shielded static pressure sensor suitable for ceiling surface mounting, complete with multiple sensing ports, pressure impulse suppression chamber, airflow shielding, compression takeoff fittings, all contained in a welded stainless steel casing, with polish finish on the exposed surfaces.
    b. These probes shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow from a radial source.
    c. The shielded static sensing devices shall be used for both reference and space pressure sensing.
    d. Pressure sensors used for outside air pressure reference purposes shall be equipped with a conduit seal for pneumatic tubing and bushings for a weather tight installation.
    e. All sensors shall be installed according to the manufacturer's installation specifications sheet and in a location that is not subject to frequent air disturbance.

4. Static Pressure Traverse Probe
   a. Provide multipoint traverse probes in the duct at each point where static pressure sensing is required.
   b. Each duct static traverse probe shall contain multiple static pressure sensors located along the exterior surface of the cylindrical probe. Pressure sensing points shall not protrude beyond the surface of the probe.
   c. The duct static traverse probe shall be of 304 stainless steel construction and be complete with threaded end support rod, sealing washer and nut, and mounting plate with gasket and static pressure signal fitting. The static traverse probe shall be capable of producing a steady, non-pulsating signal of standard static pressure levels without the need for correction factors, and an instrument accuracy of 5% full range.
   d. The probe shall be installed according to the manufacturer's installation specifications sheet and in a location that is not subject to frequent air disturbance.

5. Liquid Flow Meters
   a. Electronic Type Flow Meters: (ONICON F-Series Manufacturer or approved equal)
      1) Accuracy of flow meter shall be ±0.5% of reading at calibrated velocity with a pressure drop of less than 1 PSI at 20 ft/s in 1.5" pipe, decreasing in larger pipes and lower velocities.
      2) Electronic sensing method shall be electromagnetic.
      3) Insertion-type for renovation projects.
      4) Inline-type for projects involving new hydronic piping or piping reconfiguration.
      5) The standard temperature range shall be 180^{o} F continuous, 200^{o} F peak. High temperature range shall be 280^{o} F continuous, 300^{o} F peak with an operating pressure of 400 PSI maximum.
      6) The flow meter shall be wet-calibrated at the manufacturer's laboratory against primary volumetric standards directly traceable to NIST. Provide certification of calibration with each meter.
      7) Input signal from flow meter to be 0-10VDC or 4-20mA.
      8) Insertion-type meters shall be installed to allow removal of meter removal during system operation.
   b. Venturi Type Flow Meters:
      1) Pressure drop on venturi type flow meters shall not exceed 0.25" WC. Each venturi low and high-pressure taps shall be equipped with nipples, valves, and quick disconnects.
      2) Equip each venturi with a metal identification tag indicating the size, location, flow (gpm), and meter reading for the flow specified.
      3) Provide (1) dial differential pressure meter of the proper range to determine piping system flow rate. The meter shall become the property of AISD.
      4) Venturi meters shall utilize flanged or screwed connections for removal purposes and shall be rated for the system operating pressures.
      5) The venturi flow meter shall be factory calibrated to provide a minimum of flow accuracy between actual and factory flow calibration data.

6. Current Transformers
   a. The current transformers shall be designed to be installed or removed without dismantling the primary bus or cables. The transformer shall be of a split core

design. Solid core current transformers shall not be used without the prior approval from the AISD Energy Management Department.

b. The core and windings shall be completely encased in a suitable safety or regulatory agency approved thermoplastic rated 94VA. No metal parts shall be exposed other than the terminals.

c. The current transformers shall meet the following specifications:
   1) Frequency Limits: 20 to 100 Hz
   2) Insulation: 0.6 KV Class, 10 KV BIL
   3) Accuracy: ± 1% at 5.0 to 25.0 VA accuracy class with U.P.F burden

7. Current Sensing Switches
   a. The split core current sensing switch shall be self-powered with solid-state circuitry. Current sensing switches shall consist of a solid-state current sensing circuit, adjustable trip point, solid state switch, single-pole double-throw or double-pole double-throw relay, as required and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device and looped if required to attain the correct sensing value. The current sensing switch shall accept over current up to twice its trip into range.
   b. It shall be reverse voltage protected and have high over current capability.
   c. Frequency Limits: 20 to 100 Hz.
   d. Accuracy: ±0.5% of full scale.
   e. Response Time: 300 milliseconds to 90% of step change.

8. Power Monitoring
   a. Wattnode BACnet or approved equal.
   b. Current transformers rated and as required for proper interfacing to electrical gear scheduled to be monitored.
   c. Provide voltage disconnect switch and CT shorting block equal to ELKOR i-BLOCK or approved equal.
   d. Install in dedicated control panel.

2.8 CONTROL VALVES AND DAMPERS

A. General Control Valve Requirements

1. All automatic control valves shall be linear, fully proportioning, with modulating ball, plug or V-port inner guidelines unless otherwise specified. The valves shall be quiet in operation and fail safe in either normally open, normally closed position or fail in last commanded state in the event of loss of electronic output signal. See drawings and sequence of operation for system requirements.
2. All valves shall be capable of operating per sequence when required by the sequence of operation. All control valves shall be sized by the BAS system contractor and/or the valve manufacturer, and shall be guaranteed to meet the heating and cooling loads as specified. All control valves shall be suitable for the pressure conditions, and shall close against the differential pressures involved. Valve body pressure rating and connection type (screwed or flanged) shall conform to ANSI pressure classifications appropriate for the system working pressures.
3. All valves shall be programmed to be 0% on HMI = 0% signal on DDC controller = Valve Closed to Coil. Likewise, 100% on HMI = 100% Signal (10VDC, 20mA, etc.) on DDC controller = Valve Open to Coil. Same holds true for Dampers (Multizone dampers shall be 0% = Full Hot Deck, 100% = Full Cold Deck). Any deviation from this strategy shall require permission from Owner during the 90% Submittal review.

B. Hot and Cold Water Control Valves

1. Hot and cold water globe type control valves shall be single-seated type, with equal percentage flow characteristics. The valve discs shall be composition type and shall be sized using ISA methods.
2. Pressure drop through the valves shall not exceed 5 PSI when the valve is fully open and under design flow unless otherwise indicated
3. Ball valves shall be equipped with 316 stainless steel trim, Teflon seals and adjustable packing gland nuts. Provide a handle for manual operation during start-up and maintenance.

C. Air Terminal Reheat Valves

1. Reheat valves shall be modulating logarithmic equal percentage type globe or ball valves as detailed in paragraph C above. 2-position control is not acceptable.

D. Two Position Control Valves

1. For open/closed and/or three-way diverting applications, butterfly valves are acceptable and shall be heavy-duty pattern with a body rating comparable to the pipe rating.
2. Provide each butterfly valve with a replaceable lining suitable for temperature and service requirements.
3. Equip each with a butterfly valve with disc and stainless steel stem.
4. Valves used for shut-off or isolation purposes shall be bubble-tight.

E. Automatic Control Dampers

1. Automatic dampers shall give a feedback of position only when noted in contract documents.
2. Automatic dampers shall have multiple blades and sized for the application by the BAS Contractor and/or as indicated on the design drawings.
3. Submit a schedule of damper sizes to the Prime Contractor, with a copy to the Architect/Engineer and AISD within 15 days after being awarded the contract.
4. Dampers used for throttling airflow shall be opposed blade type arranged for normally open or normally closed operation as required. The damper is to be sized so that when wide open the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear. Multi-section dampers must be provided with sufficient interconnecting hardware or jackshaft for unison operation of all blades in the entire assembly.
5. Damper frames and blades shall be constructed of either minimum 16 gauge galvanized steel or 14 gauge aluminum and arranged to facilitate field assembly of several individual sections into a larger damper area and allow secure fastening of damper frame to the surrounding ductwork, collar or fan housing. Maximum blade length in any section shall not be longer than 48 inches. Additional stiffening or bracing shall be provided for any section exceeding 48 inches in height.
6. Damper blades shall not exceed eight (8) inches in width. All blades except for fume hood exhaust systems shall be galvanized sheet steel. Blades shall be suitable for high velocity performance.
7. All damper bearings to be made of nylon. Bushings that turn in the bearing are to be oil impregnated sintered metal. Dampers shall be tight closing, low leakage type with synthetic elastomer seals on the blade edges and on the top, bottom and sides of the frame. Dampers shall not leak in excess of 8 cubic feet per minute per square foot when closing against 4 inches water gauge static pressure.

8. Leakage and flow characteristic charts shall be submitted to the Architect/Engineer for review.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not proceed with work without approved submittals. Any alterations and/or changes to the control sequences shall be submitted to the Engineer for approval for such changes prior to design of the control system and submittal of control shop drawings. AISD Energy Management Department to review and comment on shop drawings before work begins. All work performed prior to submittal approval shall be at contractor's own risk.

B. Provide all hardware, software, programming, materials, labor, licenses, permits and incidentals necessary to provide completely operational digital controls systems. Perform start up and commissioning on each control product, system, and subsystem to provide fully operable systems in accordance with the specified functional performance.

C. Comply with applicable codes and ordinances. If any conflict arises between these specifications and drawings or codes and ordinances, immediately notify the Architect/Engineer and AISD. Do not deviate from the drawings and specifications nor install any work which may be in conflict with codes and ordinances until the conflict is resolved and the solution accepted by the Architect/Engineer and AISD.

D. The BAS System Contractor is responsible for providing a complete and operational system as described in the description of operation, in the points lists summary, and/or the mechanical/electrical drawings for this project. Any item referenced in one part of the system documentation but not listed elsewhere shall be covered under contractors pricing (i.e. damper called out in sequence but not indicated on drawings).

E. The mechanical, electrical, and building automation system drawings show the general arrangement of the respective systems. Follow these drawings, as closely as actual building construction and the work of other trades permit. Provide devices, fittings, and accessories, which may be required but not shown on the drawings or specified herein. Investigate conditions affecting the work and arrange the work accordingly. Provide modifications and accessories as required to meet such conditions.

3.2 COORDINATION OF WORK

A. Examine and compare the BAS specifications and drawings with the specifications and drawings of the other trades and report any discrepancies between them to the Architect/Engineer and AISD. Obtain the Architect/Engineer's written instructions for changes necessary to the BAS work.

B. Install and coordinate the BAS work in cooperation with the other trades installing interrelated work including mechanical, testing adjusting and balancing, and electrical (including fire alarm) during bidding and submittal process. All changes required in the work of the contractor, caused by inadequate coordination and noncompliance with specifications, shall be made at contractor's expense.

C. Where control system will interface with controls provided by equipment manufacturers, ensure that coordination takes place such that all sequences and required control and monitoring points are made available. Documentation stating "work by others" is not acceptable. All work must be clearly coordinated.

D. Carefully check space requirements with other trades to ensure that all material can be installed in the allotted spaces, including above finished suspended ceilings, between coils sections, etc.

E. Install the BAS work to permit removal (without damage to other parts) of parts requiring periodic replacement or maintenance.

F. Renovations/Additions: The BAS contractor shall examine the existing controls system and shall become familiar with all pertinent components and functions of the existing system, including any energy management systems. The contractor shall be responsible for including all work necessary for the following:

1. Existing controls that are to remain in operation after this project shall remain in place and be modified only as required to incorporate new controls.
2. The new controls shall be fully compatible with the existing system.
3. The new controls shall be fully interconnected with the existing system.
4. In shall be the responsibility of the Prime contractor to insure the coordination of proper decommissioning and disconnection/removal of old control system components that will not be reused. Old database and sequences of operation shall be cleaned up, old conduit and wiring removed, old devices and controllers salvaged and returned to the AISD Energy Management Department in a timely manner. Any controllers and/or field devices damaged during the removal process shall be repaired and/or replaced at no cost to AISD.

3.3 WIRING INSTALLATION

A. GENERAL

1. BAS contractor shall be responsible for all communication, control and power wiring associated with the control system including:
   a. Ethernet/BACnet-IP cabling between AISD Network Switches and NCU.
   b. Ethernet/BACnet-IP cabling between NCUs and LCUs/TCUs.
   c. Any related 120V electrical work that may require interlocks, circuit breakers, and/or connections at the panel boards spares or spaces.
2. All electrical work shall be performed in accordance with the requirements of Division 26.
3. All wiring shall be run parallel and perpendicular to building lines (no angles) and concealed where possible. All wiring shall be installed in a professional manner and in accordance with the National Electrical Code and local ordinances. Electrical or mechanical inspection sign off does not remove AISD's right to refuse acceptance of the electrical installation for incorrect or noncompliance with NEC and project specifications. Installation must comply with all local control system electrical code requirements.
4. The control contractor shall use a licensed, qualified and bonded electrical contractor for all wiring above 24Volts.
5. Units already having 120 VAC power run by Division 26 for fans, VAV's, electric heat, etc. shall be provided with required 24 VAC power via a step-down transformer and protected with a circuit breaker, whether provided by the BAS system contractor or unit manufacturer.
6. Provide electrical disconnecting means for servicing, for each control panel, digital controller, transformer, power supply, and other devices that are served by 120VAC or higher voltage.

7. Raceways:
   a. Wiring shall be run in EMT conduit in exposed areas and in vertical risers between floors with sleeves and including any new walls or existing walls that have additional work being performed. EMT conduit fittings shall be steel compression type. All firewall penetrations shall be caulked with approved fire caulking material.
   b. Low voltage plenum rated wire may be used without conduit in concealed but accessible areas (i.e. above lay-in ceilings) and shall be installed in a professional and workmanship like manner and secured up as high as possible. All wall penetrations by plenum cable shall use sleeves with bushings to avoid sharp edges.
   c. All conduits on roofs, in areas exposed to weather conditions, in mechanical spaces, and located within six (6) feet above floor level shall be of rigid type conduit with watertight fittings. Use of non-threaded fittings on rigid conduit shall be limited and used only when necessary.
   d. Underground conduit shall be of the appropriate schedule PVC or coated ridged and back filled per code.
   e. Where flexible metal conduit is used, the maximum allowable length shall be 36 inches, and the minimum shall be 18 inches. All flex conduit fittings shall be of the compression type. Where conduit is attached to vibrating or rotating equipment, flexible metal conduit with a minimum length of 18 inches and maximum length of 36 inches shall be installed and anchored in such a manner that vibration and equipment noise will not be transmitted to the rigidly mounted conduit. Where exposed to the elements or in damp or wet locations, (such as Mechanical rooms) waterproof flexible metal conduit shall be installed at and below 6 feet above floor level. Installation shall be as specified for flexible metal conduit.
   f. When in crawl spaces, EMT conduit may be used when kept up high to the structure; otherwise rigid type conduit shall be used. Waterproof flexible metal conduit shall be used in crawl spaces with the above length requirements.
   g. Provide a pull string in all conduits for pulling spare wire.
   h. No conduit shall be filled to more than 80% of available space.
8. Coordinate with the Mechanical and Electrical Installation Contractors to ensure controls shall be accessible for repair and maintenance.
9. Provide supervised field-wiring for all alarm panel monitoring points, asset protection points (safeties, sump pumps, maintenance alarms) and all points identified to include supervised wiring on the points schedule.
10. Separate Ground: Where recommended by controls manufacturer for the system/application involved, DDC system/components shall employ and maintain a separate, “clean earth” grounding protection. “Mixing” of grounding systems shall be prohibited. (Isolate DDC controls conduits/metal boxes from other raceway systems using isolation bushings and other measures as necessary.)
11. There shall be no power wiring of 120 volts or higher in the same conduit or raceways with communications or low voltage control wiring
12. There shall be no power wiring of 120 volts or higher in the same conduit or raceways with communications or low voltage control wiring.
13. Control wiring shall follow the following jacket coloring conventions:
    a. Purple Jacket: BACnet IP wiring
    b. Orange Jacket: BACnet MS/TP wiring
    c. Yellow Jacket: Thermostat wiring
    d. White Jacket: All other field wiring

14. Hardwired Safety Circuit:
    a. Hardwired safety alarm monitoring and shutdown shall be accomplished through the use of a Fan Safety Relay Board Model: RIBMNLB-6/-4/-2 manufactured by Functional Devices, Inc. or approved equal. The number of circuits/size of board (6, 4 or 2) shall be selected accordingly to accommodate all the specified safety devices plus one spare relay/circuit. Each safety device shall be manual-reset and shall be homerun to the safety relay board via dedicated wiring. Daisy-chaining of devices shall only be permitted when more than one device of the same kind is required to accomplish the specified scope of work (i.e. two freeze-stats to cover the entire area of the cooling coil). Safety relay board shall be installed in the associated controls cabinet. Enclosed version of this safety relay board shall not be used. Each relay on the board shall be clearly labeled identifying the function of the circuit (i.e. Freeze-Stat, High-Static, Smoke-Detector, etc). The first dry-contact of the master relay shall be used to shut down the fan(s) of the associated unit via the Starter or VFD. The second dry-contact shall be used to report the general status of the safety circuit back to the BMS. Individual status monitoring of safeties shall be provided if specified in the scope of work.
    b. Units scheduled to receive only one safety device (i.e. float switch), are permitted to be installed without a Fan Safety Relay Board if safety device is not scheduled to be monitored by the BMS for status reporting.
    c. Freeze-stat normally-closed contact shall be homerun to control panel to energize a DPDT (Double-Pole, Double-Throw) relay. First contact shall be wired to Fan Safety Relay Board for Fan Shutdown. Second contact shall be wired to cut power to all spring-return actuators.

B. Wiring less than 30 volts:

1. In ceilings of areas where return air plenum is used, plenum rated cable will be allowed unless noted otherwise. Where plenum cable is used, it shall be run parallel with building lines, banded together in bundles, supported without sags or “clothes line” appearance at 5 foot centers or less. Cabling that is not run in a neat fashion shall be removed and reinstalled. Determination of neatness shall be at the discretion of the Owner and Engineer. All plenum rated cabling shall be clearly marked on the outside jacket to indicate “Plenum” service.
2. Exposed, unfinished locations, such as mechanical rooms and below accessible raised flooring: Conductors and cable plenum rated (where local code or officials allow). All plenum rated cables shall be in conduit in unfinished area and mechanical rooms starting 6 feet above finished floor.
3. Concealed, unfinished locations, such as ceiling plenums, ceiling spaces, shafts, crawl spaces, tunnels: Conductors enclosed in raceway and cable enclosed in raceway or plenum-rated cable (where local code or officials allow).

C. Twisted-Pair Communication Media

1. Only use the transceiver manufacturers recommended cable types.
2. Install the network communications segments for device channels using bus topology format. Install the network communications segments for all backbone channels using bus topology format.
3. Provide all network communication cables, terminations to network control devices and network infrastructure components in accordance with the current requirements of the BACnet Wiring Guide.

D. Control Power Wiring

1. BAS system contractor to provide list/location of all control panels requiring 120 VAC power so they may be coordinated with Electrical.
2. The BAS system contractor shall provide final low voltage power supplies and termination of power wiring to network devices and infrastructure components where required.
3. Provide interlock wiring between supply and return fans, electrical wiring for relays (including power feed) for temperature and pressure indication. Provide interlock wiring between refrigeration machines, pumps and condensing equipment as required for the specified sequence of operation and the refrigeration system integral controller(s). Do not provide interlock wiring if a dedicated digital output has been specified for the equipment or the sequence of operation requires independent start/stop.
4. Provide power wiring, conduit and connections for low temperature thermostats, high temperature thermostats, alarms, flow switches, actuating devices for temperature, humidity, pressure and flow indication, point resets and user disconnect switches for electric heating, appliances controlled by this division.

E. Input/Output Control Wiring

1. RTD wiring shall be three-wire or four-wire twisted, shielded, and at a minimum of 18 gauge conductors.
2. Other analog inputs shall use, twisted, shielded, and at a minimum of 18 gauge conductors.
3. Binary control function wiring shall use at a minimum of 18 gauge conductors.
4. Analog output control functions shall be twisted, shielded, and use at a minimum of 18 gauge conductors.
5. Binary input wiring shall be a minimum of 18 gauge conductors.
6. Thermistors shall be equipped with the manufacturers calibrated lead wiring.
7. 120 VAC control wiring shall be minimum of #14 gauge wire, THHN type, in ½" conduit.

F. Conduit and Fittings

1. Conduit for Control Wiring, Control Cable and Transmission Cable: Electrical metallic tubing (EMT) with steel compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections. Rigid steel (RGS) with threaded fittings (connections to junction/outlet boxes and cabinets shall be made with threaded HUBS or double lock-nuts). Provide insulated bushings at all RGS conduit terminations where double lock-nuts are used. The use of Hubs are preferred. The use of threadless RGS fittings shall be kept to a minimum and used only when threading of the GRS is impossible.
2. Outlet Boxes (Dry Location): Sheradized or galvanized drawn steel suited to each application, in general, four inches square or octagon with suitable raised cover.
3. Outlet Boxes (Exposed to Weather): Threaded hub cast aluminum or iron boxes with gasket device plate.
4. Pull and Junction Boxes: Size according to number, size, and position of entering raceway as required by National Electrical Codes. Enclosure type shall be suited to location.

G. Relays

1. Relays other than those associated with digital output cards shall be general-purpose, enclosed plug-in type protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required. All relays shall be equipped with an LED pilot light.
2. Solid State Relays (SSR): Solid state relays are not permitted and shall not be used without prior authorization from AISD Energy Management Department.
3. Contactors: Contactors shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contractor shall be double-break silver-to-silver type protecting arcing contacts. The number of contacts and rating shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices.
4. Acceptable Manufacturer/Products: IDEC (Relays)

3.4 CONTROL PANELS

A. Enclosed cabinet type with hinged door for mounting controllers, relays, power supplies and miscellaneous control and communication devices.

B. Control panels shall be fabricated to match the approved shop drawings submitted by the controls contractor. Fabrication shall be in a neat and workmanlike manner and shall facilitate repair, maintenance, and adjustment of the equipment contained therein.

C. Locate all panels in mechanical or electrical rooms. Submit proposed locations for approval prior to preparing control drawings.

D. Control panels shall be fabricated and laid out to incorporate the following features:

1. Lockable doors. All control panels shall be provided with lockable doors using a cylinder AH2 lock kit.
2. Hinged door shall swing left.
3. Identification of all internally and cover mounted devices. Cover mounted labels shall be engraved labels as specified in this section.
4. Provide one duplex outlet mounted inside the control panel. This receptacle may be served from the control panel 120 VAC power source. Label receptacle with source circuit information.
5. Each control panel shall be provided with a control power disconnect switch located and wired so as to disconnect all control power in the panel. Provide one control power disconnect switch per system served (i.e. two disconnect switches for control panel serving two units).
6. All control panels containing electrical equipment shall be NEMA rated for the location in which they are installed. Cover mounted components, tubing penetration, and conduit penetrations shall be made in a manner consistent with the NEMA rating.
7. All conduits entering the control panel shall be fitted with a plastic insulating bushing to prevent cable damage.
8. Wires and tubes that pass from the panel interior to cover mounted devices shall be provided with a flex loop that is anchored on both sides of the hinge.
9. All internal wiring and tubing shall run inside plastic open-slot wire ducts. Wire duct shall be sized to hold the required number of wires and tubes without crimping the wires or tubing and with sufficient space to allow wiring and tubing to be traced during troubleshooting operation.

10. All control panels shall be provided with removable backplane to allow the panel enclosures to be installed at the job site during rough-in while the panels are fabricated off-site for later installation.
11. Labels serving all input/output wiring shall be installed between the open-slot wire duct and the controller so that labels are visible without removing the covers from the wire ducts. Labels shall be as specified in this section.
12. All wiring inside the panel shall be separated by classification; i.e., Class 1 circuits shall not be run with Class 2 circuits, etc. Segregation shall be maintained inside the panel to the fullest extent possible. Where low voltage wires carrying low level ac and dc signals cross wires containing power and high level ac signals, the wires shall cross at a 90° angle.
13. 120 VAC power wiring shall enter the panel separately as close to the point of connection as possible
14. Provide a wireway above or below the control panel whenever more than six conduits enter the panel. Wireway shall be the width of the panel with a minimum of six inches in height and six inches in depth.

E. Panel Location:

1. Each control panel is to be located for convenient servicing. Top of panel shall be at six foot above finish floor.
2. Mount panels adjacent to associated equipment.

F. Network Control Unit (NCU) Panel:

1. Mount in IDF/MDF room or pre-approved location.
2. Provide one duplex outlet mounted inside the control panel.
3. Locate NCU power adapter inside the control panel.

3.5 TEMPERATURE AND PRESSURE SENSOR INSTALLATION

A. Temperature and pressure sensors shall require no field calibrations, initial calibration and range set at factory. BAS contractor to calibrate the DDC system with the field sensors. Thermistors are not field calibratable, but still must be field calibrated with the DDC system.

B. Temperature and pressure sensor assemblies shall be readily accessible and adaptable to each type of application in such manner as to allow for quick, easy replacement and servicing without special tools or skills.

C. Differential pressure transmitters provided with a LCD readout display shall be mounted on wall at 5-feet AFF and nearby from sampling ports in accessible location.

D. Differential pressure transmitters intended for control of building chilled water or hot water distribution pumps, shall be hardwired to the Local Control Unit (LCU) in direct control of the associated Variable Frequency Drives.

E. Sensors installed on units shall be provided with their own dedicated handy box and under no circumstances a sensor shall be “tucked in” or hidden in a junction-box. Installation shall allow the replacement of a sensor without dismantling other sensors, wiring or conduit.

F. Outdoor installation shall be; of weatherproof construction or in appropriate NEMA enclosures. These installations shall be protected from solar radiation and wind effects. Protective shield shall be stainless steel.

G. Sensors shall be provided with protective enclosure where located on plans in common areas (hallways, library, cafeteria, gymnasium). Enclosure shall be clear plastic and keyed alike. Key type is C254A as in a Honeywell Versa Guard TG510A 1001. All Gymnasium areas shall use a wire basket type of enclosure.

H. Sensors in duct shall be mounted in locations to sense the correct temperature of the air only and shall not be located in dead air spaces or positions obstructed by ducts, equipment, and so forth. Locations where installed shall be within the vibration and velocity limit of the sensing element. Ducts shall be securely sealed where elements or connections penetrate ducts to avoid measuring false conditions.

I. All sensors measuring temperatures in pipes larger than 2 inches in diameter or in pressure vessels shall be supplied with wells properly fabricated for the service. Wells shall be non-corrosive to the medium being measured and shall have sufficient physical strength to withstand pressures and velocities to which they are subjected. Wells shall be installed in the piping at elbows where piping is smaller than the length of the well to affect proper flow across the entire area of the well.

3.6 INSTALLATION OF ACTUATORS

A. Where damper motors operate outdoor relief, exhaust and fresh air dampers, pretension damper drive linkage to ensure tight closure.

B. Do not install damper motors on ductwork of less than 0.76 mm thick without first reinforcing it.

C. Where a damper motor is installed on an insulated surface of a duct plenum, mount it on a standoff bracket so as not to interfere with the continuity of the insulation.

D. Locate damper and valve actuators so that they are easily accessible for testing and servicing.

E. Damper motors shall be selected for the torque requirements of the damper. Damper operators that are undersized for the application shall be replaced with larger operators, at no extra cost. On retrofit applications, when existing dampers are suspected to be dragging, the next larger torque actuator shall be used.

F. Provide one damper motor and linkage for every 2-m^2 damper section area, or as required to meet the torque requirements of the damper under design airflow conditions (or minimum of one damper motor per damper section). Do not use two motors linked together on one shaft, or by jackshaft.

G. Actuators shall be installed in such manner to avoid damage to actuator due to condensation.

3.7 NETWORK INFRASTRUCTURE INSTALLATION

A. All network infrastructure components and wiring shall be installed prior to control device installation. For twisted pair networks - install, test, and document test results and physical locations of cabling, conduit, and junction boxes on as-built drawings.

B. Install and commission all routers, physical layer repeaters, and terminators prior to control device installations. Test routers, etc. with the approved network management tool, document results, and identify physical locations of all routers, repeaters, and terminators on as-built drawings.

C. Install necessary power supplies for infrastructure components and devices prior to device installation. Document the following: power source location indicating panel number and breaker id on the set of as-built drawings, at the source panel, and at each device or infrastructure component.

3.8 CONTROL DEVICE INSTALLATION

A. Coordinate with mechanical and electrical contractors and identify each physical network device location. For retrofit applications physically inspect the site. Document locations on shop drawings and include with submittals provided to architect/engineer and AISD Energy Management department representative.

B. Provide all isolation, interfacing, and wiring to complete the installation of equipment items that have integral control systems such as packaged air conditioners, heating units and boiler firing systems. Coordinate with manufacturers prior to submitting proposals and again prior to preparing submittals. Provide all components and circuits and interdisciplinary coordination required to interface the controls system for all required status monitoring, operational features, and fire management functions. Completely test and adjust all systems.

C. Prior to device installation confirm that wiring for all network media, power supply, and I/O has been completed and is available at each location. Notify architect/engineer and/or owners representative immediately of any discrepancies or missing items

D. Install each network device as physically close as possible to controlled equipment with respect to environmental and electrical noise conditions.

3.9 NETWORK DEVICE PROGRAMMING, GRAPHICAL DISPLAYS, STANDARD SETPOINTS, POINT NAMING STANDARDS, ALARMING AND TREND LOGGING.

A. All network device programming used to implement control sequences shall be provided to AISD. It shall not be necessary for AISD to further program the system. However, provisions shall be made to allow future modification of the installed control programs.

B. Provide licensed copies of all software tools, programming aids, and connecting cables, used to install, develop and troubleshoot the controls system to AISD.

C. Implement the control sequences for the equipment on this project as prescribed in the construction documents and drawing sequence of operation descriptions.

D. Provide the following Graphic User Interfaces (GUI) as the minimum acceptable but not limited to:

1. Home Page
2. Time Schedule Page
3. Alarm Console Page
4. Trend Logs Page
5. Summary Page(s)
6. Floor Plan(s)
    a. Provide each floor plan with key plans and dynamically highlight which part of the key plan is in current view.
    b. Mark location of space sensors to match final installation.
    c. Provide calibrated space readings (i.e. space temp, CO2, RH, etc.)
    d. Provide quick links (buttons) to associated HVAC equipment graphic pages.

7. Dedicated GUI per each equipment being monitored/controlled by the BAS
   a. Provide dedicated override points for all outputs.
   b. Group points as follows:
      1) Setpoints: Bottom left-hand side
      2) Status Points: Bottom center (i.e. space temp, effective setpoints, etc.)
      3) Overrides: Bottom right-hand side
      4) Actual Occupancy: Top right
      5) All Other Points: Overlaid around HVAC schematic
8. All graphics shall adhere to the Owner's graphic standards. Contact CxA for access to templates prior to graphics development.

E. Point naming shall adhere to the Owner's point name conventions. Contractor shall reach out to the CxA prior to the commencement of programming for a copy of the latest version of the Point Naming Standards.

F. Provide the following minimum cooling and heating setpoints for equipment scheduled to control to maintain space temperature:

1. Occupied Cooling Setpoint (OCS) [Default: 74°F]
2. Occupied Heating Setpoint (OHS) [Default: 70°F]
3. Unoccupied Cooling Setpoint (UCS) [Default: 85°F]
4. Unoccupied Heating Setpoint (UHS) [Default: 55°F]
5. Unoccupied Dead-band [Default: 5°F]
6. Slider Adjust Range [Default: ±3°F]
7. Effective Cooling Setpoint
8. Effective Heating Setpoint
9. Effective Cooling Setpoint (Occupied) = OCS + Slider Adjust Value
10. Effective Cooling Setpoint (Unoccupied) = UCS
11. Effective Heating Setpoint (Occupied) = OHS + Slider Adjust Value
12. Effective Heating Setpoint (Unoccupied) = UHS

G. Provide Alarm Extensions to the following points:

1. Freeze-Stat (Change of State Alarm)
2. Condensate Float Switch (Change of State Alarm)
3. Low/High Static Pressure Alarm (Change of State Alarm)
4. Fan Command vs Fan Status (Command Failure Alarm)
5. Compressor Command vs Compressor Status (Command Failure Alarm)

H. Provide Trend Logs to the following points:

1. All temperature sensors (Change of Value; Tolerance 1.0F)
2. All outputs
3. All status points

3.10 LABELS AND IDENTIFICATION

A. All devices relating to the work or systems included herein, including controllers, valves, relays, etc., shall be identified with a unique identification number or name on the submitted control drawings. This identification number or name, along with the service of the device (discharge air temperature, freeze-stat, etc.), shall be permanently affixed to the respective device.

B. All field devices shall be supplied with a label indicating its function and point name. Labels shall be "DYMO"-type electronically printed approximately 2-1/2" x 3/4". Surface shall be cleaned before installing labels. No handwritten labels shall be accepted.

C. Damper and valve actuators shall be labeled indicating which direction is towards open/bypass position (i.e. CW=BYPASS; CCW=OPEN).

D. Label ceiling grid where sensors installed above ceiling when applicable.

E. BAS Panels shall be supplied with a nameplate indicating the equipment being served (i.e. AHU-1 Cafeteria, CO2 Monitoring, etc.). Nameplates shall be engraved on rigid plastic labels approximately 3" x 1". "DYMO" tape will not be accepted. Only black phenolic with white lettering will be accepted.

F. All 120 VAC power shall be labeled with source panel and circuit number.

G. All BAS Junction Boxes covers shall be spray-painted green with "BAS" stenciled over.

H. All controls wiring, tubing and cabling both inside and outside of control panels shall be labeled at both ends using BRADY PermaSleeve Black on White Wire Marker Sleeves (do not shrink). The wire designations shall match those on the shop and installation drawings. All markings shall be mechanically produced. No handwritten labels shall be accepted.

I. Communication wiring shall be labeled to specify where it is coming from (previous device) and where it is going next (next device) at each communication drop (e.g. each controller inside a control panel, each VFD provided with a communication card).

3.11 EQUIPMENT PROTECTION AND CLEANING

A. The BAS system contractor shall provide adequate means for and shall fully protect all finish parts of the materials and equipment against damage during the progress of the work until final acceptance.

B. Equipment and accessories shall be thoroughly cleaned of cement, plaster, and other materials; grease and oil spots shall be removed with cleaning solvent and surfaces carefully wiped.

3.12 AIR BALANCING

A. The BAS system contractor shall assign an individual full time to assist the air balance technician during the air-balancing process to assure full balance compliance.

B. The air balance plug-in shall have the ability to globally override local set point values and command all VAV air terminal devices to fully closed, fully open, minimum, and maximum damper positions.

C. All air balance settings and values shall be documented on the as-built control drawings for future reference.

3.13 SUBSTANTIAL PERFORMANCE TEST PROCEDURES

A. General

1. The work under this section shall undergo a formal Functional Testing Commissioning process as documented in Section 230926c. Contractor shall set aside

adequate time for the Commissioning process, including point checkout, sequence verification, and graphics checkout. Contractor shall include adequate time to respond to deficiencies without delaying project completion.

2. Prior to requesting Functional Testing, this Contractor shall have every control point checked end to end to ensure accuracy and integrity of the system.
3. Upon completion of control point end-to-end checkout, Contractor shall submit check-out documentation and DDC O&M Manuals to AISD and Commissioning Authority for review. Refer to Part 1 of this specification for O&M documentation requirements.
4. Upon review and approval of DDC O&M documentation, AISD and Commissioning Authority shall schedule the date for commencement of Functional Testing.
5. Controls Contractor shall make available for the Commissioning process a competent technician who is familiar with the installation and programming of the system. Contractor's technician shall accompany AISD and Commissioning Authority during Functional Testing.
6. Refer to Section 230926c for detailed description and requirements of the Commissioning process.

B. Documentation

1. Upon successful completion of the Commissioning process, and once all deficiencies identified during Commissioning have been corrected, Contractor shall submit a final As-Built DDC O&M Manual with all programming, control points, network variables, setpoints, and graphics as actually implemented.
2. Provide as-built wiring diagrams showing all device locations, infrastructure component locations, control panels, sensors, actuators, ladder diagrams, for associated hardware interlocks, and sequence of operation descriptions for each subsystem within the network design. Show all interfaces with existing and equipment controls.
3. Provide control panel layout sheets complete with point names, point addresses and wire identification numbers. Attach one copy to each respective panel door.
4. All As-Built (O&M Manuals, etc.) documentation, shop drawings, points verification sheets, coordination meeting minutes, etc. shall be included in the O&M manuals as well as on a Compact Disc (CD) accompanying the final As-Builts.

C. Software Backups & Platform Access

1. Upon successful completion of the Commissioning process, the Contractor shall provide a Platform & Station Backup of the Network Control Unit along with the Credentials to access the NCU Platform.

3.14 PROJECT ACCEPTANCE

A. Upon receipt and approval of final DDC O&M Controls work shall be considered substantially complete, as recommended by the Commissioning Authority and approved by Owner and Engineer For additional acceptance requirements see Div 230926c.

3.15 POINT LISTS AND SEQUENCES OF OPERATIONS

A. Refer to drawings.

END OF SECTION 230926a

SECTION 230926c
COMMISSIONING OF BUILDING AUTOMATION SYSTEM (TRIDIUM-BACNET)

PART 1 - GENERAL

1.0 SCOPE

This specification is Austin Independent School District's Division 230926c Rev. 7/30/2018 and supplements the Commissioning Requirements in Division-1 with specific requirements from Direct Digital Controls (DDC) specified under Division 23. This specification shall be used in its entirety and shall only be modified by, or with permission from AISD-Energy Management Department.

1.1 RELATED DOCUMENTS

A. Division-1, Section 019113 -Commissioning Requirements, addresses responsibilities and procedures for the commissioning process. All requirements of Division-1 specifications apply to this section.

B. Division-23, Section 230926a -Direct Digital Controls for Local Building Automation Systems (TRIDIUM-BACNET) addresses requirements for design, installation and testing of DDC system using the BACnet protocol for local control of building HVAC systems. All requirements of Section 230926a apply to this section.

1.2 RESPONSIBILITIES

A. Commissioning is the joint responsibility of the Contractor (including subcontractors and vendors) and the Commissioning Authority hired directly by the Owner, the Owner, and the Design Engineer. General assignment of responsibilities during the Commissioning process is specified in Section 019113. All the requirements of Section 019113 apply to this section.

B. (General) Contractor retains responsibility for coordinating participation of Local Building Automation System subcontractors (Section 230926) throughout the commissioning process, and for ensuring participation by other subcontractors and equipment suppliers, vendors and manufacturers as required to conduct activities specified herein.

C. Building Automation Systems subcontractor (Division 23) is responsible for assigning representatives with expertise and authority to act on behalf of the subcontractor to conduct commissioning activities specified. Building Automation Systems subcontractors are also responsible for providing tools, software and equipment required to conduct commissioning activities.

D. Commissioning Authority is responsible for organizing, witnessing and documenting commissioning activities specified.

E. Owner is responsible for assigning personnel with expertise and authority to act on behalf of the Owner as relates to commissioning of Building Automation Systems, and to provide access to facilities, equipment, and servers as required to conduct commissioning tasks.

F. Design Engineer is responsible for developing a design that is in compliance with the Owner's Project Requirements and Design Guidelines and for responding to Commissioning Authority's comments.

Design Engineer is also ultimately responsible for the proper operation of the system as designed, regardless of whether or not he chooses to participate in testing and demonstrations.

1.3 SUMMARY OF WORK

A. DESIGN PHASE (Information Only)

1. Conceptual Design Meeting: Early during Conceptual Design and prior to making firm decisions on the type of HVAC systems and controls to be provided, Design Team shall request a meeting with AISD Service Center personnel and Owner's Commissioning Authority. The main objective of the meeting is to review the Owner's Standard Specifications and Guidelines and ensure design will proceed in accordance.

2. Preliminary Design Submittal: Design Engineer provides complete DDC points list and sequence of operations for all systems at DD design submittal and again at 95% CD design submittal. Sequences and points lists shall be in accordance with Owner's guidelines and standard points lists. Electronic Submittals shall be provided to AISD Service Center personnel and Owner's Commissioning Authority.

3. Design Review Comments: Owner and Commissioning Authority provide comments upon review of DD and 95% CD design submittals. Comments issued in electronic form.

4. Design Review Meeting: A final design review meeting is held upon review of 95% CD's, to verify inclusion of review comments in design. Meeting is attended (at least) by Design Engineer, Owner, and Commissioning Authority. Commissioning Authority provides written documentation of decisions made during meeting.

5. Design Review Follow-up: Commissioning Authority conducts a follow up review of Construction Documents issued for permitting/bids and forwards comments to Owner and Engineer on any outstanding items.

B. SUBMITTAL PHASE

1. Preliminary Submittal: Controls subcontractor (Div-23) provides preliminary DDC submittal in accordance with specifications, with digital copies transmitted to AISD Service Center and Owner's Commissioning Authority (ACR). This submittal shall occur shortly after contract award and prior to approval of equipment submittals so that systems may be properly coordinated. In addition to requirements of Section 230926, Building Automation System submittal shall include at least the following:

a. Detailed written sequences as they will actually be programmed and using the program variable names;

b. Complete point lists including all controlled devices, monitored values, status points, set-points and all variables obtained from BACnet devices including those from equipment provided with BACnet communication cards;

2. Preliminary Submittal Review: Owner and Commissioning Authority issue joint review comments on Preliminary Submittal to Engineer for inclusion with Design Team's review comments to Contractor.

3. Preliminary Submittal Review Meeting: Upon acknowledgement of receipt of Preliminary Submittal review comments, Local Controls subcontractor will request through the Contractor and AISD Project Manager, a review meeting with Owner, Engineer, and Commissioning Authority. Commissioning Authority documents action items resulting from meeting for inclusion in Final Submittal.

4. Final Submittal: Upon addressing comments, Local Controls subcontractor issues Final Submittal for review by Engineer, Owner, and Commissioning Authority.

5. Final Submittal Review Comments: Owner, and Commissioning Authority issue joint comments to Engineer for inclusion with Design Team's final submittal review comments to Contractor.

6. No hardware installation should take place prior to receiving submittals that have been approved by Owner, Engineer and Commissioning Authority.

C. PRE-FUNCTIONAL INSPECTION -Local Building Automation Systems Controls

1. Controls Contractor Request for Pre-Functional Inspection: Upon completion of installation and programming of ALL systems, Controls subcontractor shall issue a written request for Pre-Functional Inspection by Engineer, Owner and Commissioning Authority, certifying that the following work is complete and ready for inspection:

   a. Manufacturer start-up has been conducted for all equipment requiring it - coordinate with Mechanical Contractor;

   b. Piping has been flushed and (preliminary) test and balance completed - coordinate with Mechanical Contractor;

   c. All control and monitoring devices installed, wired and tested;

   d. Point-to-point check to verify correspondence of control points to control devices verified (provide report);

   e. All operational sequences tested;

   f. Control Panel layout sheets complete with point name, point address, and wire identification number (indicating DDC device), with one copy attached to each respective panel door;

   g. All points and devices permanently tagged with point name, address, and panel number;

   h. As-Built Controls Diagrams and Sequence Documentation reflecting systems as programmed and installed, to be used during inspection.

2. Pre-Functional Inspection: Contractor shall set aside a minimum of two days to conduct a joint Pre-Functional Inspection of Local Controls Building Automation System work with Engineer, Owner and Commissioning Authority. Work will include the following:

   a. Physical inspection of installation for compliance with specifications;

   b. Sample testing of sensors and devices for verification of calibration;

   c. Sample point-to-point checkout to verify correspondence of commanded points to controlled devices;

   d. Testing of central plant cooling sequences including plant enable/disable sequences and call for unoccupied operation;

   e. Testing of central plant heating sequences including plant enable/disable and call for unoccupied operation;

   f. Testing of air handler units operating sequences (sampling) including occupied/unoccupied sequences and call for unoccupied operation;

   g. Testing of zone controls (fan-coil, dx-split, vav-boxes) operating sequences (sampling) including occupied/unoccupied sequences and call for unoccupied operation;

3. Pre-Functional Inspection Report: Commissioning Authority prepares a report detailing deficiencies identified during Pre-Functional Inspection and submits to Engineer so he may evaluate and forward to Contractor.

4. Pre-Functional Re-Inspection(s) Request: Upon completion of items on Pre-Functional Inspection Report, Local Controls subcontractor issues a request for Pre-Functional Re-Inspection and the process is repeated.

5. Pre-Functional Acceptance: Upon completion of all items identified during Pre-Functional Inspection, Commissioning Authority issues an official notification of Pre-Functional Acceptance to Engineer so he may forward to Contractor.

6. When deem advantageous to the project, and depending on system configuration, Pre-Functional Inspection and Functional Testing may be combined into a single activity, at CxA's discretion.

D. FUNCTIONAL TESTING

1. Point Check-out Request: Upon completion of controls installation, the Controls Contractor shall submit documentation and issue written notification to Owner, Engineer, and Commissioning Authority stating that the entire system is ready for Point Check-out, including all graphics.

2. Point Check-out & Report: Commissioning Authority shall inspect system via the Web-based Graphic User Interface (GUI) to verify that all specified points are present, that they are reading properly and that they are accessible, commandable and

overridable as specified. Commissioning Authority will issue a point check-out report listing deficiencies to be corrected.

3. Point Check-out Corrections: Controls contractor shall correct deficiencies listed in the Point Check-out Report and issue written notification when system is ready for Functional Testing.

4. Functional Testing: Upon notification by controls contractor that deficiencies in the Point Check-out Report have been corrected, Engineer, Owner, and Commissioning Authority will meet controls contractor at the project site to conduct Functional Testing as described in Part-4 of this specification.

5. Functional Test Report: Upon completion of Functional Testing, Commissioning Authority shall issue a report listing deficiencies to be corrected.

6. Functional Testing Deficiencies Resolution: Controls contractor shall resolve deficiencies in Functional Test Report. Corrections shall be accomplished within a period of no more than 2 weeks. Upon correction of deficiencies, Contractor shall notify Owner and Commissioning Authority when system is ready for Final Functional Testing.

7. Final Functional Test & Report: Upon receiving notification from Contractor, Owner and Commissioning Authority will verify corrections to controls systems. Commissioning Authority will complete a Final Functional Test Report documenting that systems work as per design intent, and/or outlining any recommendations for future improvement.

E. O&M MANUALS AND AS-BUILT DOCUMENTS

1. Requirements for O&M Manuals and As-Built Documentations are included in Section 230926a.

2. Commissioning Authority shall conduct review of O&M's and As-Builts concurrently with Engineer and track documentation.

F. TRAINING

1. Requirements for training of Owner's personnel are included in Section 230926a.
2. Commissioning Authority shall review training material and attend selected training sessions as deemed useful in order to document adequacy.

PART 2 - PRODUCTS -NOT APPLICABLE

PART 3 - EXECUTION -NOT APPLICABLE

PART 4 - FUNCTIONL TESTING PROCEDURES

4.0 GENERAL

A. Seven (7) Day Performance Test: Contractor shall schedule a seven (7) day period to conduct Functional Testing specified herein. Any upset of system operational functionality greater than (2) hours during the seven (7) day test period shall cause the test to be restarted.

B. Prerequisites for Functional Testing: The following must be complete prior to proceeding with Functional Testing

1. Pre-Functional Testing and Acceptance Notice by Commissioning Authority.

2. End to End Point Checkout by Contractor.

3. Point Checkout Report by Commissioning Authority.

4. Time schedules built and in control of time-controlled equipment.

5. Graphics displays installed and fully operational for each unit, system, and subsystem.

C. Trending: Implement the following trends prior to initiating testing.

1. Each space sensors shall be placed on a five (5) minute trend for 24 hours to document accurate temperature control of room or zone. Trends shall be recorded electronically for inclusion in Commissioning Report.

2. Each control loop measured variable, controlled variable and setpoint if calculated shall be place on a one (1) minute continuous trend for at least twenty-four (24) hours to document stability of loop. Trends shall be recorded electronically for inclusion in Commissioning Report.

3. Runtime totalizer shall be set on selected digital outputs.

4. Additional variables will be trended at the request of Owner/Commissioning Authority.

4.1 FUNCTIONAL TESTING

A. Local Network Testing (BACnet)

1. The fire alarm system shall be enabled at the time of testing to ensure correct action of all fire and smoke sequences that interface with controls.

2. Network traffic for each device channel shall be measured for 24 hours utilizing a protocol analyzer tool. Channel analysis shall include bandwidth utilization, and error

statistics. Reconfigure nodes and/or install additional routers as necessary to maintain traffic at a no more than 60% of channel bandwidth capacity. Backbone channels that contain permanent HMI's shall consume no more than 30% of total bandwidth capacity.

3. Each network control device, intelligent router, and network interface shall be tested and health verified using the protocol analyzer diagnostics application. Test results shall include neuron error log statistics, self-test results and device state information.

4. A power failure for the building shall be simulated and system recovery monitored. A protocol analyzer log shall record the network traffic for each channel for a 60-minute period following building power restoration.

5. Disable all sending (upstream) devices and simulate connection failures for receiving devices (downstream) that implement fail-safe configuration settings. Verify that downstream devices play failsafe values in the event that network variable updates are not detected by downstream devices within the minimum receive update intervals.

6. Test results shall be printed, recorded electronically and submitted to Owner, Engineer and Commissioning Authority.

B. Functional Testing of Sequences and Controls

1. Functional Checklists: Functional Testing forms shall be developed by Commissioning Authority for each specific system or subsystem to be tested, identifying all control and monitoring points that must be active.

2. End-to-End Verification: Proper operation/response of controlled points shall be verified from the Web-based Graphic User Interface (GUI) front-end to the actual physical devices in the field, as follows:

   a. Controlled devices shall be commanded to a value at the GUI and its reaction observed in the field.

   b. Status points shall be changed and observed both in the field and at the GUI.

   c. Selected sensors shall be tested for accuracy and proper placement to ensure that sensors are properly assigned to the area served.

   d. Selected points shall be disabled in the field and the proper alarm/response verified at the GUI.

3. Sequence Verifications: Proper operation of programmed sequences shall be verified for each major system type and sampled for multiple identical systems. Sequence verification will include the following as directed by the CxA:

   a. Response to time schedule commands.

   b. Response to changes in setpoints.

c. Responses to changes in field conditions.

d. Response to loss and restoration of power.

e. Response to loss and restoration of communication.

END OF SECTION 230926c

SECTION 23 21 13 – ABOVE GROUND HYDRONIC PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Pipe and pipe fittings.

B. Valves.

C. Heating water piping system.

D. Chilled water piping system.

E. Condenser water piping system.

F. Condensate drain piping.

1.3 RELATED WORK

A. Section 23 05 16 – Expansion Fittings and Loops for HVAC Piping.

B. Section 23 05 29 – Hangers and Supports for Piping and Equipment HVAC.

C. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 23 05 53 – Identification for HVAC Piping and Equipment.

E. Section 23 07 19 – HVAC Piping Insulation.

F. Section 23 21 16 – Underground Hydronic Piping.

G. Section 23 21 19 – Hydronic Specialties.

1.4 REFERENCES

A. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.

B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.

C. ANSI/ASME B31.9 - Building Services Piping.

D. ANSI/AWS A5.8 - Brazing Filler Metal.

E. ANSI/AWWA C110 - Ductile-Iron and Gray-Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

F. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

G. ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service

H. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

I. ASTM B32 - Solder Metal.

J. ASTM B88 - Seamless Copper Water Tube.

1.5 QUALITY ASSURANCE

A. Foreign made pipes, valves and fittings will not be acceptable.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ANSI/ASME SEC 9. and applicable state labor regulations.

D. Welder’s Certification: In accordance with ANSI/ASME SEC 9.

1.6 SUBMITTALS

A. Submit product data under provisions of Division One.

B. Include data on pipe materials, pipe fittings, valves, and accessories.

C. Include welder’s certification of compliance with ANSI/ASME SEC 9.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

C. Deliver and store valves in shipping containers with labeling in place.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, proper storage and dunnage, completing sections of the work, and isolating parts of completed system. Tape will not be allowed as an acceptable end cover.

PART 2 - PRODUCTS

2.1 CHILLED AND HEATING WATER PIPING

A. Steel Pipe: ASTM A53, Schedule 40, [0.375 inch wall for sizes 12 inch and over,] black.

1. Fittings: ANSI/ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
2. Joints: Screwed, or ANSI/AWS D1.1, welded.

2.2 CONDENSER WATER PIPING

A. Steel Pipe: ASTM A53, Schedule 40, [0.375 inch wall for sizes 12 inch and over,] **[black.]**

1. Fittings: ANSI/ASTM B16.3, **[black]** malleable iron or ASTM A234, galvanized forged steel welding type.
2. Joints: Screwed, or ANSI/AWS D1.1 welded.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53, Schedule 40 galvanized.

1. Fittings: Galvanized cast iron, or ANSI/ASTM B16.3 malleable iron.
2. Joints: Screwed, or grooved mechanical couplings.

2.4 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; 1/16 inch thick preformed neoprene bonded gasket.

C. Grooved mechanical pipe couplings (ONLY ALLOWED AT MECHANICAL EQUIPMENT CONNECTIONS OUTDOORS OR IN A MECHANICAL ROOM), fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods. All grooved components shall be of one manufacturer, and conform to local code approval and/or is listed by ANSI-B-31.1, B-31.3, B-31.9, ASME, UL/ULC. FM, IAPMO or BOCA. Grooved end manufacturer to be ISO-9001 certified. Grooved couplings shall meet the requirements of ASTM F-1476. Manufacturer shall be Victaulic or approved equal. Can be utilized only in mechanical rooms or cooling tower areas.

2.5 ACCEPTABLE MANUFACTURERS - GATE VALVES

A. Milwaukee.

B. Crane.

C. Dezurik.

D. Nibco.

E. Substitutions: Under provisions of Division One.

2.6 GATE VALVES

A. Up to 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc, threaded ends.

B. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.7 ACCEPTABLE MANUFACTURERS - GLOBE VALVES

A. Milwaukee.

B. Nibco.

C. Stockham.

D. Dezurik.

2.8 GLOBE VALVES

A. Up to 2 Inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable stainless steel disc, screwed ends, with back seating capacity.

B. Over 2 Inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.9 ACCEPTABLE MANUFACTURERS - BALL VALVES

A. Milwaukee.

B. Nibco.

C. Jamesbury.

D. Dezurik.

E. Kitz.

F. Victaulic (For grooved systems only)

2.10 BALL VALVES

A. Up to 2 Inches: Bronze two-piece body, 600 PSI full port, stainless steel ball and stem, teflon seats and stuffing box ring, lever handle, and balancing stops, threaded ends.

B. Over 2 Inches: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, or gear drive hand wheel for sizes 10 inches (250 mm) and over, flanged.

C. Ball valves installed in insulated lines shall have stem extensions compatible with up to 2” of insulation. Extensions shall be non-metallic equal to Nibco “nib-seal”.

2.11 ACCEPTABLE MANUFACTURERS - PLUG COCKS

A. Nibco.

B. Jenkins.

C. Dezurik.

D. Milwaukee.

2.12 PLUG COCKS

A. Up to 2 Inches: Bronze body, bronze tapered plug, non-lubricated, teflon packing, threaded ends, with one wrench operator for every ten plug cocks.

B. Over 2 Inches: Cast iron body and plug, pressure lubricated, teflon packing, flanged ends, with wrench operator with set screw.

2.13 ACCEPTABLE MANUFACTURERS - BUTTERFLY VALVES

A. Milwaukee.

B. Nibco.

C. WECO.

D. Dezurik.

E. Victaulic (For grooved systems only)

F. Substitutions: Under provisions of Division One.

2.14 BUTTERFLY VALVES

A. Iron body, aluminum bronze disc, resilient replaceable seat for service to [180 degrees F] [250 degrees F] lug or grooved ends, extended neck, [infinite position lever handle with memory stop.] [hand wheel and gear drive.] Valve shall be rated at full working pressure with downstream flange removed in either direction.

2.15 ACCEPTABLE MANUFACTURERS - SWING CHECK VALVES

A. Milwaukee.

B. Nibco.

C. Stockham.

D. Dezurik.

E. Victaulic (For grooved systems only)

F. Substitutions: Under provisions of Division One.

2.16 SWING CHECK VALVES

A. Up to 2 Inches: Bronze 45 degree swing disc, screwed ends.

B. Over 2 Inches Iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged or grooved ends.

2.17 ACCEPTABLE MANUFACTURERS - SPRING LOADED CHECK VALVES

A. Milwaukee.

B. Nibco.

C. Mueller.

D. Dezurik.

E. Victaulic (For grooved systems only)

F. Substitutions: Under provisions of Division One.

2.18 SPRING LOADED CHECK VALVES

A. Iron body, bronze trim, stainless steel spring, aluminum bronze disc, screwed, grooved, wafer or flanged ends.

2.19 ACCEPTABLE MANUFACTURERS - RELIEF VALVES

A. Nibco.

B. Jenkins.

C. Dezurik.

D. Milwaukee.

E. Substitutions: Under provisions of Division One.

2.20 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. After completion, fill, clean, and treat systems.

E. Provide extended necks for all vents, thermometer wells, pressure gauge wells, pet cocks and pete’s plugs.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space and other work.

C. Group piping whenever practical at common elevations.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

E. Provide clearance for installation of insulation, and access to valves and fittings.

F. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 8.

G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Division 9.

J. Install valves with stems upright or horizontal, not inverted.

K. All grooved components (couplings, fittings, valves, gaskets, and specialties) shall be of one manufacturer.

L. Grooved manufacturer shall provide on-site training for contractor's field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and the product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products.

3.3 APPLICATION

A. Use grooved mechanical couplings and fasteners only in mechanical rooms or cooling tower area.

B. Install unions downstream of valves, and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install plug valves for throttling, bypass, or manual flow control services.

F. Provide spring loaded check valves on discharge of condenser and chilled water pumps.

G. Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

H. Use only butterfly valves in condenser water systems for throttling and isolation service.

I. Use lug end butterfly valves to isolate equipment.

J. Provide chain operated butterfly valve for installations at 12 feet or higher.

K. Provide 3/4-inch ball (drain) valves equal to Nibco T-585-70-HC at main shut-off valves, low points of piping, bases of vertical risers, and at equipment and pipe to nearest drain.

L. Provide automatic air vents at all high points and air pockets in the system.

3.4 CONDENSATE DRAIN PIPING

A. Drain piping from each unit shall be extended to the nearest floor drain or condensate drainage system. Drains shall be of the size indicated but not less than the full size of the drain pan connections.

B. Use plugged tees in lieu of elbows.

C. Pipe shall be Schedule 40 galvanized with malleable iron screwed or type "L" copper fittings.

D. Slope all drain lines 1/8" per foot, minimum.

E. Provide auxiliary drain pan on all AHU's above ceiling with auxiliary drain line routed to discharge in visually prominent area. Discharge location shall be coordinated with Architect.

3.5 PIPE FABRICATION AND INSTALLATION

A. All pipes shall be cut accurately to measurements established at the site and shall be worked into place without springing or forcing.

B. Piping layout and installation shall be made in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance from other work. Particular attention shall be given to piping in the vicinity of equipment; layout shall be made in such manner as to preserve maximum access to the various equipment parts for maintenance.

C. All changes in directions shall be made with fittings; field bending and mitering of pipe is prohibited.

D. Air vents and air chambers shall be installed as hereinafter specified.

3.6 OFFSETS AND FITTINGS

A. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, etc. which may be required. The Contractor shall carefully investigate structural and finish conditions affecting the Work, and shall take such steps as may be required to meet such conditions at no additional cost to the Owner.

B. All piping shall be installed close to walls, ceilings and columns, (consistent with the proper space for covering, removal of pipe and special clearances), so as to occupy the minimum of space, and all offsets, fittings, etc., required shall be provided at no additional cost to the Owner.

3.7 SECURING AND SUPPORTING

A. All piping shall be adequately supported to line and grade, with due provisions for expansion and contraction.

B. Piping shall be supported on approved clevis type, split ring, or trapeze type hangers properly connected to the structural members of the building.

C. All insulated piping shall be fitted with suitable steel protection saddles.

D. Perforated bar hangers, straps, wire or chains will not be permitted.

3.8 ISOLATION VALVES

A. All piping systems shall be provided with line size shut-off valves located at risers, at

branch connections to mains, and at other locations as indicated and required.

3.9 TESTING OF PIPING SYSTEMS

A. During the progress of the Work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Engineer. The Engineer or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this Work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems, testing shall be accomplished prior to the application of any insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 2 hours at a pressure of 150 psi(g) or 150% of design pressure, whichever is greater. Tests shall be witnessed by the Engineer or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks, damage, or defects.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

3.10 PIPE CLEANING, FLUSHING AND PURGING REQUIREMENTS AND PROCEDURES

The hydronic system shall be flushed and purged by contractor:

1. All mains, branches and zones shall be cleaned and treated per steps indicated below.
2. Owner/Engineer shall be given 72-hour notice prior to each step being performed.

A. Pre-flush requirements: Purpose is to get system ready for flushing and purging:

1. Piping must pass all required pressure testing and visual inspection for leaks.
2. All pumps shall be tested for rotation and properly aligned and lubricated.
3. Chemicals planning on being used must have certificate of assurance and product cut sheets presented to the owner/engineer prior to being used. All chemicals must: be approved by the state prior to being added to the system, FDA approved and meet ASTM-1384. Automotive grade chemicals are not allowed.
4. Bypass all terminal units and coils by connecting the supply and return piping

together.

5. Fill entire system with clean fresh potable water.

B. The flush requirements: Purpose is to completely remove all debris, dirt and air from hydronic system.

1. Add system cleaner that contains detergent and emulsifying agents to properly remove grease, grime and other debris for steel pipe. Volume of cleaner used shall be about 10% of total volume.
2. System shall be circulated for a minimum of 48 hours with water velocities of a minimum of 5 ft/sec or greater. After completed all strainers shall be removed and cleaned thoroughly. House pumps are acceptable to circulate water.
3. The system shall be entirely drained and flushed out to remove all of the cleaner from the system as quickly as possible after cleaning to prevent debris from settling. All strainers shall be removed and thoroughly cleaned after no more dirt and cleaner is visible in the flushing water as it leaves the system.

C. Final fill:

1. All air vents shall be opened to allow air to escape during filling.
2. Reconnect all flex connections to equipment.
3. System shall be drained and filled with a local domestic/softened water mixture as required by chemical treatment supplier. System shall be filled with pressure reducing valve at the specified fill pressure.

D. Purging: Purpose is to remove all air from the system:

1. System shall be circulated for a minimum of one hour with water velocities of a minimum of 5 ft/sec or greater until all visible air is removed.

E. Final chemical addition: Purpose is to install chemicals during inhibitor as required:

1. After the above final fill and purging has been completed and accepted by the engineer/owner the final chemical addition can be done.
2. Chemical treatment shall be added to the system after thoroughly mixing water per the manufacturer’s recommendations. Chemical treatment shall include inhibitors. Quantities and concentrations of inhibitor/chemicals should be applied per the manufacturer’s specifications and approval submittals.
3. System water shall be tested for chemical inhibitor concentrations, reserve alkalinity and PH. Reports shall be submitted to engineer/owner.
4. All records and documentation shall be kept and given to the owner upon completion.

END OF SECTION

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. In-line circulators.

B. Base mounted pumps.

C. Vertical Turbine Condenser Water Pumps

1.3 RELATED SECTIONS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 07 16 - HVAC Equipment Insulation.

D. Section 23 07 19 - HVAC Piping Insulation.

1.4 REFERENCES

A. ANSI/UL 778 - Motor Operated Water Pumps.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum five years' experience.

B. Alignment: Base mounted pumps shall be aligned by qualified millwright and alignment certified.

C. Impellers: All impellers shall be dynamically balanced.

D. The Mechanical Contractor shall be responsible for accurately checking all pumping heads, based upon the actual piping and equipment installation. The Contractor shall be responsible for furnishing pumps and motors of proper sizes suitable for the actual installation. Do not provide pumps with capacities less than the amount indicated on the Drawings.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

C. Submit manufacturer's installation instructions under provisions of Division One.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division One.

B. Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

1.9 EXTRA PARTS

A. Provide one set of replacement mechanical seals for each size of pump. After the pumps are in operation for ninety days, the Contractor shall check the seals and replace any that are defective. If the replacement seals are not used during the 90-day operational period, they shall be delivered to the Owner.

1.10 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Taco.

B. Bell and Gossett.

C. Armstrong

2.2 GENERAL CONSTRUCTION REQUIREMENTS

A. Balance: Rotating parts, statically and dynamically.

B. Construction: To permit servicing without breaking piping or motor connections.

C. Pump Motors: Operate at 1750 rpm unless specified otherwise. Provide totally enclosed motors when mounted outdoors. Refer to Section 23 05 13.

D. Pump Connections: Flanged, for pipe size two inches and larger. Provide union for pipe sizes less than two inches.

E. Critical speed of each pump shall be at least 115% of the running speed listed in the schedule.

F. PROVIDE WARRANTY REQUIREMENTS OF THE AISD PROJECT DEVELOPMENT MANUAL.

A.

2.3 BASE MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, back pull-out, radially [or horizontally] split casing, for [125 psig] [175 psig] [250 psig] maximum working pressure.

B. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze or Stainless Steel, fully enclosed, keyed to shaft.

D. Bearings: Grease or Permanently lubricated roller or ball bearings, 40,000 hour minimum life.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Carbon rotating against a stationary ceramic seat, viton fitted [225 degrees F] [275 degrees F] maximum continuous operating temperature.

G. Drive: Flexible drop-out coupling with coupling guard.

H. Baseplate: Cast iron or fabricated steel with integral drain rim or pan.

I. For pumps driven by motors 25 horsepower and larger, the steel base shall be fabricated of structural shapes and formed steel sections. The main structural member and formed steel section shall have a depth of at least 1/12 the overall length of the base but not less than 4 inches. The base shall be filled with concrete or grout after installation.

a.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25

percent of midpoint of published maximum efficiency curve.

D. Pumps shall be free of flashing and cavitation at all flow rates from 25% to 125% of design flow under the suction conditions of the pump installation.

E. The impeller selected for compliance with design requirements shall not exceed 85% of cutwater diameter for the selected pump casing size. This shall be clearly certified on the Shop Drawing submittal.

F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge lines.

G. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and shut-off valve on pump discharge.

H. Provide air cock and drain connection on horizontal pump casings.

I. Provide drains for bases and seals, piped to and discharging into floor drains.

J. Lubricate pumps before start-up.

K. Install base mounted pumps on concrete base, with anchor bolts, set and level, and grout in place.

L. Qualified millwright shall check, align, and certify base mounted pumps prior to start-up.

END OF SECTION

SECTION 23 25 16 – WATER TREATMENT FOR OPEN HYDRONIC SYSTEMS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 23 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Provide all equipment, chemicals, and treatment materials for the complete water treatment system.

B. Determine which chemicals to use for the results of a water sample analysis taken from the building domestic water supply.

C. Provide all water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to achieve the required water quality for the cooling tower condenser water system.

1.3 SERVICE AND SUPPLIES

A. All work shall be performed by a qualified full-time water program manager.

1. Specialist in the field of industrial water treatment.
2. Facilities including water analysis laboratory, development facilities and service department.

B. Provide a water treatment test set for each system (pH, alkalinity, hardness, chloride, and chemical residual) for field use.

1. Reagents as required, suitable for specific use with the treatment products employs.

C. Where specialized supplementary testing or control equipment is required, the appropriate items shall be provided.

D. Provide a water management and service program for a period of one (1) year beginning at substantial completion of mechanical contractor’s scope of work.

1. Make routine visits bi-weekly during first two months of operation and monthly during the remainder of the specified period.
2. Provide a water analysis report on each operating system.
3. Analysis should include, but is not limited to:
    a. Corrosion inhibitor and/or organophosphate level to determine chemical residual value.
    b. Specific conductance in micro-ohms.
    c. pH
    d. Iron and/or copper
    e. Sodium chloride
    f. Calcium hardness
    g. Methyl alkalinity

4. A system free of excess biomass and tube scale is required. Contractor warranty to cover restoring system to clean condition (if necessary) is required. Owner will clean the cooling tower and brush the condenser tubes annually.

E. Routine Services

1. Check and adjust water treatment system operation.
2. Specify chemical value limits with proposal. MSDS pages required on all products used.
3. Adjust chemical pump and/or panel during each visit to maintain supplier's pre-determined values. A minimum of four (4) cycles of water is required.
4. Instruct, train, and advise operating personnel.
5. Check efficiency of chemicals and chemical applications.
6. Maintain present chemical feed system, parts, and labor. Or, supply a chemical feed system at no cost that is appropriate for the size of the system, operating conditions, and water chemistry values.
7. Twice per year, perform a microbiological culture study on all systems.

F. Chemically clean the piping system. If galvanized piping is used, cleaning chemical and operating treatment chemicals cannot exceed a pH of 9.0.

G. Provide a complete laboratory analysis of water samples.

H. Provide review of report figures in the field water testing.

I. Provide report charts and log sheets, and reorder charts for maintenance of water control tests.

J. Establish the recommended maintenance schedule for analysis and replenishment of the corrosion inhibitors.

1.4 QUALITY ASSURANCE

A. Quality: The contractor for the work specified in this Section shall have:

1. Research and development facilities.
2. Regional laboratories capable of making water analysis.
3. A service department and qualified technical service representative located within a reasonable distance of the project site.
4. A *Certified Water Technologist* (CWT) professional qualification is preferred. Service representatives who are Registered Engineers of factory-certified technicians with not less than five (5) years of water treatment experience with the water treatment system manufacturer are acceptable.

B. Packaging and Labeling: Water treatment chemicals will be supplied in a container suitable for product, and will be in accordance with DOT shipping standards.

C. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters Laboratories (UL) and which comply with National Electrical Manufacturers' Association (NEMA) standards.

D. Ensure that neither products, waste, blow-down, nor other effluents violate local, state, or federal laws or regulations in effect.

1.5 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nalco

2.2 CONDENSER WATER SYSTEM

INTERNET WATER TREATMENT DATABASE

Contractor must provide, configure, and support an Internet-accessible database account for the retrieving, recording, and archiving of water treatment related information AS WELL AS PROVIDE A BACNET INTERFACE. Such a system must have the following features:

a) Provide data drop.
b) Secure, password-protected access for each manager and their chosen operators.
c) Access to the system from anywhere via the Internet.
d) Zero software requirements (Internet browser required for user).
e) Ability for facility operators to record routine test log data online.
f) Ability for facility director and operators to upload pertinent digital images and PDF files.
g) Retrieve service reports, operator logs, laboratory analysis, corrosion coupon reports, inventory, digital images, MSDSs, product data sheets, technical papers, procedures, surveys, and training information.
h) Graphing and trending capabilities for any recorded service report and/or facility operator test data entries.
i) Ability of database system to routinely accept data (i.e., conductivity, ORP, pH, inhibitor, tank level sensor readings) electronically from the facility's water treatment controller(s).
j) Graphing and trending capabilities that compare entries of wet test data with controller sensor data.
k) Ability to set alarm limits and assign recipients for email alarm notifications for chosen test variables of service report and/or operator log entries.
l) Multiple security levels for various users.
m) Contractor training and in-services on use and navigation of the database system.

INTERNET-ACCESSIBLE WATER TREATMENT CONTROLLER

Contractor must provide, install, program, and support Internet-accessible water treatment controllers (i.e., eController, PLC, Hydro Triton) for condenser water treatment control. Such control equipment must have the following features:

a) Secure, password-protected access for each facility director and their chosen operators.
b) Access to the controller from anywhere via the Internet (facility dedicated phone line with service or public IP address mandatory).
c) Secure, password-protected access at controller unit keypad.
d) Daily status reports emailed to chosen recipients.
e) ≥ Seven (7) 110 volt NO/NC relays, plus one (1) for alarms.
f) ≥ Eight (8) 4-20 mA inputs.
g) ≥ Six (6) digital inputs.
h) Ability to assign any input to any output online.
i) Output ≥ (4) 4-20 mA signals.
j) Cellular modem built in or peripheral with one (1) year of cellular service for remote communication for remote alarming and data feed.
k) Industrial grade pH, ORP, corrosion, inhibitor, and conductivity sensors and housing as required per facility and system type.
l) Ability to read the make-up and blowdown water meters to determine evaporation credits.
m) Ability to record chemical tank level sensor data.
n) Ability to feed oxidizing biocide base on ORP set point(s) and record ORP of condenser water for any given period.
o) Ability of controller to routinely send data (i.e., conductivity, ORP, pH, inhibitor, tank level sensor readings) electronically to the facility's water treatment Internet database system.
p) Ability to review controller data trend charts.
q) Real-time availability of controller data.
r) Execution of controller changes (i.e., set points, dead bands, etc.) via the Internet.
s) Detailed email alarm notifications to chosen recipients.
t) UBS and Ethernet direct connect access.
u) Contractor training and in-services on use and navigation of the controller and its database system.

CHEMICAL FEED AND STORAGE EQUIPMENT

Contractor must have the ability to deliver and transfer chemical products to chemical storage tanks at each facility while minimizing the use of drums and pails. Contractor delivery technicians must be Hazmat trained and licensed truck drivers.

Contractor must provide, install, and support all relevant chemical feed and storage equipment necessary to treat the condenser water systems. The following water treatment equipment items must be installed and supported by the contractor:

a) Chemical storage tanks (i.e., Peabody, Snyder, GTP) with 110% containment. Tanks may come in a variety of sizes appropriate relative to the plants calculated chemical demand and have injection pump standpipe and vent line, as well as chemical fill point attachments.
b) Injection pump containment boxes (i.e., Stahlin) which are splash proof. Boxes shall be wall mounted above and near their related storage tank. Boxes must have sensor capable of interlocking injection pumps with leak detection.
c) Internet-accessible water treatment controllers (see Section above).
d) Industrial grade pH, ORP, and conductivity probes/sensors.
e) Industrial grade inhibitor monitoring probe (i.e., Turner) to ensure proper dosage of scale and corrosion inhibitor chemical.
f) Chemical injection pumps (i.e., Iwaki, Prominent) with controllable speed and stroke.
g) Storage tank level sensors (i.e., Flowline) which can be read by the controller.
h) Rotameter (i.e., King) for bypass loop piping.
i) Two (2)-pass corrosion coupon rack constructed of clear PVC.
j) Blowdown solenoid valve or motorized ball-valve (i.e., Parker, Belimo, or similar).

k) One (1)-inch schedule 80 PVC for bypass loop construction.
l) Chemical tubing containment from storage tank to pump box and from pump box to injection point. Materials of construction shall be 1 ¼-inch clear vinyl hose secured with stainless steel hose clamps shall be installed over all plastic chemical tubing for containment purposes.
m) Stainless steel chemical tubing (i.e., Swagelok or similar) where applicable (i.e., acid if used).
n) Contractor startup, training, and in-services on all provided equipment.

CHEMICALS-CONDENSER WATER

Contractor must select, manufacture, deliver, and transfer to storage tank chemicals capable of inhibiting and controlling mineral scale, corrosion, microorganisms, and biological fouling (i.e., biofilm) on all water-side surfaces (i.e., cooling tower fill, basin, piping, condenser tubes) of the condenser water system. Chemical supply will be for one (1) year past Date of Substantial Completion.

NOTE: The microbiocide program must be consistent with CTI (Cooling Technology Institute) and or AWT (Association of Water Technologies) guidelines relative to the control of condenser water pathogens such as *Legionella*.

Contractor must be able to control the condenser water at a minimum of four (4) cycles of concentration while maintaining a Ryznar Stability Index (RSI) between 4.0 and 4.8. If this cannot be accomplished naturally based on the make-up water characteristics, the use of pH control with acid is acceptable.

a) Scale and corrosion inhibitor chemical. This product must be in liquid form and impart the following active ingredients at the following dosages when fed in condenser water: 1) phosphonate = 3-7 ppm, 2) AA copolymer = 4-10 ppm, 3) maleic acid (or) acrylate homopolymer = 4-10 ppm, 4) azole = 2-4 ppm, and 5) PTSA dye.
b) Oxidizing microbiocide chemical. This product must be in the form of liquid sodium hypochlorite, chlorine dioxide, or liquid bromine. The use of oxidizer “tablets” is prohibited. This product must convey the following water test results during and shortly after feeding: 1) free oxidant = 0.1-0.5 ppm, 2) total oxidant = 0.4-1.0 ppm. This product must be fed in a manner to hold these residuals continuously using the ORP sensor feature of the controller.
c) Antifoulant/dispersant “OR” non-oxidizing microbiocide chemical. The antifoulant / dispersant product must be in liquid form and be fed at a rate consistent with the recommendations in its product literature a minimum of one (1) time per week during low load periods. The non-oxidizing microbiocide shall be either isothiazolin or glutaraldehyde and be compatible with all other chemicals fed into the system. The non-oxidizing biocide shall be a broad-spectrum biocide effective at alkaline pHs. The product shall be capable of being handled and administered safely to the systems by operating personnel. Carbamate and other highly toxic microbiocides are prohibited. The non-oxidizing biocide shall be fed on a weekly basis to achieve a lethal dosage for the time necessary to provide effective control of microorganisms.
d) Acid (OPTIONAL). This product must be in liquid sulfuric acid form if implemented. This product is to be part of the program ONLY if pH control is necessary to operate the condenser water at the desired 4 cycles of concentration minimum and 4.0-4.8 RSI. This product must be fed at a rate so as not to lower condenser water pH below 8.3 at any time. The dead band for the control of pH cannot be any more than 0.1 pH units. The pH set point will be chosen by the contractor based on make-up water characteristics, but no less than 8.3.

OPERATOR TEST KIT

Contractor must select, prepare, and deliver a relevant test kit and components for operator's use for operator testing. Test kit must come in a carrying case for ease of handling and contain testing procedures, log sheets, and reagent MSDSs. The contractor must provide a minimum of one (1) hour in-service to operators involved in routine testing. The contractor will replenish reagents at no charge for the one (1) year term.

Contractor must provide one (1) handheld fluorometer with single channel PTSA (i.e., Turner) for measuring condenser water scale and corrosion inhibitor dosage.

NOTE: If acid (pH control) is used in the condenser water program, a hand-held conductivity/pH meter (i.e., Myron L 6-P) must be included in the test kit. Otherwise, a simple conductivity meter (i.e., Myron L EP-10) must be included in the test kit.

PART 3 – EXECUTION

3.1 CONDENSER WATER SYSTEM

A. Start-up Procedures: During condenser water system start-up, operate condenser water treating system to maintain the required steady-state characteristics of cooling water. Demonstrate system operation to Owner's operating personnel.

B. Reports: Prepare certified test report for each required water performance characteristic. Comply with the following ASTM standards, where applicable.

1. D1067 – Tests for Acidity or Alkalinity of Water.
2. D1068 – Tests for Iron in Water and Waste Water.
3. D1126 – Tests for Hardness in Water.

3.2 PERSONNEL TRAINING

A. Operator Training: Train Owner's personnel in use and operation of condenser water treating systems including preparation of chemical solution reservoir. A Program Administration Manual shall be furnished encompassing all systems in this section of the Specifications.

END OF SECTION

SECTION 23 31 13 - METAL DUCTWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Low pressure ductwork.

B. Medium and high pressure ductwork.

C. Casings.

D. Underground buried ducts.

E. Kitchen hood ductwork.

F. Laboratory fume hood exhaust ductwork.

G. Welding hood exhaust.

H. Paint hood exhaust.

I. Commercial dryer vent.

J. Duct cleaning.

1.2 RELATED SECTIONS

Division 9 - Finishes: Weld priming, weather resistant, paint or coating.

A. Section 23 02 00 - Basic Material and Methods.

B. Section 23 05 29 – Hangers and Support for Piping and Equipment HVAC.

C. Section 23 05 93 - Testing, Adjusting and Balancing.

D. Section 23 07 13 - Duct Insulation.

E. Section 23 33 00 - Ductwork Accessories.

F. Section 23 37 13 - Air Distribution Devices.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer’s Qualifications: Firms with least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Codes and Standards:

1. SMACNA Standards: Comply with latest SMACNA’s “HVAC Duct Construction Standards, Metal and Flexible” for fabrication and installation of metal ductwork.

2. ASHRAE90.1 Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 “Duct Construction”, for fabrication and installation of metal ductwork.
3. NFPA Compliance: Comply with NFPA 90A “Standard for the Installation of Air Conditioning and Ventilating Systems”, NFPA 90B “Standard for the Installation of Warm Air Heating and Air Conditioning Systems”, and NFPA 96 Standard.
4. IECC 2015: Comply with 2015 International Energy Conservation Code.

1.4 GENERAL DESCRIPTION

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.5 SUBMITTALS

A. Contractor shall submit AISD Sustainability Submittal Sheets as found in the AISD Project Development Manual and comply with sustainability requirements.

B. Submit shop drawings, duct fabrication standards and product data under provisions of Division One.

C. Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work.

D. The contract documents are schematic in nature and are to be used only for design intent. The contractor shall prepare sheet metal shop drawings, fully detailed and drawn to scale, indicating all structural conditions, all plumbing pipe and light fixture coordination, and all offsets and transitions as required to permit the duct to fit in the space allocated and built. All duct revisions required as a result of the contractor not preparing fully detailed shop drawings will be performed at no additional cost.

1.6 DEFINITIONS

A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain indicated clear size inside lining. Where offsets or transitions are required, the duct shall be the equivalent size based on constant friction rate.

B. Low Pressure: Low pressure ductwork shall be rated for an operating pressure of 2”. Low pressure ductwork shall be defined as all return, exhaust, and outside air ducts, all supply ductwork associated with constant volume air handling units with a scheduled external static pressure of less than 2”, and all supply ductwork downstream of terminal units in variable volume systems.

C. Medium Pressure: Medium pressure ductwork shall be rated for an operating pressure of 4”. Medium pressure ductwork shall be defined as all supply ductwork extending from variable volume air handling units to terminal units in variable volume systems with air handling units having a scheduled external static pressure of less than 4”. The supply ductwork of constant volume air handling units having a scheduled external static pressure greater than 2” and less than 4” shall be rated for medium pressure.

D. High Pressure: High pressure ductwork shall be rated for an operating pressure of 6”, or the scheduled external pressure of the equipment it is connected to, whichever is greater. The supply ductwork of air handling units having a scheduled external static pressure greater than 4” shall be high pressure.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings, use sheet metal end caps on any lined duct exposed to the weather.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. SUSTAINABILITY REQUIREMENTS: Low-Emitting Materials are required and must conform to VOC limits, TVOC content, meet CPDH Standard Method v1.1-210, meet SCAQMD Rule @1113 or CARB 2007 SCM, list Green Seal GS-11 VOC limits and confirm that there is no methylene chloride/perchloroethylene.

B. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

C. Sheet Metal.: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.

D. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A167; Type 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

E. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B 209, Alloy 3003, Temper H14.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Non-combustible and conforming to UL 181, Class 1 air duct materials.

B. Flexible Ducts: Flexmaster U.S.A., Inc. Type 3M or approved equal, corrosive resistant galvanized steel formed and mechanically locked to inner fabric with 1” thick insulation when flexible ducts are located in conditioned spaces and with R-5 insulation when located in unconditioned spaces. Flexible duct shall have reinforced metalized outer jacket comply with UL 181, Class 1 air duct.

C. Sealants: Hard-Cast “iron grip” or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
2. For aluminum ductwork, provide aluminum support materials.

2.3 LOW PRESSURE DUCTWORK

A. Fabricate and support in accordance with latest SMACNA Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer's approval prior to using round duct in lieu of rectangular duct.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E. Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.

F. Use double nuts and lock washers on threaded rod supports.

2.4 MEDIUM AND HIGH PRESSURE DUCTS

A. Fabricate and support in accordance with SMACNA Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.

C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

D. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.5 CASINGS

A. Fabricate casings in accordance with SMACNA Duct Construction Standards and SMACNA High Pressure Duct Construction Standards and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gauge galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Reinforce doorframes with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 6 X 6 inch size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge back facing and 22 gauge perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb./cubic foot minimum glass fiber media, on inverted channels of 16 gauge.

2.6 BURIED UNDERGROUND DUCTS

A. Buried ducts may be concrete encased sheet metal or fiberglass reinforced plastic as indicated.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.

B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect terminal units to medium or high pressure ducts with four feet maximum length of flexible duct. Do not use flexible duct to change direction.

E. Connect diffusers or troffer boots to low pressure ducts with 6 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.

F. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

G. The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

H. All ductwork located exposed on roof shall be "crowned" to prevent water from ponding. Ref: Insulation for additional requirements.

I. Where ducts pass through floors, provide structural angles for duct support. Where ducts pass through walls in exposed areas, install suitable sheet metal escutcheons as closers.

J. All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.

K. All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

L. All duct hangers shall be attached to building structure. Cutting slots in roof or floor decking for hanger straps to be cast in concrete is not acceptable.

3.2 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

3.3 REQUIREMENTS FOR DUCTS BURIED UNDERGROUND

A. Slope underground ducts to plenums or low pump-out points at l:500. Provide access doors for inspection.

B. Coat buried, metal ductwork without factory jacket with one coat and seams and joints with additional coat of asphalt base protective coating.

C. Insulate buried supply duct runs over 50 feet long with one inch thick insulation covered with plastic vapor barrier.

D. Encase buried metal ductwork in 3 inch minimum of concrete. Provide adequate tie-down points to prevent ducts from floating during concrete placement. Introduce no heat into ducts for 20 days following placement of concrete.

3.4 REQUIREMENTS FOR UNIT CASINGS

A. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

3.5 REQUIREMENTS FOR KITCHEN HOOD EXHAUST DUCT

A. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.

B. Provide access openings in each change in direction, located on sides of duct 1½" minimum from bottom, and fitted with grease-tight covers of same material as duct

C. Use stainless steel for ductwork exposed to view.

3.6 DUCTWORK APPLICATION SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel, Aluminum
Buried Supply or Return	Concrete, Glass Fiber Reinforced Plastic
Medium and High Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel, Aluminum

General Exhaust	Galvanized Steel, Aluminum
Outside Air Intake	Steel

3.7 DUCTWORK HANGERS AND SUPPORTS

A. All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork, provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA edition.

B. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this Division.

3.8 AIR DUCT LEAKAGE: (From SMACNA Duct Standards Latest Edition) Test all ductwork (designed to handle over 1000 CFM) as follows:

A. Test apparatus

The test apparatus shall consist of:

1. A source of high pressure air--a portable rotary blower or a tank type vacuum cleaner.
2. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

B. Test Procedures

1. Test for audible leaks as follows:
2. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
   a. Start the blower with its control damper closed.
   b. Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.
   c. Survey all joint for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.
3. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
   a. Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
   b. Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
   c. Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

d. Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which, must be corrected.

4. Testing Report
   a. Contractor shall provide a testing report for each air system to the engineer. The report shall indicate the completion of testing and compliance with testing specification.
   b. All duct testing reports shall be included in the final close out documents.

3.9 DUCT SYSTEM CLEANING

A. Duct system cleaning shall be performed in accordance with the current published standards of ASHRAE and NADCA.

B. Duct system cleaning method used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

C. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

D. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

E. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

F. Duct cleaning method used shall not damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

G. Replace the fiberglass material if there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating.

H. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

I. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

J. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

K. Cleaning Report: Contractor shall provide a report to the Owner indicating the completion of duct cleaning per specification and areas of the duct system found to be damaged and/or in need of repair.

3.10 DUCT JOINTS AND SEAMS

A. Seal all non-welded duct joints with duct sealant as indicated.

END OF SECTION

SECTION 23 64 16 - CENTRIFUGAL LIQUID CHILLER

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 230000, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

A. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

B. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

C. ANSI/ASME Section 8 - Boiler and Pressure Vessel Code.

D. ANSI/UL 465 - Central Cooling Air Conditioners.

E. AHRI 550/590 - Centrifugal or Rotary Water Chilling Packages.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

C. Verify unit voltage matches voltage on electrical drawings.

D. Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

E. Submit written certification that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.

F. Submit manufacturer's installation instructions including: Power, power wiring requirements, control wiring requirements, insulation details for unit motor starter details, etc.

G. Performance Data - Submittal shall include chiller manufacturer's computer generated performance ratings. These computer ratings shall be certified in accordance with AHRI 550/590. Computer ratings shall also contain AHRI Certified part load values for operation at 100%, 75%, 50%, and 25% of full load with 2.5 degree F reduction in entering condenser water temperature per every 10% reduction in load. In addition, provide data with constant 85 degree F condenser water temp. The chiller manufacturer

shall guarantee that the chiller will maintain stable operation at the resulting entering condenser water temperatures for these four (4) load points and at 15% of full load and minimal flow conditions with reduced ECWT as stated above.

H. Supporting documentation certifying internally enhanced condenser tubes if provided may be cleaned by conventional means.

1.5 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

WARRANTY

A. Provide five year warranty on parts and labor for the entire chiller, including controls and refrigerant loss.

B. Warranty: Include parts and labor coverage for complete chiller package by chiller manufacturer for one year from start-up or 18 months from date received on site.

PART 2 - PRODUCTS

2.1 DESIGN CHANGES

A. The design and layout shown on the drawings are based on the manufacturer shown in the equipment schedule. If equipment other than that of the manufacturer shown is submitted to the engineer for consideration as an equal, it shall be the responsibility of the bidder wishing to make the substitution to submit with the request a revised drawing of the mechanical room layout acceptable to the engineer. This revised drawing shall show the proposed location of the substitute unit and the area required to pull the tubes, compressor, and motor. This drawing shall also show clearances of adjacent equipment and service area required by that equipment.

B. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected subcontractors shall be the responsibility of this bidder and not the owner.

2.2 CHILLER

A. Chiller shall consist of motor, compressor, evaporator (cooler), condenser, purge unit, isolation assembly, machine control center, and starter, with the controls for automatic operation mounted on the chiller.

B. Chiller shall be a fully packaged unit complete in all details to chill fluid shown on drawings in quantities indicated from and to the temperature shown, when supplied with condenser water quantity indicated and with a rise from 86□F (30 degree C) to 96 degree F (35 degree F). Capacity shall be no less than that noted in the schedule on the

drawings.

C. Unit power required shall not exceed that shown on the drawings in kW/ton (kW/watt) at full load, based on load required, not on machine total capacity. Power required at 25, 50, 75, and 100% of rated equipment capacity shall be submitted for evaluation.

D. Pressure drop through evaporator and condenser shall not exceed that shown on the drawings. Units submitted having less pressure drop than shown on the drawings are encouraged but should be called to the attention of the engineer.

E. Chiller shall be shipped factory-assembled with all refrigerant piping and control wiring factory-installed.

F. Chiller shall use refrigerant R-123 or R134a and shall be provided with a pump-out system for removal of the refrigerant. Provide compressor, drive, piping, wiring, etc., as required for removal and external storage of the refrigerant. Storage vessel shall have capacity equal to that of the largest unit in the installation, plus 20% excess storage. Only one pump-out system is required for multiple units, but system shall have capacity of the largest system.

G. Provide positive metering of the refrigerant flow in the machine. Chiller shall be capable of operating with entering condenser water of 60 degree F, or a cooling tower bypass valve, controls, and associated piping shall be provided by the contractor, whether shown on the drawings or not.

2.3 COMPRESSOR AND DRIVE

A. Provide with VFD’s.

B. Motor and compressor shall be hermetically sealed into a common assembly for direct driven units.

C. Compressor shall be single-stage with hot gas bypass or multiple stage with an interstage economizer. Impellers shall be overspeed-tested to 20% above operating conditions at the factory.

D. Compressor motor shall be cooled by sub-cooled liquid refrigerant in intimate contact with all internal motor components. Motor starter shall be arranged for service with only minor compressor disassembly and without requiring the breaking of main refrigerant piping connections.

E. For Direct Drive Units: Compressor wheel(s) shall be mounted on the motor shaft and supported by the motor bearings. Motor speed shall be 3600 rpm.

F. Provide a 5 year warranty on all parts and labor for the entire chiller, including controls and refrigerant loss.

2.4 LUBRICATION SYSTEM

A. Lubrication system shall be factory-installed to deliver oil under pressure to all bearings. System shall consist of hermetic motor-driven oil pump, with starter and controls, oil cooler, pressure regulator, oil filter, automatic water control valve, thermostatically controlled oil heater, and oil reservoir with temperature gauge.

2.5 COMPRESSOR MOTOR CONTROLS

A. Provide with VFD's.

B. Provide devices to limit current draw to full-load amps. Provide demand-limiting device so that maximum current may be set between 40 and 100% of full load.

2.6 COOLER AND CONDENSER

A. Cooler and condenser shall be separate shell and tube vessels with ASME stamp where applicable.

B. Tubes shall be integrally finned copper tubing rolled into tube sheets and support sheets and individually replaceable. Pipe connections and water boxes shall be designed for 150 psig (1035 kPa) unless noted otherwise and shall be provided with vents and drains. Provide tappings in water boxes or adjacent piping for control sensors, gauges, and thermometers. Minimum tube thickness shall be 0.028".

2.7 PURGE SYSTEM

A. Purge system shall be furnished for chillers operating under a vacuum.

B. Purge system shall be self-contained compressor type with necessary devices for evacuating air and water vapor and with means of separating the refrigerant and returning it to the system.

C. If other types of purge systems are proposed, all changes in piping and wiring shall be noted in the submittal, as required in 2.1 of this Section of the Specifications.

D. Vent purge unit to outdoors.

2.8 CONTROLS

A. Controls shall be solid-state, fully automatic, and fail-safe. The chiller shall shut down in the event of motor overcurrent, high bearing temperature, high condenser pressure, high motor temperature, and low oil pressure. Each of the above controls shall have an individual manual reset.

B. Provide a leaving chilled water low-temperature shutdown with automatic reset.

C. Provide a low-limit, manual reset, freeze protection thermostat in the leaving chilled water.

D. Provide devices to limit current draw to full-rated amps. Provide demand-limiting device so that maximum current may be set between 40 and 100% of full load.

E. Capacity control shall modulate the capacity from 100 to 10% of full load (AHRI conditions) without the use of hot gas bypass.

F. Controls shall be factory-prepiped and factory-prewired to terminal strips where interlocks to other equipment can be easily field-connected. Terminals and wires shall be individually identified.

G. Controls shall include a program timer to ensure prelube and postlube needs prior to start and during coast-down (under power for power failure conditions). The control shall prevent restart for a field-adjustable time period.

H. Controls shall prevent compressor from short cycling under any circumstances.

I. Provide with BACNET interface.

J.

2.9 SUPPORTS

A. Chiller manufacturer shall furnish soleplates and isolation pad assembly for mounting and leveling chiller on concrete base.

B. Spring-type isolators shall be provided for chillers not installed on a grade-supported concrete base. Isolators shall be selected by the chiller manufacturer for the conditions involved to prevent noise and vibration transmission to the structural frame.

2.10 INSULATION

A. The evaporator (cooler), the suction elbow between the compressor and the evaporator, and the cooler water box covers shall be factory-insulated.

B. All small water piping and incidental items shall be field-insulated.

C. Insulation shall be closed-cell, foamed, fireproof plastic, 3/4 in. thick with thermal conductivity as recommended by manufacturer to prevent condensation on the surface.

2.11 COMPRESSOR MOTOR STARTER

A. Compressor manufacturer shall furnish a VFD for each chiller.

B. Chiller manufacturer shall furnish control wiring diagrams for the installation of chiller and associated equipment.

2.12 FOULING FACTORS

Condenser: .00075; Cooler: .00025, AHRI 550/590 ratings.

2.13 ACCEPTABLE MANUFACTURERS:

A. Trane, Carrier, Smartd, Johnson Controls shall be considered as acceptable if they meet all intentions and requirements of the drawings and specifications.

B. Units shall have Energy Efficiency Rate not less than scheduled. More energy efficient chillers are desirable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall set the chiller in place as shown on the submittal drawings and in such a position that all tubes, compressor, and motor can be pulled and removed from the equipment room.

B. The contractor shall install, and leave in place, necessary rigging to lift the motor and compressor. The rigging shall be supported by structural members of adequate size, or sufficient members shall be provided.

C. The chiller shall be set level on soleplates or isolators as required above.

D. Piping connections for chilled fluid, condenser water, and miscellaneous small piping required shall be installed as shown on the drawings and as recommended by the manufacturer. Note that piping to the unit shall provide for removal and replacement for the servicing of the equipment by the use of flanges, couplings, etc.

E. The chiller starter and related pump motor starters shall be mounted, wired for power, and interlocked with the controls.

F. Flow or pressure differential switches shall be provided in the chilled liquid and in the condenser water circuits as recommended by the manufacturer.

G. Power wiring shall be provided for the oil pump starter, oil heater, purge unit, and other equipment requiring power. This power shall be independent of the main compressor starter.

H. Provide small water piping for the oil cooler and any other equipment required. Provide drain and vent connections for all water connections.

I. Provide refrigerant vent connection to the outside from the rupture disk and purge unit and any other location where refrigerant might be expelled or released from the chiller.

J. Install thermometers and gauges as recommended by the chiller manufacturer and as shown on the drawings

K. Units provided with refrigerant R-123 shall also be provided with the following for the mechanical room: Adequate mechanical ventilation, refrigerant monitors and alarms to maintain safe operating conditions for plant operators. The monitors, ventilation and alarms shall be provided within this contract. The guidelines established in ASHRAE Standards 34R and 15R shall be followed. All electrical requirements shall be provided.

3.2 START-UP AND TESTING

A. The chiller manufacturer shall provide the services of a factory-trained engineer to check the installation and report to the contractor and the engineer any changes required in the installation to ensure proper operation and servicing of the chiller. Changes recommended by the start-up engineer shall be made as soon as recommended so as to avoid delay in the use of the equipment. This review and necessary changes shall be at the contractor's expense.

B. After the equipment installation has been checked, the start-up engineer shall check out the equipment. If all factory wiring, etc., is in order, the chiller shall be charged as necessary and placed in service.

C. The operation of the chiller shall be observed and all safeties set and checked for proper operation.

D. The refrigerant pressure, water pressure, water flow, temperature, and power shall be read, recorded and submitted to the owner as required under Balancing and Testing, Section 230593.

E. The start-up engineer shall submit a full report to the contractor, engineer, and owner confirming the system was thoroughly checked and placed in service. This report shall include the items required above. Verbal comments and reports should not be directed to the owner, or the owner's representative, unless contractor and engineer are present.

3.3 TRAINING

A. The contractor and the manufacturer's engineer shall provide full sets of parts and operating instructions to the owner's operating personnel.

B. These persons shall be fully briefed in the normal start-up of the system, operation under light load and full load, and normal and emergency shutdown of the chiller and associated equipment.

C. Routine maintenance, yearly maintenance, winterization, and spring start-up shall be fully discussed and documented by written instructions.

D. Names of those instructed and dates, as well as a list of information handed over to the owner, shall be included in the start-up report.

END OF SECTION

SECTION 23 73 13 – MODULAR INDOOR CENTRAL STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Central station air handling unit.

1.2 RELATED SECTIONS

A. Section 23 02 00 – Basic Materials and Methods

B. Section 23 05 16 – Expansion Fittings and Loops for Piping

C. Section 23 05 13 – Common Motor Requirements for HVAC Equipment

D. Section 23 05 26 – Variable Frequency Motor Speed Control for HVAC Equipment

E. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment

F. Section 23 07 13 – Duct Insulation

G. Section 23 34 00 – HVAC Fans

H. Section 23 41 00 – Air Filters

I. Section 23 31 13 – Metal Ductwork

J. Section 23 33 00 – Ductwork Accessories

1.3 QUALITY ASSURANCE

A. Unit performance shall be certified in accordance with AHRI Standard 430 for central station air handling units.

B. Coil performance shall be certified in accordance with AHRI Standard 410.

C. Direct-expansion coils shall be designed and tested in accordance with ASHRAE 15 Safety Code for Mechanical Refrigeration.

D. Insulation and insulation adhesive shall comply with NFPA 90A requirements or flame spread and smoke generation.

1.4 GENERAL DESCRIPTION

A. Indoor mounted, central station air handling unit designed to provide air to a conditioned space as required to meet specified performance requirements for ventilation, heating, cooling, filtration, and distribution. Unit shall be assembled for horizontal/vertical application and arranged to discharge conditioned air as shown on the drawings. Units shall be supplied by the specified manufacturer.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.
B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finishes of materials.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

F. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.

G. Submit manufacturer's installation instructions under provisions of Division One.

H. Submit operation and maintenance data under provisions of Section 23 02 00.

I. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.6 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled in accordance with the unit manufacturer's instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.8 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

1.02 WARRANTY

A. Provide a minimum of 1-year from substantial completion for parts and labor for all mechanical equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier:

B. Trane:

C. York/JCI

D. Substitutions: Under provisions of Division One.

2.2 GENERAL DESCRIPTION

A. Unit shall be factory supplied, central station air handler suitable for the capacities and configurations as shown on drawings. Unit may consist of a fan and coil section with a factory installed chilled water or direct-expansion coil, heating coil section, electric heat section, face and bypass section, filter section, access section, mixing box or combination filter-mixing box, return fan, diffuser, or air blender as indicated on the drawings.

B. All sections, whether assembled into a unit or supplied as separate components, shall have mating flanges for bolted assembly. The flange shall extend around the complete perimeter of each section. The manufacturer shall supply bolts and sufficient closed cell gasket for full perimeter coverage.

2.3 CASING

A. All unit sections shall be supplied with 12 gauge galvanized steel structural perimeter base rail. Condensate drain connection will not penetrate the base rail. If external isolators are not used, provide 6 inch minimum height housekeeping pads or sufficient overall height to provide p-trap with 1 inch greater that unit total static pressure.

B. Unit panels for all sections shall be double wall construction and shall be constructed of minimum 14 gauge G90 mill galvanized steel. Casing panels shall be fully removable for easy access to the unit, and shall be secured to structural frame with aluminized or cadmium plated screws. Removal of panels must not affect the structural integrity of the unit. All panels shall have a minimum of 1 inch thickness foam insulation or 2 inch thickness, 1-1/2 lb. per cubic feet density fiberglass insulation. All panels shall be completely gasketed prior to shipping.

C. Casing air leakage shall not exceed Leakage Class 6 per ASHRAE 111 at +/- 8” w.g. Engineer shall select one (1) unit at their discretion, to test in the field (manufacturer to carry leakage test cost for 1 unit). The selected unit shall be tested and documented to leak no more than 1% unit design flow at +/- 8" w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class in the submittal. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8” w.g., whichever is less, and shall not exceed 0.0042” per inch of panel span (L/240). Floor panels shall be double-wall construction and designed to support a 250 lb. load during maintenance activities and shall deflect no more than 0.0042” per inch of panel span.

D. Double wall hinged removable access doors with multiple handles shall be provided in the fan and filter sections on the drive side of the unit. Access doors must also be provided in all sections where the removal of sheet metal screws is required for unit access. Doors shall be of the same thickness and construction as the wall panels. A gasket shall be provided around the entire door perimeter.

2.4 FANS

A. Fan section shall be constructed of insulated galvanized steel and have formed channel base for integral mounting of fan assembly and casing panels. Fan scroll, wheel, shaft, bearings, drives, and motor shall be mounted on a structural steel assembly which shall be isolated from the outer casing with factory installed 2 inch deflection spring isolators and vibration absorbent flexible canvas connection between fan discharge and casing.

B. Fans shall be equipped with double width, double inlet centrifugal type wheels with forward curved blades or airfoil blades as required for stable operation.

C. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected to operate at least 25% below the first critical speed, and shall be statically and dynamically balanced as an assembly.

D. Fans shafts shall be solid steel coated with rust preventative oil.

E. Fans bearings shall be self-aligning, pillow block, re-greaseable ball or roller type selected for a minimum average life of 200,000 hours. Extend grease lubrication fittings to drive side of unit with plastic tube and fittings rigidly attached to casing.

F. A motor shall be mounted within the fan section casing on slide rails to permit adjustment of belt tension.

G. Fan drive shall be designed for a minimum 1.3 service factor and shall be adjustable pitch.

2.5 COILS (STAINLESS STEEL COIL CASINGS)

A. All coils shall be tested at 300 psig air pressure, under water.

B. All coils shall be installed on tracks for easy removal from the air handling unit. Units that require disassembly of the unit for coil removal are not acceptable.

C. Coils shall be aluminum plate fin type with belled collars and shall be bonded to 1/2 inch or 5/8 inch OD copper tubes by mechanical expansion. Coils shall have headers with steel MPT connections. Working pressure shall be 250 psig at 300°F.

D. Coils shall be drainable and have non-trapping circuits. Headers shall have drain and vent connections extended to the outside of the unit casing. Supply and return headers shall be clearly labeled on the outside of the unit. Provide grommets at all pipe penetrations through cabinet.

E. Main drain pan shall be double wall stainless steel with minimum 2 inch insulation, sloped toward drain fitting, with integral elbow for side discharge and FPT connection, and shall comply with ASHRAE Standard 62. A maximum of one drain shall be supplied for each cooling coil section. The unit design shall not require a drain pan in any downstream section to contain the coil condensate. Moisture shall not carry over past the coil. Moisture eliminators are not acceptable for moisture carryover prevention.

F. Direct expansion coils shall be furnished with a brass distributor with solder type connections. Suction and discharge connections shall be on the same end regardless of rows deep. Coils shall have intertwined circuits for equal operation on each circuit.

G. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on equipment schedule.

H. Coils in series shall have a minimum of 6 inch space between coil casings.

2.6 FILTERS

A. Filter section shall accept MERV 13, 2 inch or 4 inch filters of standard sizes as indicated on drawings and shall be designed and constructed to house the type of filter specified. Section shall include side access slide rails.

B. A magnahelic differential pressure gauge shall be factory installed and flush mounted on drive side to measure the pressure drop across the filter.

2.7 ACCESSORIES

A. Mixing boxes and filter mixing boxes sections shall have opposed blades and interconnecting outside air and return air dampers. All mixing boxes shall have a double wall hinged access door on the drive side of the unit.

B. Face and bypass sections shall have opposed acting damper blades.

C. All damper blades shall be galvanized steel, double skin airfoil type, housed in a galvanized steel frame and mechanically fastened to a hex axle rod rotating in stainless steel bearings. Dampers shall be sectionalized to limit blade length to no more than 48 inches so as to minimize blade warpage. Blade seals are required to assure tight closure. The damper shall be rated for a maximum leakage rate of 1 percent of nominal airflow at 1 inch w.g.

D. Access sections shall be installed where indicated on the drawings and shall have a double walled hinged door.

E. Diffuser sections shall consist of casing as specified with an integral perforated aluminum plate placed on the discharge side of the supply fan to ensure even and uniform air distribution over the adjacent downstream component. Diffuser section is required if a filter section is directly following the fan.

PART 3 - EXECUTION

3.1 If floor mounted air handling units are furnished with internal vibration isolation option, provide 2" thick Amber/Booth type NRC ribbed neoprene pads or approved equal to address high frequency breakout and provide additional unit elevation with overall sufficient height to provide p-trap with one inch greater than the unit total static pressure. Ribbed neoprene pads shall be located in accordance with the air handling unit manufacturer’s recommendations. Condensate drain connection shall not penetrate the base air handling unit’s rail.

3.2 Install in accordance with manufacturer’s instructions.

3.3 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

END OF SECTION

SECTION 23 81 33 - ROOFTOP HEATING AND COOLING UNITS (ELECTRIC COOLING - GAS HEATING)

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 – Basic Materials and Methods is included as a part of this Section as though written in full in this document.

1.2 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.3 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 23 09 63 – Energy Management and Control System

1.4 RELATED SECTIONS

A. Section 23 02 00 – Basic Materials and Methods

B. Section 23 05 13 – Common Motor Requirements for HVAC Equipment

C. Section 23 05 26 – Variable Frequency Motor Speed Control for HVAC Equipment

D. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

E. Section 23 05 93 – Testing, Adjusting, and Balancing

F. Section 23 33 00 - Ductwork Accessories

G. Section 23 41 00 – Air Filters

1.5 QUALITY ASSURANCE

A. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.

B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. AHRI 360 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard.

D. ANSI/ASHRAE/IES 90 A - Energy Conservation in New Building Design Standard provides performance requirements to improve the utilization of energy in new buildings.

E. AHRI 410 - Forced Circulation Air-Cooling and Air- Heating Coils Standard for establishing requirements for testing, rating and certification of ratings.

F. ANSI/UL 465 - Central Cooling Air Conditioners Standard for safety requirements.

G. AMCA 300 - Reverberant room method for sound testing of fans.

H. ANS S1.32 - Precision methods for the determination of sound power levels of discrete frequency and narrow band noise sources in reverberation rooms.

1.6 SUBMITTALS

A. Submit Shop drawings and product data under provisions of Division One.

B. Shop drawings shall indicate components, dimensions, weights, required service clearances, and location and sizes of field connections. Indicate equipment, piping and connections and valves required for complete system.

C. Product data shall include full and part load efficienty data, rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

D. Provide fan curves with specified operating point clearly identified.

E. Submit manufacturer's installation instructions.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation data.

B. Include start-up instructions, maintenance data, controls, and accessories. Include trouble-shooting guide.

C. Submit maintenance data.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site. Comply with manufacturer's installation instructions for rigging, unloading and transporting units.

B. Accept products on site and inspect for damage.

C. Protect units from physical damage. Factory shipping covers and skids shall be kept in place until installation. Store in a clean dry place and protect from weather and construction traffic.

1.9 WARRANTY

A. Provide a full parts and labor warranty for five years from start-up or 18 months from shipment, whichever occurs first.

B. Provide five-year warranty for all parts and labor. Gas fired furnaces require a 15-year parts warranty directly from the manufacturer.

1.10 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 – PRODUCTS

2.1 PRODUCTS

A. Rooftop unit shall be packaged and include electric cooling and gas-fired heat, with capacity and modulating cooling and heating as shown on the drawings.

B. Unit shall be factory-charged and tested, shall be UL-labeled and ARI-certified by Standard 210 and 270, and shall be AGA-certified.

C. Unit casing shall be heavy-gauge galvanized steel or heavy-gauge aluminum with protective coat of baked enamel. Weatherproof access panels shall be provided for access to all parts requiring service.

D. Compressor(s) shall be hermetic scroll type and shall be resiliently mounted to avoid vibration and noise. Compressor shall be provided with anti-slugging protection, crankcase heater, and time delay on recycling of the compressor. Two internal compressor motor thermal cutouts and a hot gas cutout shall protect the compressor in addition to high-pressure and low-pressure safeties. Standard controls shall permit operation down to 35 deg. F (2 deg. C), and compressor shall be locked out below this temperature.

E. Condenser fan(s) shall be direct-driven and shall be designed for operation exposed to the weather.

F. Condenser coils shall have a sub-cooling section.

G. Refrigerant circuit shall include filter dryer, moisture indicator, sight glass, and gauge ports.

H. Filter rack shall be provided for filters 2 in. thick and shall filter both outdoor air and return air. See Section 23 41 00 for type of filters, and the number of filter changes to be furnished with the equipment.

I. Evaporator fan shall be quiet-type centrifugal blower, directly connected to an adjustable-speed motor or belt driven with an adjustable-pitch pulley on the motor.

J. Heat exchanger shall be aluminized steel, designed for long life and quiet operation. Burner shall provide dependable and quiet ignition in the stages as called for.

K. Gas burner controls shall provide automatic safety pilot, dual automatic gas valves, manual gas cock, and pressure regulator. Ignition shall be electric for the intermittent pilot with 100% shutoff when the unit is off.

L. Induced draft blower shall provide pre-purge and shall be provided with a proving switch to prevent burner operation if venter is not in operation.

M. Provide fan switch and limit control to delay the fan until heat is available and to continue

fan operation until heat is dispersed. Limit switch shall shut the burner down in case of failure of operating controls.

2.2 ACCESSORY EQUIPMENT

A. Unit shall be provided with hot gas reheat option for dehumidification. Hot gas reheat coil shall be located on the leaving air side of the evaporator coil and fully piped and circuited at the factory.

B. Condenser coil hail guards shall be provided.

C. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

D. Provide economizer dampers and controls to provide "free cooling" from 0 to 100% outdoor air (OA) when the outside air humidity and temperature are acceptable. Provide OA, return air, and relief air dampers in a factory-provided enclosure. All air shall be filtered and bird screen shall be installed. A solid state enthalpy changeover control shall determine the capability of the outside air to provide free cooling. The control package shall include a differential enthalpy sensor in the return air duct to compare the enthalpy of the outside air and return air and use the air with the lowest enthalpy for free cooling or assisting the mechanical cooling. The cooling control sequence is as follows:

1. The changeover control determines if the outdoor air is suitable for free cooling.
2. The space thermostat determines if cooling is needed in the building. If so,
3. The actuator modulates the outdoor air and return air dampers to maintain the desired mixed air temperature.
4. The second cooling stage of the space thermostat energizes the compressor to assist the economizer if required.
5. If the outdoor air is not suitable for free cooling, the outdoor air damper remains in the minimum ventilation position and the compressor is energized when space cooling is required.

E. Provide a warm-up thermostat to prevent the OA dampers from opening if the return air temperature is below the set point (65 deg. F) (18 deg. C).

F. Provide necessary controls for operation of the compressor below the normal temperature of the compressor cutout. Operation shall be permitted down to temperature specified on Drawings.

G. Provide factory-trained service person to check out the system, calibrate the controls, and see that the RTU is operating properly. The service person making the settings shall make a written report to the Engineer and the Owner with all set points listed for future reference.

H. Rooftop units mounted on slabs or other fixed locations shall be provided with adapters for end discharge and return to the unit.

I. Provide programmable combination thermostat/humidistat and other controls required to produce the control functions called for.

J. Manufacturer shall provide BACnet interface card for communication with EMCS.

2.3 ACCEPTABLE MANUFACTURERS

A. Roof top unit shall be the make and model number shown on the schedule on the Drawings, or acceptable equivalents by Carrier, Lennox, Trane, Johnson Controls, Valent, Aaon.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the curb as required by the job conditions and as recommended by the manufacturer, and install proper flashing and counterflashing. See details on the Drawings.

B. Set the unit in place, taking care to protect the adjacent roofing, and connect the supply and return ductwork.

C. Make electrical and gas line connections, taking care that these do not block access to any part of the equipment requiring service.

D. Have the factory service person check out the unit and make a written report. Place the unit in service.

E. Connect full size condensate drain pipe to roof top unit and extend to nearest drain. Pipe shall be schedule 40 galvanized with malleable iron screwed fittings.

3.2 BALANCING AND TEST

A. Operate the roof top unit and check for proper supply air quantity, noise, and proper operation.

B. Report the airflow, static pressure, voltage and current draw of each item, refrigerant pressure readings, etc., as required by Section 23 05 93 – Testing, Adjusting, and Balancing. This system is not complete until these readings have been made, submitted to the engineer, and accepted.

END OF SECTION

SECTION 260100 – COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section 016500 – "GENERAL COMMISSIONING REQUIREMENTS" for general commissioning process requirements.

2. Division 22 Section 220100 – "COMMISSIONING OF PLUMBING SYSTEMS".

3. Division 23 Section 230100 - "COMMISSIONING OF MECHANICAL SYSTEMS".

1.3 DEFINITIONS

A. Commissioning Authority (CxA): Independent agent hired by Owner and not associated with General Contractor or its subcontractors, Architect or its sub-consultants, or Construction Administrator or its staff or consultants. Under Owner's direction, and not General Contractor's direction, CA will direct and coordinate day-to-day commissioning activities without assuming oversight responsibilities.

B. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

B. Perform commissioning tests at the direction of the CxA.

C. Attend construction phase controls coordination meeting.

D. Participate in electrical systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Complete project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

G. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.

H. Provide test data, inspection reports, and certificates for Systems Manual.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.
5. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.6 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, pre-start, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to section 016500 - GENERAL COMMISSIONING REQUIREMENTS.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall conduct Pre-functional Testing to document compliance with installation and start-up checklists prepared by Commissioning Authority for the Division-26 items.

B. Request verification of Pre-functional checklists by CxA prior to proceeding with system start-up and Functional Testing of systems.

C. Contractor shall participate in Pre-Functional testing activities to document electrical work associated with mechanical and plumbing systems.

D. Refer to Section 016500 - GENERAL COMMISSIONING REQUIREMENTS for issues relating to pre-functional checklists and testing, including list of systems to be commissioned, description of process, details on non-conformance issues relating to pre-functional checklists and test.

3.3 SYSTEM START-UP, TESTS & INSPECTIONS

A. Contractor is solely responsible for system start-up. CxA may, at his discretion, witness start up procedures, but will not perform any Functional Testing of systems until General Contractor has completed start-up and resolved all operating deficiencies.

B. Contractor is solely responsible for all tests and inspections required by the Authority Having Jurisdiction (AHJ). All test reports and certificates required by the AHJ shall be submitted prior to Functional Testing.

C. Contractor shall provide no less than 48 hours notice prior to conducting tests specified in other sections of the specifications, including:

1. Grounding tests

3.4 FUNCTIONAL TESTING PREPARATION

A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

D. Inspect and verify the position of each device and interlock identified on checklists.

E. Check all notification and initiation devices and interlocks with associated systems during each mode of operation.

F. Testing Instrumentation: Provide instrumentation and personnel as required to conduct tests.

3.5 FUNCTIONAL TESTING PROCEDURES OF SYSTEMS TO BE COMMISSIONED

A. All Electrical and Electrically Powered Equipment

1. Inspect electrical wiring and grounding for proper connections, color coding, and quality of installation.
2. Verify supply voltage, all hot legs.
3. Verify amperage is within allowable limits.
4. Inspect for physical damage, proper installation, anchorage.
5. Verify equipment runs smoothly and quietly.
6. Verify operation of safeties.
7. Verify all required means of disconnect are in place.
8. Verify maintenance and NEC clearances are maintained.

B. Lighting Systems:
1. Light Fixtures: Verify all lamps work without flicker.
2. Verify light levels
3. Light Switches: Verify switches control lights per design
4. Lighting Controls:
    a. Verify sensors pick up motion and turn on lights immediately.
    b. Verify that lights turn off after specified time.
    c. Verify sensor coverage includes entire room area being sensed.
    d. Verify sensor does not pick up occupancy outside the area sensed.
    e. For ceiling mounted occupancy switches, verify light switches still function in circuit.
5. Emergency Egress: Verify operation of emergency egress lighting and associated light levels.

3.6 TRAINING

A. Refer to sections 016500 - GENERAL COMMISSIONING REQUIREMENTS.

3.7 O&M MANUALS

A. Refer to sections 016500 - GENERAL COMMISSIONING REQUIREMENTS and section 017800 CLOSEOUT SUBMITTALS.

END OF SECTION

SECTION 26 05 19 - WIRE, CABLE AND RELATED MATERIALS

PART 1 - GENERAL

1.1 SCOPE

A. Provide 600 volt building wire, cable and connectors and 300 volt wire, cable and connectors.

B. WORK INCLUDED: Include the following Work in addition to items normally part of this Section.

1. Wiring for lighting and power.

2. Automatic Control Wiring.

3. Connection of equipment shown.

4. Fire Alarm System.

C. WORK SPECIFIED ELSEWHERE:

1. Heating, ventilating, and air conditioning equipment.

2. Structured cabling system.

3. Coaxial cables

1.2 STANDARDS

A. UL83

B. ASTM B-3

C. All wire cable and connectors shall be UL approved.

1.3 ACCEPTABLE MANUFACTURERS

A. 600 VOLT WIRE AND CABLE

1. Southwire

2. Encore

3. Cerro

B. 300 VOLT WIRE AND CABLE

1. Westpenn

2. Beldon

3. Alpha

4. Tappan - Southwire

C. CONNECTORS

1. Ilsco
2. Cooper
3. AMP - TYCO
4. Burndy
5. Ideal
6. 3M
7. O.Z. Gedney
8. Thomas & Betts
9. Buchanan

1.4 SUBMITTALS

A. Shop drawings shall include, but not limited to:

1. Cutsheets of wire, cable and connectors to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 WIRING

A. All wire shall be new and continuous without weld, splice, or joints throughout its length. It must be uniform in cross-section, free from flaws, scales and other imperfections.

B. WIRE MATERIAL: Conductors shall be soft drawn, annealed copper. Aluminum wiring is not acceptable unless otherwise noted on drawings.

C. TYPES:

1. Provide type “THHN/THWN-2” insulation for all buried feeders and service entrance conductors.

2. Provide type “THHN/THWN-2” insulation for all branch circuits and above grade feeders.

3. All wire No. 8 and larger shall be stranded. All wire No. 10 and smaller shall be stranded or solid. Use solid for #10 and smaller.

4. Provide type "XHHW" or other 90 degrees insulation wiring for branch circuit wiring installed through continuous rows of fluorescent fixture bodies.

5. All 300-volt cable including but not limited to telephone, fire alarm, data, CATV and security shall be UL listed for use in return air plenums.

D. CONDUCTOR SIZES

1. Feeder conductors shall be sized for a maximum of 2% drop in rated voltage at scheduled load.

2. Branch circuit conductors shall be sized for a maximum 3% drop in the rated voltage to the longest outlet on the circuit.

3. Minimum wire shall be No. 12, unless otherwise shown on Drawings or required by Code.

E. COLOR CODING: No. 6 or larger shall use tape for color coding. No. 8 and smaller wire shall be color coded in accordance with the governing authority requirements or as follows:

120/208 Volt	277/480 Volt	120/240 Volt
Neutral: White	Neutral: Gray	Neutral: White
Phase A: Red	Phase A: Brown	Phase A: Red
Phase B: Black	Phase B: Yellow	Phase B: Orange
Phase C: Blue	Phase C: Purple	Phase C: Black
Ground: Green	Ground: Green	Ground: Green

2.2 GROUNDING

Permanently connect all conduit work, motors, starters, and other electrical equipment to grounding system in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.1 WIRE

A. Do not pull wire into conduit until Work of an injurious nature is completed. Where two or more circuits run to a single outlet box, each circuit shall be properly tagged. Wyreze or approved equal may be used as a lubricant where necessary.

B. Splices shall be fully made up in outlet boxes with compression crimp-on type splice connectors.

C. Joints and splices will not be permitted in service entrance or in feeders. Joints in branch circuits will be permitted where branch circuits divide, and then shall consist of one through-circuit to which the branch shall be spliced. Joints shall not be left for the fixture hanger to make. Connect joints and splices with Buchanan Series "2000" solderless connectors complete with insulating caps or properly sized twist on wire nuts.

D. All stranded conductors shall be furnished with lugs or connectors.

E. Connectors furnished with circuit breakers or switches shall be suitable for copper wire termination.

F. "Sta-Cons" shall be used to terminate stranded conductors on all switches and receptacles.

G. All stranded #10 and small conductors shall be terminated with an approved solderless terminal if the device or light fixture does not have provisions for clamp type securing of the conductor.

H. The jacket for all travelers used on 3-way and 4-way switches shall be pink.

I. Route conductors for 480Y/277 systems in a separate raceway. Do not combine with 208Y/120 volt or 120/240 volt systems.

J. Emergency circuits shall not be routed with normal conductors.

3.2 BALANCING SYSTEM

The load on each distribution and lighting panel shall be balanced to within 10% by proper arrangement of branch circuits on the different phase legs. Provide written documentation showing results. Submit with O & M manuals.

3.3 LOW VOLTAGE WIRING

A. Low voltage wiring shall be plenum rated. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

B. Low voltage wiring shall be routed in separate raceways from power wiring systems.

C. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

D. Provide Caddy J-hooks supported independently from other system to support cable at 4-foot on center or closer if required by manufacture.

3.4 CABLE SUPPORTS

A. Provide cable supports in all vertical raceways in accordance with Article 300-19 of the NEC.

3.5 DEFECTS

A. Defects shall include, but are not to limited to, the following:

1. Tripping circuit breakers under normal operation.

2. Improperly connected equipment.

3. Damaged, torn, or skinned insulation.

END OF SECTION

SECTION 26 05 26 - GROUNDING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. WORK COMBINED WITH OTHER SECTIONS: Combine the work specified herein with the following Sections to form a single responsibility for the Work:

1. Electrical.

2. Basic materials and methods.

B. Provide electrical service, equipment and wiring device grounding as shown, scheduled and as specified.

C. The types of grounding include, but not limited to, the grounding bonding of all equipment devices, building steel piping, and as required by the National Electrical Code, Local Inspection Department and Power Company.

1.3 STANDARDS

A. NATIONAL ELECTRICAL CODE (NFPA-70)

B. Local municipal and State codes that have jurisdiction.

C. NECA

1.4 ACCEPTABLE MANUFACTURES

A. Provide grounding products manufactured by Copperweld and Cadweld.

1.5 SUBMITTALS

A. Shop drawings shall include, but not limited to the following:

1. Cut sheets of ground rods, clamps and connectors.

2. Grounding system diagram.

PART 2 - PRODUCTS

A. GENERAL: Provide all materials required to construct a complete grounded electrical system, if grounding is not already existing.

B. GROUND RODS: Ground rods shall be 3/4" inch diameter by 10 feet long construction with copper jacket and a steel core.

C. CLAMPS: Ground clamps shall be copper except for steel or iron pipes in which the clamps shall be galvanized iron.

D. CONDUCTORS: Conductors shall be connected by means of an approved pressure connector or clamp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Install grounding system as shown and specified to ensure a properly grounded system.

B. BUILDING STEEL AND PIPING SYSTEM: Install a bonding jumper between building steel and metallic piping systems to bond them to the electrical grounding system.

C. NEUTRAL: The neutral shall be grounded only at the service entrance and other separately derived systems. The neutral shall be kept separate from the grounding system and shall not be used as a ground.

D. GROUNDING CONDUCTOR: A grounding conductor and metallic conduit system shall bond all equipment served by the electrical system. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

E. CONDUIT GROUNDING BUSHING:

Conduit terminating in equipment that has a ground bus such as switchboards, panelboards, etc., shall have grounding bushings installed. Ground each conduit by means of a grounding bushing and to the ground bus in the equipment.

F. MOTORS: The frame of all motors shall be grounded.

G. SPECIAL GROUNDING: Provide a #6 AWG copper grounding conductor for each telephone board, television system, etc. Terminate the grounding conductor on ground bus and to the building electrical grounding system. Refer to 800-40(d) and 820-40(d) of the NEC.

H. REMOTE PANELBOARDS: Provide a grounding electrode conductor all remote panels as required by the NEC and shown on drawings.

I. LIGHTING FIXTURES: Flexible fixture whips containing a green grounding conductor shall be used to connect light fixtures. Flexible fixture whips shall not exceed ten feet.

J. RECEPTACLES: All receptacles shall be grounded using the branch circuit grounding conductor. Receptacles shall use an approved grounding yoke.

3.2 TESTING: Perform a ground resistance test using a biddle analog or digital portable earth/ground resistance tester. The system resistance shall not exceed 5 OHMS. Provide additional electrodes as required (refer to 250-84 of the NEC or the most current edition 250-56). Test shall not be conducted following wet weather. Provide personal instruments to conduct these tests and submit certified test for review. Test shall be verified by Engineer.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. Provide panelboards as shown, scheduled and as specified herein.

B. The types of panelboards include:

1. Panelboards.
2. Power distribution panelboards.

1.2 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

B. Products shall conform to all applicable UL standards and shall be UL-labeled.

1.3 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. Square D Company
2. Eaton

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of all enclosures, circuit breakers, fusible switches, bussing, rating, schedules and all accessories clearly labeled.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General

Provide power distribution and panelboards as indicated in the panelboard schedule and as shown on the plans. Power distribution panelboards shall be equipped with fusible switches or circuit breakers as shown on the schedule. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.

B. Busing Assembly and Temperature Rise

Panelboard bus structure and main lugs or main breaker shall have current ratings as

shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50ºC. rise above 40ºC ambient. Heat rise test shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All current carrying parts of the bus shall be tin or silver plated copper.

1. Bus structure shall be isolated. Bus bar connections to the branch circuit breakers shall be distributed phase or phase sequence type and shall accept bolt-on circuit breakers for lighting and appliance panelboards.

2. The lugs for terminating conductors shall be rated at 75° C on all panel boards and circuit breakers.

Provide an extruded bare copper ground bus. Provide an isolated ground copper bus in each panel serving isolated ground circuits. Provide a full size copper neutral bus in each panelboard enclosure. Provide a double size neutral buss when served by a harmonic mitigating transformer.

C. Distribution Panelboards

Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between “ON” and “OFF”. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Circuit breakers shall be of the frame size, trip setting and interrupting capacity as indicated on the drawings. Circuit breakers shall be rated 65,000 AIC unless otherwise noted on plans.

1. Provide arc energy reduction switch for each breaker rated 1200 amps or larger to comply with 240.87 of the NEC. Switch shall be equipped with a pad lockable cover with a blue LED pilot light that illuminates when system is activated. Locate switch and cover recessed mounted adjacent to the breaker it serves or remote as indicated on the plans. Provide label and all required hardware. Remote switch(es) shall be flush mounted in wall near entry to the room.

D. 480/277 Volt Panelboards

Main breakers shall be vertically mounted. Horizontally mounted main breakers are not acceptable.

Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2 or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breaker shall have an over-center, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have “ON”, “OFF” and “TRIPPED” positions. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 277 volt ac (single pole, 15-30 amperes) or 480Y/277 volts ac (2 and 3 pole) with continuous current ratings as noted on the plan. Interrupting ratings shall be a minimum of 18,000 rms symmetrical amperes at 277 volts ac (single pole) or 480Y/277 volts ac (2 and 3 pole). Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking. Circuit breakers shall be rated at a minimum of 18,000 AIC unless otherwise noted on plans.

E. 240 Volt Panelboards

Main breakers shall be vertically mounted. Horizontally mounted main breakers are not acceptable.

Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2, or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions.

Circuit breakers shall be UL listed in accordance with UL standard 489 and shall be rated 240 volts ac maximum with continuous current rating as noted on the plans.

Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip settings of the breaker to prevent repeated arcing short resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac and carry the SWD marking.

UL Class A 5mA ground fault circuit protection shall be provided on all receptacle circuits serving wet areas and on all 120V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker.

UL Class B 30mA ground fault circuit protection (GFEP) shall be provided on all equipment circuits requiring ground fault protection. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring.

Provide Shunt Trip Breakers including control power for circuits under cooking hoods and other equipment having this requirement.

Provide Breaker with Switched Neutral circuits with common trip for gasoline pumps and other equipment having this requirement.

Circuit breakers shall be rated 22,000 AIC at 240V unless otherwise noted on plans.

Provide double sized neutral bus with panels served from a non-linear transformer or when indicated on drawings. This shall be a UL approved assembly.

F. Cabinets and Fronts

The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. All panelboard lock shall be keyed alike. Circuit breaker and fusible distribution panels shall have four-piece trims. A welded circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Provide NEMA 1 enclosure where installed indoors unless otherwise noted. Provide NEMA 3R enclosure where installed outside or in a sprinkled area.

G. Safety Barrier

The distribution panelboard interior assembly shall be dead front with panelboard cover removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

H. Integrated Equipment Short Circuit Rating

Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the over-current devices mounted in the panelboard. The short circuit tests on the over-current devices and on the panelboard structure shall be made simultaneously by connecting the fault to each over-current device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard over-current devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install panelboards, including electrical connections, in accordance with manufacturers written instructions, NEC and recognized industry practices.

B. Housekeeping Pads: Mount floor mounted panelboards on 4 inch high concrete housekeeping pads.

C. Fuses: Install fuses of the rating and class as shown in each fusible distribution panel scheduled on drawings.

D. Conduits: Stub up three one inch conduits to an accessible location above the ceiling for each recessed panelboard.

3.2 IDENTIFICATION

A. Nameplate: Each panelboard shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show panel designation. Nameplates shall be attached with stainless steel screws. Refer to Section 26 02 00, paragraph 2.8(C).

B. Directory Card: Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be clear plastic pocket. Circuit lists shall be typewritten. Circuit descriptions shall include location and name of each item of equipment served. Spares and spaces shall be written in erasable pencil for future use. Circuit directory shall show the room served by each circuit. The final graphs/signage room numbers shall be used. Do not use Architectural numbering on plans.

END OF SECTION

SECTION 26 29 13 - MOTOR STARTERS

PART 1 - GENERAL

1.1 SCOPE

A. Provide motor starters as shown, scheduled and as specified herein.

B. The types of motor starters include:

1. Individual motor starters.

2. Combination motor starters.

3. Manual motor starters.

C. All motor starters for equipment furnished under Division 23 shall be installed under Division 26 requirements unless noted otherwise on the plans.

1.2 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

B. Products shall conform to all applicable UL standards and shall be UL-labeled.

1.3 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. **Square D Company**

2. Eaton

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of all enclosures, circuit breakers, fusible and non-fusible switches, overloads, ratings, schedules and all accessories clearly labeled.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.

2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

A. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FVNR) starter. Provide FVNR speed, single

winding starter where indicated. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. IEC sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served.

B. CONTACTS: Magnetic starters contacts shall be double break solid silver alloy.

All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.

C. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.

D. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset.

E. PILOT LIGHTS: Provide a red “on” running pilot light and green “off” pilot light for all motor starters. Provide fast and slow pilot lights for two speed starters. Pilot lights shall be mounted in the starter enclosure cover and shall be “L.E.D.”. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.

F. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.

G. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.

H. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.

I. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.

J. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted outside. Provide NEMA 4X stainless steel mounted next to cooling towers.

K. Power Monitor: Provide a Square "D" RM3TAR114TS7 or approved equal phase failure and under-voltage relay, base and wiring required for starters serving motors 5 horse power and larger. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

2.2 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.1/A, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Section 26 28 16.

2.3 MANUAL MOTOR STARTERS

A. GENERAL: Manual starters shall consist of a manually operated toggle switch equipped with melting alloy type thermal overload relay. Thermal unit shall be of one-piece construction and interchangeable. Starter shall be inoperative if thermal unit is removed. Contacts shall be double break, silver alloy, visible from both sides of starter. Manual starters shall be Square D class 2510 or 2512 or approved equal. Provide the size and number of poles shall be as shown and required by equipment served. Furnish red pilot light as indicated.

B. ENCLOSURES: All manual motor starter enclosures shall be NEMA 1, general purpose enclosures, or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA-4X when mounted next to cooling tower.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTORS

A. GENERAL: Mount electric motors which are not factory installed.

B. MOTOR CONNECTIONS: Provide electrical and grounding connections to motors as indicated. Connections as follows:

1. Not less than 18 inch length of Sealtite, extending from motor connection box to motor branch circuit conduit on outdoor and wet locations. Provide Greenfield for inside dry locations.

2. Install connections mechanically secure, assuring electrical continuity, proper and effective grounding.

3.2 INSTALLATION OF MOTOR STARTERS

A. GENERAL: Install motor starters in accordance with the manufacturer's written instructions, the applicable requirements of the NEC and the NECA's "Standard of Installation", and recognized industry practices to ensure that products serve the intended function.

B. OVERLOADS: Install overload heaters in each motor starter. Heater ratings shall be based on actual motor nameplate full load amps.

C. COORDINATION: Motor starters shall be provided to properly coordinate with motors as furnished by Division 23. Motor starter controls shall be provided to properly coordinate with controls specified in Division 23.

D. SUPPORTS: Motor starter enclosures shall be installed on galvanized unistrut or other supports where mounting on wall and shall not be supported by conduit alone. When

enclosures are unit mounted on equipment served, the switch shall not inhibit the removal of any service panels or interfere with any required access areas. Combination starter disconnects and starters mounted in ceiling plenums shall be installed 18” above ceiling grid.

3.3 TESTING

A. GENERAL: Check motor starters for continuity of circuits, for short circuits and demonstrate that it is functioning properly with HVAC controls.

B. MOTOR-STARTER COORDINATION DOCUMENTATIONS: Provide motor-starter coordination documents including, but not limited to, the following information in the operation and maintenance manuals.

1. Motor size in horsepower

2. Motor full load amp

3. Motor efficiency

4. Service factor

5. Size and manufacturer catalog number of starter and thermal overloads.

END OF SECTION

SECTION 26 51 00. 13 - LIGHTING FIXTURES- LIGHT EMITTING DIODE (LED)

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install general and emergency lighting fixtures as noted on the drawings. Fixtures shall be completely wired with lamps installed and shall be in perfect operating condition at the time of substantial completion.

B. The types of lighting fixtures required for this project include:

1. LED

1.2 STANDARDS

A. All fixtures shall conform to all applicable UL standards and shall be UL label including damp and wet location ratings. “ETL listed” is an acceptable listing.

B. NFPA 101

C. ANSI/UL 1789-2015

D. NEMA LE4-2012

E. IEEE Publication 1789-2015

F. All LED drivers shall be UL recognized Class 2 per UL1310 or non-Class 2 per UL 1012 as applicable.

G. All LED drivers shall comply with applicable requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, for Non-Consumer Equipment.

H. All LED drivers shall be RoHS compliant.

I. TM-21

J. LM-80

K. LM-79

L. L70

M. DLC

N. UL 1008

1.3 ACCEPTABLE MANUFACTURERS

A. Provide lighting fixtures produced by manufacturers as follows:
1. Acuity Brands
2. Eaton
3. Hubbell
4. Philips.

B. LED DRIVER:
1. Provide one of the following manufacturers
a. Eldo
b. Lutron
c. Osram
d. Philips

C. LAMPS:

1. Provide one of the following LED Chip manufacturers
a. Cree
b. Nichia
c. North American Philips
d. Seoul
e. Lumileds

1.4 SUBMITTALS

A. Shop drawings shall include a brochure with a separate cut sheet for each fixture type arranged in alphabetical order with fixture and all accessories/options clearly labeled. Provide performance data for each fixture. Provide an independent test lab report for each fixture if requested by the Architect/Engineer.

B. Provide driver and LED module data brochures for each fixture type.

C. Furnish air handling and heat removal data for light fixtures specified with these requirements.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.
3. UL fire resistance directory.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General:

Provide the size, type and rating of each light fixture shown and scheduled. All light fixtures shall complete with reflectors, lens, trim rings, flanges, LED modules, lamp holders, drivers, fuses, wiring, earthquake clips, etc. to provide a complete functioning light fixture.

B. Lighting Fixture Types:

1. LED Fixtures
a. Fixtures shall be pre-wired with frame-in kit and integral thermal management system for fixtures. Driver shall be encased in metal-can construction for optimal thermal performance.
b. Total fixture lumen output is dependent on the chip, thermal management, driver current and optical system. LED fixtures shall be tested as a complete unit or system. Only DOE recognized CALiPER testing laboratory results shall be utilized.

c. Interior LED fixtures shall have integral common mode and differential mode surge protection of 3kV(1.2/50µs, 2 ohm combination wave).
d. Exterior LED fixtures shall have integral common mode and differential mode surge protection of 10kV/10kA(1.2/50µs, 2 ohm combination wave).

2. Exit signs
a. Exit signs shall meet all federal, state and local codes.
b. Provide fire alarm interface relay when required to flash exit signs.
c. Provide battery packs for emergency operation when not connected to emergency generator power.

2.2 LED MODULES AND DRIVERS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. LED

1. Driver manufacturer shall have a 10-year history producing electronic drivers for the North American market.

2. Driver shall carry a five year limited warranty from date of manufacture against defects in material or workmanship (including replacement) for operation at a maximum case temperature of 80 degrees Celsius.

3. Drivers shall not contain any Polychlorinated Biphenyl (PCB).

4. Provide driver with integral color-coded leads.

5. Driver shall operate from 50/60 Hz input source of 120 Volt through 277 Volt or 347 Volt through 480 Volt with sustained variations of +/- 10% (voltage) with no damage to the driver.

6. Driver output shall be regulated to +/- 5% across published load range. And shall have a power factor greater than .90 for primary application to 50% of full load rating with an input current Total Harmonic Distortion (THD) of less than 20% to 50% of full load rating.

7. Provide drivers with a Class A sound rating.

8. Provide LED drivers for outdoor fixtures with a minimum operating temperature of -40 degrees Celsius (-40 F). Provide LED drivers for indoor fixtures with a minimum operating temperature of -20 degrees Celsius (-2F).

9. Drivers shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.

10. Driver output ripple current shall be less than 15% measured peak-to-average, with ripple frequency being greater than 100Hz.

11. Driver performance requirements shall be met when operated to 50% of full load rating.

12. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.

13. Drivers shall comply with NEMA 410 for in-rush current limits.

14. Dimmable drivers shall be controlled by a Class 2 low voltage 0-10VDC controller

with dimming range controlled between 1 and 8VDC with source current 150µA.

2.3 LAMPS – COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. LED Lamps shall be appropriately matched to the driver with junction-down design for improved thermal management. Maximum DC Forward Current.

2.4 EMERGENCY LED BATTERY BACKUP

A. Provide Bodine #BSL310M for emergency light fixtures in 9 or 10-foot ceiling.

B. Provide Bodine #BSL20 for emergency LED driver for emergency light fixtures in ceiling heights greater than 12 feet.

C. Provide Bodine #BSL17-C2 for emergency LED driver for LED downlights.

D. Provide unswitched hot leg. Hot leg shall originate from the same branch circuit as required in NEC article 700.12 (F).

PART 3 - EXECUTION

3.1 INSTALLATIONS

A. General

1. Install the type of lighting fixture where shown and indicated in accordance with manufacturer's written instructions.

2. Provide earthquake clips on all recessed lay-in lighting fixtures as required by building code.

3. Adjust all adjustable lighting fixtures, as directed by the Architect.

4. Provide safety chains and wire guards for lighting fixtures located in gymnasium, multi-purpose rooms, play areas, etc.

B. Coordination

1. The contractor shall verify the type of fixtures with the ceiling types as indicated on the drawings. Any discrepancies shall immediately be brought to the architect's attention before the contractor places his order and accepts delivery. Fixtures shall fit exact in the type of ceiling scheduled. Provide plaster frames, trim rings and other accessories required for a correct fit.

2. Provide supports attached to structural member to support fixtures when the ceiling system cannot maintain support. Provide separate supports for all recessed ceiling mounted HID fixtures.

3. Refer to architectural reflected ceiling plan for the exact location of all lighting fixtures. Notify the architect for any discrepancies or conflicts with structural, architectural, mechanical piping or ductwork before installation.

C. Mounting

1. Provide support channels to support outlet boxes used support surface mounted

lighting fixtures such as exit signs or downlights.

2. Pendant or surface mounted fixture shall be provided with required mounting devices and accessories, including hickeys and stud-extensions, ball-aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with mechanical contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings or established in the field. The allowable variation tolerance in mounting individual fixtures shall not exceed 1/4 inch and shall not vary more than 1/2 inch from the floor mounting height shown on the Drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Fixtures shall employ single - not twin - stem hangers unless otherwise noted.

3. All structure mounted fixtures (i.e. bracket mounted, pipe mounted and surface mounted) shall be provided with cables of suitable size and weight to support the weight of the fixture. Cables shall be fastened around or fastened to the housing of the fixture. On pendant fixtures, one safety cable of suitable size and weight to support the weight of the fixture assembly shall connect the top of the pendant to the supporting structure by means of welding or bolting, and one safety cable shall connect the housing of the fixture to the bottom of the pendant. Where more than one pendant per fixture occurs, only one pendant must be cabled. Track fixtures for pendant mounted track shall also be supplied with clip-on safety cables of suitable size and weight to support the weight of the fixture.

4. Provide secondary support wires from all four (4) corners of the lay-in fixtures to the structure above. Do not support fixtures from ceiling grid wire supports, piping, conduit, side walls, or mechanical equipment. Ceiling specifications do not supersede this requirement.

D. Electrical Connection

1. All light fixtures shall be connected from a branch circuit junction box using 1/2" flexible metal conduit or MC cable fixture pigtails not exceeding 8'- 0". Provide #12 AWG conductors. All fixtures must be grounded by using a grounding conductor. Fixture to fixture wiring of fixtures installed in an accessible ceiling is not permitted. Fixture whips shall not lay-on ceiling tile or grid. Provide caddy clips to provide additional support.

E. Fire Rated Ceiling

1. Provide fire rated canopy or enclosure for all fixtures recessed in a fire rated ceiling. The fire rated canopy or enclosure shall be as required by the UL design number listed in the UL fire resistance directory. Refer to architectural drawing for the UL design number. Coordinate with ceiling installer and manufacturer. Provide proper rated ballast/drivers for lighting fixtures installed within these rated enclosures.

3.2 FINAL INSPECTION

A. Remove all plastic and protective coating from all fixtures. Fixtures shall be thoroughly cleaned. Replace any damaged fixture or fixture parts including reflectors, louvers, lens and metal parts that show signs of corrosion.

B. Replace all other defective fixtures showing signs of excessive usage.

C. Demonstrate proper operation of all fixtures and controls. Refer to other sections and

details on the drawings for lighting controls.

END OF SECTION

ABBREVIATIONS:

A

ABV	ABOVE
ACOUST	ACOUSTICAL
ACCU	AIR COOLED CONDENSING UNIT
ACT	ACOUSTICAL CEILING TILE
AD	ACCESS DOOR
ADA	AMERICAN WITH DISABILITIES ACT
ADJ	ADJUSTABLE OR ADJACENT
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
ALUM	ALUMINUM
AP	ACCESS PANEL
ARCH	ARCHITECT, ARCHITECTURAL

B

BFF	BELOW FINISHED FLOOR
BFE	BRACKET MOUNTED FIRE EXTINGUISHER
BLDG	BUILDING
BOC	BACK OF CURB
BP	BASE PLATE
BRG	BEARING
BRKT	BRACKET
BS	BOTH SIDES
BW	BOTH WAYS
BO	BOTTOM OF

C

CAB	CABINET
CIP	CAST IN PLACE
CJ	CONTROL OR CONSTRUCTION JOINT
CL	CENTERLINE
CLG	CEILING
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT
COL	COLUMN
CONC	CONCRETE
CONST	CONSTRUCTION
CONT	CONTINUOUS
CORR	CORRIDOR
CT	CERAMIC TILE
CTR	CENTER

D

D	DEPTH
DEG	DEGREES
DET	DETAIL
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DN	DOWN
DP	DAMP PROOFING
DS	DOWN SPOUT
DWG	DRAWING
DWL	DOWEL

E

E	EAST
EA	EACH
EF	EACH FACE
EIFS	EXTERIOR INSULATION FINISH SYSTEM
EFS	EXTERIOR FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRICAL
EQ	EQUAL
EQUIP	EQUIPMENT
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EXIST	EXISTING
EXP	EXPANSION
EXT	EXTERIOR

F

FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FB	FACE OF BUILDING
FCO	FLOOR CLEAN OUT
FD	FLOOR DRAIN
FDC	FIRE DEPARTMENT CONNECTION
FDN	FOUNDATION
FDV	FIRE DEPARTMENT VALVE
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF	FINISHED FLOOR
FG	FINISHED GRADE
FH	FIRE HYDRANT
FHC	FIRE HOSE CABINET
FLUOR	FLUORESCENT
FOC	FACE OF CURB
FP	FIRE PROTECTION
FPR	FIRE PROTECTION RISER
FR	FIRE RATED
FRP	FIBERGLASS REINFORCED PLASTIC
FRT	FIRE TREATED
FV	FIELD VERIFY

G

GALV	GALVANIZED
GB	GRADE BEAM
GC	GENERAL CONTRACTOR
GFRC	GLASS FIBER REINFORCED CONCRETE
GND	GROUND
GRS	GALVANIZED RIGID STEEL
GTR	GUTTER
GWB	GYPSUM WALL BOARD

H

HT	HEIGHT
HB	HOSE BIB
HC	HANDICAP
HDW	HARDWARE
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HR	HOUR
HYD	HYDRANT

I

IBC	INTERNATIONAL BUILDING CODE
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH OR INCHES
INCAND	INCANDESCENT
INSUL	INSULATION
INT	INTERIOR

J

JAN	JANITOR
JST	JOIST
JT	JOINT

K

KO	KNOCKOUT

L

L	LENGTH
LAV	LAVATORY
LB.#	POUNDS
LDG	LANDING
LF	LINEAR FEET
LG	LONG
LH	LEFT HAND
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LONG	LONGITUDINAL
LT	LIGHT
LTG	LIGHTING

M

MAS	MASONRY
MATL	MATERIAL
MAX	MAXIMUM
MECH	MECHANICAL
MEZZ	MEZZANINE
MFR	MANUFACTURER
MID	MIDDLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MK	MARK
MO	MASONRY OPENING
MTL	METAL
MTD	MOUNTED

N

N	NORTH
N/A	NOT APPLICABLE
NF	NEAR FACE
NIC	NOT IN CONTRACT
NOM	NOMINAL
NTS	NOT TO SCALE

O

OC	ON CENTER
OD	OVERFLOW DRAIN
OF	OUTSIDE FACE
OH	OPPOSITE HAND
OS	OVERFLOW THROUGH WALL SCUPPER
OPP	OPPOSITE
OPG	OPENING

P

PC	PRE-CAST CONCRETE
PERIM	PERIMETER
PERP	PERPENDICULAR
PI	POINT OF INTERSECTION
P	PLATE
PL	PROPERTY LINE
PLAM	PLASTIC LAMINATE
PLBG	PLUMBING
PLYWD	PLYWOOD
PNL	PANEL
PR	PAIR
PREFAB	PREFABRICATED
PRELIM	PRELIMINARY
PTD	PAINTED

Q

QT	QUARRY TILE
QTY	QUANTITY

R

R	RADIUS
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
REF	REFERENCE, REFER
REINF	REINFORCING
REQD	REQUIRED
REV	REVISION, REVISE
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
RP	RADIUS POINT
RTU	ROOF TOP UNIT

S

S	SOUTH
SCHED	SCHEDULED
SECT	SECTION
SF	SQUARE FEET
SHT	SHEET
SIM	SIMILAR
SHT MTL	SHEET METAL
SJ	SAW JOINT
SL	SLOPE
SPEC	SPECIFICATION
SQ	SQUARE
SS	STAINLESS STEEL
STC	SOUND TRANSMISSION CLASS
STD	STANDARD
STL	STEEL
STRUCT	STRUCTURAL
SURF	SURFACE
SUSP	SUSPEND
SYM	SYMMETRICAL

T

T	TREAD OR TOP
TO	TOP OF
TAS	TEXAS ACCESSIBILITY STANDARDS
TC	TOP OF CURB
TEL	TELEPHONE
TEMP	TEMPORARY
THK	THICKNESS
THRD	THREADED
THRU	THROUGH
TYP	TYPICAL

U

UON	UNLESS OTHERWISE NOTED
UR	URINAL

V

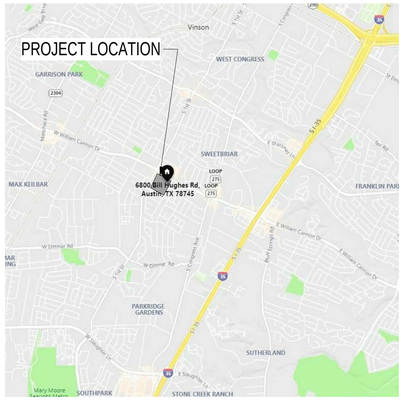
VB	VAPOR BARRIER
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VEST	VESTIBULE
VR	VAPOR RETARDER
VT	VINYL TILE
VTR	VENT THROUGH ROOF

W

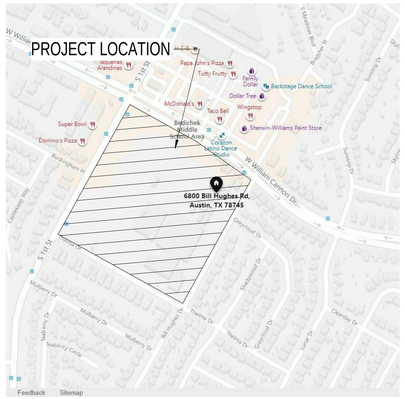
w/	WITH
WC	WATER CLOSET
WH	WATER HEATER
WP	WORK POINT

X,Y, & Z

RESERVED



VICINITY MAP



SITE MAP

AISD Bedichek Middle School RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD Project No. 20-0029 BEDCHK

BID SET

AUSTIN ISD BOARD OF TRUSTEES

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ZACK PEARCE, DIRECTOR OF PROJECT MANAGEMENT

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

09/30/2020

KINGS STRUCTURAL ENGINEERING
STRUCTURAL ENGINEERING

WILSON & GIRGENTI, LLC
MECHANICAL-ELECTRICAL-PLUMBING
MECHANICAL, ELECTRICAL, PLUMBING ENGINEERING

hollon+cannon group, llc
ROOFING CONSULTANT

Jose I. Guerra, Inc
Consulting Engineers
CIVIL ENGINEERING

SHEET LIST:

BUILDING CODES:

2015 INTERNATIONAL BUILDING CODE
2015 INTERNATIONAL EXISTING BUILDING CODE
2015 UNIFORM MECHANICAL CODE
2015 UNIFORM PLUMBING CODE
2017 NATIONAL ELECTRICAL CODE
2015 INTERNATIONAL ENERGY CONSERVATION CODE
2015 INTERNATIONAL FIRE CODE
TEXAS ACCESSIBILITY STANDARDS
CITY OF AUSTIN AMENDMENTS

THESE RENOVATIONS DO NOT CHANGE THE OCCUPANCY OR USE OF THE FACILITY.

SCOPE OUTLINE

REPORT ID: DDCALoc_e001A1

1. REPLACE EMERGENCY LIGHTS, REPLACE EXIT LIGHTS, REPLACE CEILING LIGHTS IN CAFETERIA AND CORRIDORS AND CLASSROOMS WHERE SHOWN. REPLACE CONNECTIONS TO NEW MECHANICAL AND ELECTRICAL UNITS WHERE SHOWN- REF ELECTRICAL. DEFICIENCY ID: DI-39087
2. REPLACE ROOFTOP UNITS, AIR HANDLERS, AND COOLING TOWER, REF MEP. PROVIDE STRUCTURAL REINFORCEMENT FOR HVAC EQUIPMENT, REF STRUCT DEFICIENCY ID: DI-39125
3. REPLACE RESTROOM SINKS AND TOILETS, REPAIR LINES AND VALVES, INSULATE PIPING - REF PLUMBING DEFICIENCY ID: DI-39068
4. REINFORCE/REPAIR UNDERSIDE OF CONCRETE DECK, REPLACE EXISTING SOIL RETAINERS, ENCAPSULATE ASBESTOS AND RE-INSULATE PIPING IN CRAWLSPACE. REF STRUCT & MEP
   INSTALL CRAWLSPACE LADDER IN BUILDING C - REF ARCH
   DEFICIENCY ID: DI-39007
5. PROVIDE CRAWL SPACE VENTILATION FAN & INTAKE GRATES
6. REMOVE EXISTING WALLS - REPLACE W/ NEW WALLS TO DECK IN SAME LOCATION
7. REGRADE AREAS TO DRAIN AWAY FROM BUILDING - REF CIVIL
   DEFICIENCY ID: DI-39126
8. FLUSH DOWNSPOUTS TO CLEAR DEBRIS AND CONNECT/RECONNECT TO UNDERGROUND STORM DRAIN, CLEAR AREAWAYS AND CONSTRUCT NEW AREA INLETS, REPAIR STORM DRAINS IN CRAWL SPACE. - REF CIVIL DEFICIENCY ID: DI-39008
9. EXISTING BUILT-IN EPOXY LAB STATIONS IN CLASSROOMS 131, 133, 134, AND 135 TO BE ABATED AND REMOVED. PATCH EXISTING VCT FLOORING TO MATCH EXISTING. CAP ALL UTILITIES AT FLOOR LINE.

NIC FIRE ALARM SYSTEM UPGRADES COMPLETED ON PRIOR BOND PROJECT

NIC EXTERMINATE PESTS, SEAL BUILDING HOLES W/ WIRE MESH, CLEAR ALL SHRUBS, OVERGROWTH, AND TREE BRANCHES WITHIN 10 FEET OF BUILDING
DEFICIENCY ID: DI-39067

ITEMS IDENTIFIED AS 'NIC' HAVE BEEN PREVIOUSLY COMPLETED AND REMOVED FROM PROJECT SCOPE OR DE-PRIORITIZED.

1

PHASES

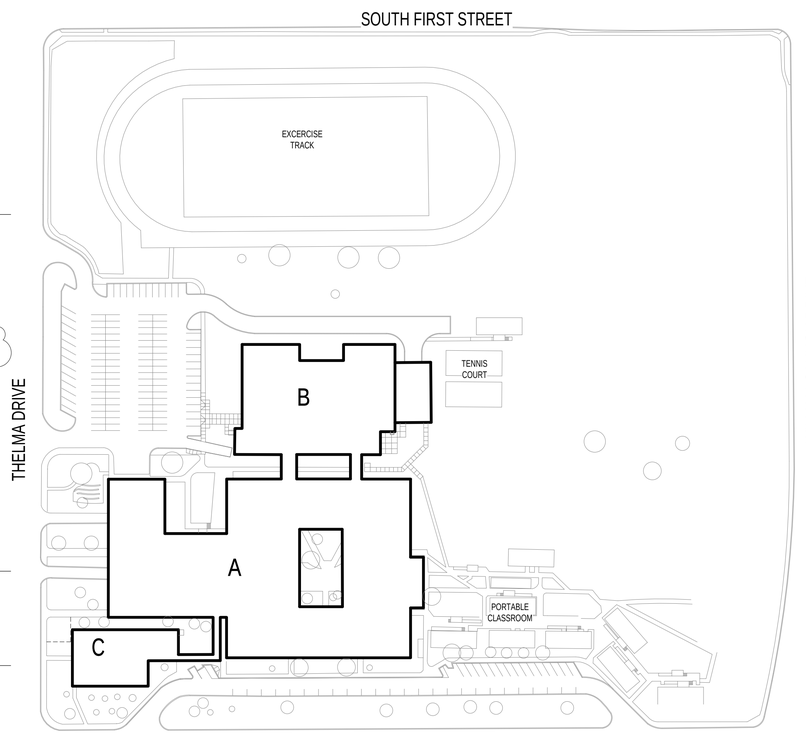
1. CRAWL SPACE PIPING:
   - PROVIDE NEW PIPING INSULATION TO REPLACE BASE BID ABATEMENT OF EXISTING PIPING INSULATION.
2. CRAWL SPACE VENTILATION:
   - PROVIDE NEW CRAWL SPACE VENTILATION FANS, POWER, LIGHTING, NEW OPENING DEMOLITION, AND ALL OTHER ASSOCIATED WORK PER DRAWINGS/SPECIFICATIONS.
3. CEILING REPLACEMENT:
   - REMOVE AND REPLACE THE EXISTING CAFETERIA LAY-IN ACOUSTIC CEILING PER DRAWINGS.
4. CHILLER MODIFICATIONS:
   - REPLACE EXISTING SCREW CHILLERS WITH NEW CENTRIFUGAL CHILLERS LIKE-FOR-LIKE (NOT SIZED PER AISD DESIGN GUIDELINES).
   - REPLACE AGED CHILLED WATER PUMPS. CONVERT SERIES LOOP INTO PARALLEL LOOP.
   - EXTEND BACNET CAPABILITY TO CENTRAL PLANT FROM EXISTING TRIDIUM JACE. NEW CHILLERS WILL BE ADDED TO BACNET.
5. AHU REPLACEMENTS:
   - REPLACE EXISTING 4-PIPE MULTI-ZONE UNITS AHU-13 AND AHU-14.
   - INSTALL NEW ACCESS DOORS AT ROOF PENTHOUSE.

UNIT COSTS

CHILLED WATER PIPING REPLACEMENT - PROVIDE UNIT COST FOR REPLACEMENT OF ANY DAMAGED CHILLED AND HOT WATER PIPING UNCOVERED BY BASE BID ABATEMENT WORK.

INSTRUCTIONS TO BIDDERS

PROVIDE BREAKOUT PRICING FOR ALL PHASES

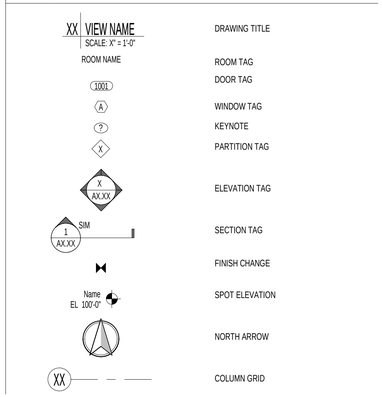


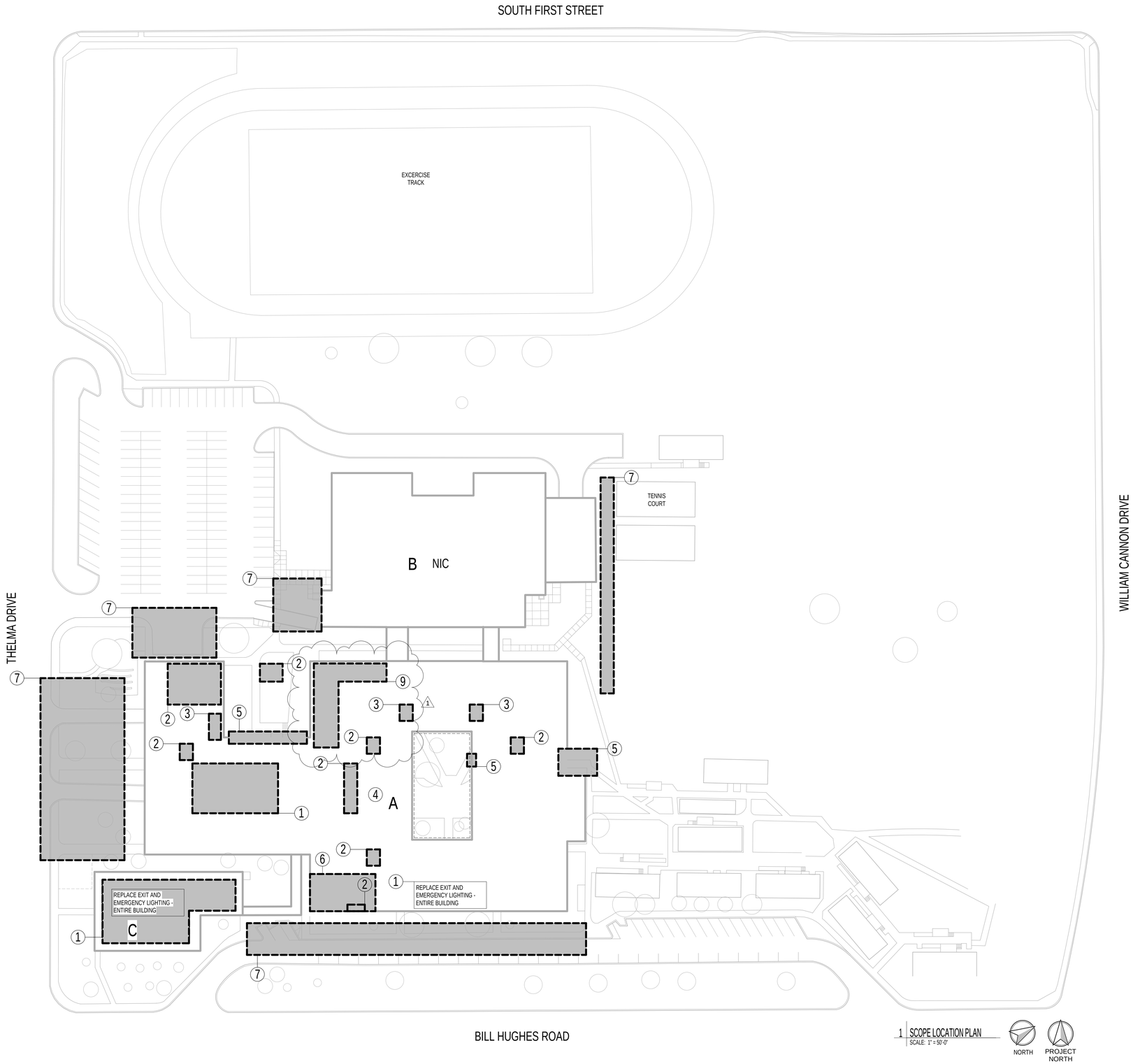
1 CAMPUS MAP
SCALE: 1" = 100'-0"

NORTH

PROJECT NORTH

ARCHITECTURAL SYMBOLS:





1 SCOPE LOCATION PLAN
SCALE: 1" = 50'-0"

NORTH

PROJECT NORTH

SCOPE OUTLINE

REPORT ID: DDCALoc_e001A1

1. REPLACE EMERGENCY LIGHTS, REPLACE EXIT LIGHTS, REPLACE CEILING LIGHTS IN CAFETERIA AND CORRIDORS AND CLASSROOMS WHERE SHOWN. REPLACE CONNECTIONS TO NEW MECHANICAL AND ELECTRICAL UNITS WHERE SHOWN- REF ELECTRICAL. DEFICIENCY ID: DI-39087
2. REPLACE ROOFTOP UNITS, AIR HANDLERS, AND COOLING TOWER, REF MEP. PROVIDE STRUCTURAL REINFORCEMENT FOR HVAC EQUIPMENT, REF STRUCT DEFICIENCY ID: DI-39125
3. REPLACE RESTROOM SINKS AND TOILETS, REPAIR LINES AND VALVES, INSULATE PIPING - REF PLUMBING DEFICIENCY ID: DI-39068
4. REINFORCE/REPAIR UNDERSIDE OF CONCRETE DECK, REPLACE EXISTING SOIL RETAINERS, ENCAPSULATE ASBESTOS AND RE-INSULATE PIPING IN CRAWLSPACE. REF STRUCT & MEP INSTALL CRAWLSPACE LADDER IN BUILDING C - REF ARCH DEFICIENCY ID: DI-39007
5. PROVIDE CRAWL SPACE VENTILATION FAN & INTAKE GRATES
6. REMOVE EXISTING WALLS - REPLACE W/ NEW WALLS TO DECK IN SAME LOCATION
7. REGRADE AREAS TO DRAIN AWAY FROM BUILDING - REF CIVIL DEFICIENCY ID: DI-39126
8. FLUSH DOWNSPOUTS TO CLEAR DEBRIS AND CONNECT/RECONNECT TO UNDERGROUND STORM DRAIN, CLEAR AREAWAYS AND CONSTRUCT NEW AREA INLETS, REPAIR STORM DRAINS IN CRAWL SPACE. - REF CIVIL DEFICIENCY ID: DI-39008
9. EXISTING BUILT-IN EPOXY LAB STATIONS IN CLASSROOMS 131, 133, 134, AND 135 TO BE ABATED AND REMOVED. PATCH EXISTING VCT FLOORING TO MATCH EXISTING. CAP ALL UTILITIES AT FLOOR LINE.

NIC FIRE ALARM SYSTEM UPGRADES COMPLETED ON PRIOR BOND PROJECT

NIC EXTERMINATE PESTS, SEAL BUILDING HOLES W/ WIRE MESH, CLEAR ALL SHRUBS, OVERGROWTH, AND TREE BRANCHES WITHIN 10 FEET OF BUILDING DEFICIENCY ID: DI-39067

ITEMS IDENTIFIED AS 'NIC' HAVE BEEN PREVIOUSLY COMPLETED AND REMOVED FROM PROJECT SCOPE OR DE-PRIORITIZED.

1

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #10701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

hg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745
AISD PROJECT No. 200029-BEDCHK

REGISTERED ARCHITECT STATE OF TEXAS

09/30/2020

REVISIONS

No.	Issue	Date
0	Issued for Bid & Permit	09/04/2020
1	Addendum #4	09/30/2020

SHEET INFORMATION

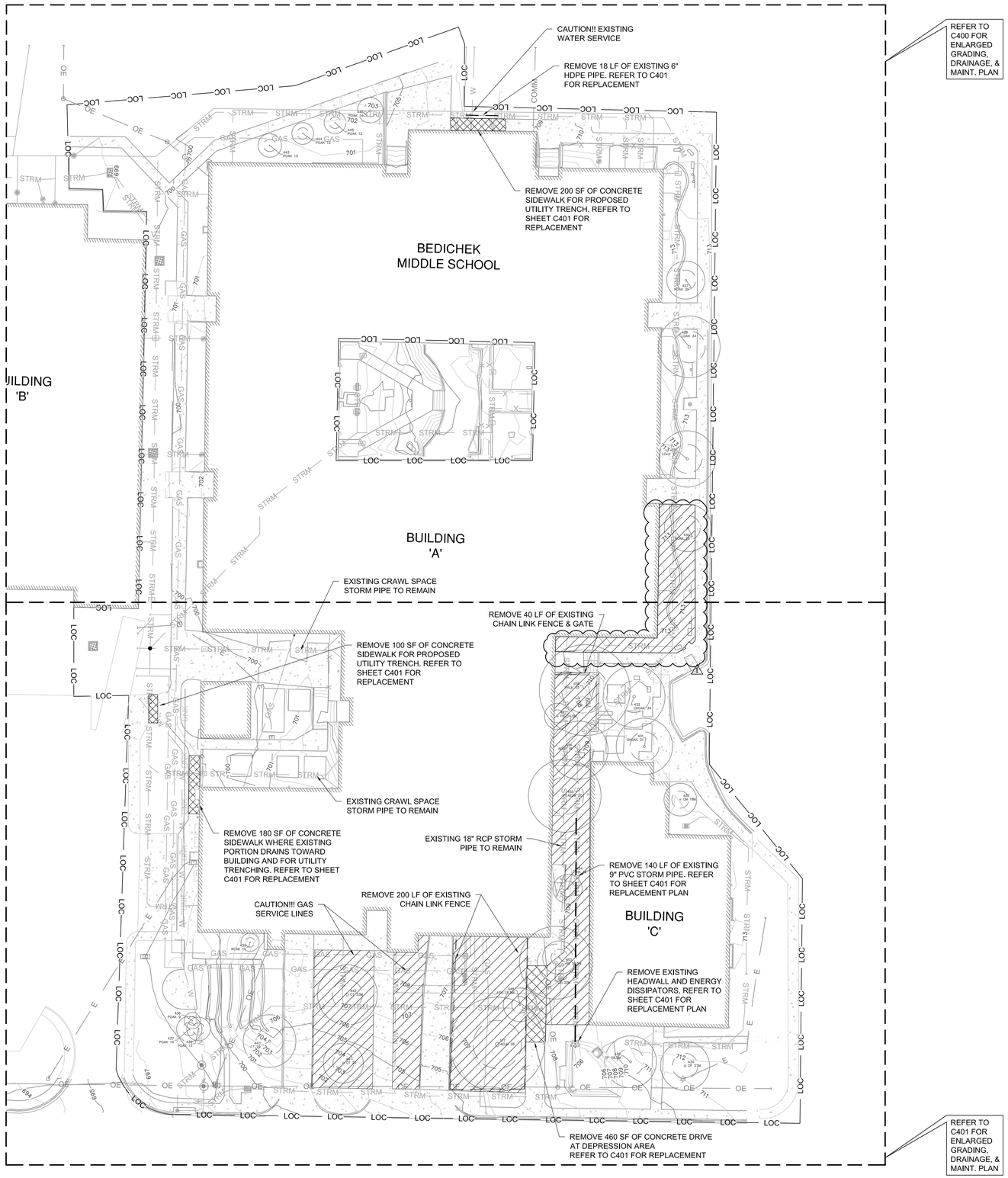
Date	09/30/2020
Job Number	20-0029
Scale	1" = 50'-0"
Drawn	CR
Checked	MC
Approved	MC

TITLE

SCOPE OUTLINE

SHEET

G0.01



1 CIVIL DEMOLITION PLAN
SCALE: 1" = 30'-0"

30' 20' 10' 0 30' 60'
1"=30'

LEGEND

TREE TRUNK
50% CRITICAL ROOT ZONE
100% CRITICAL ROOT ZONE
EXISTING TREE

LOC LOC LIMITS OF CONSTRUCTION

PAVEMENT DEMOLITION

VEGETATION & DEBRIS (REMOVAL)

GENERAL DEMOLITION NOTES

1. ALL TREES ARE TO REMAIN AND BE PROTECTED U.N.O
2. ALL SIDEWALK AND PAVEMENT REMOVAL SHALL BE DONE FROM JOINT TO JOINT.

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
KINGS STRUCTURAL ENGINEERING

TBPE Firm #10701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
Office: 813-855-3330
P.O. Box 1377
Fax: 727-726-2070
Safety Harbor, FL 34695

Jose I. Guerra, Inc.
Consulting Engineers
1701 Directors Blvd. Suite 400
Austin, Texas 78744
(512) 445-2090
Civil + Structural + Mechanical + Electrical
TBPE FIRM F-3

hcg hollon+cannon group, llc

AUSTIN I.S.D.
DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX
78745
AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
GLENN CHRISTOPHER FREY
123856
LICENSED
PROFESSIONAL ENGINEER
09-30-2020

REVISIONS

No.	Issue	Date
1	ADDENDUM 4	09-30-2020

SHEET INFORMATION

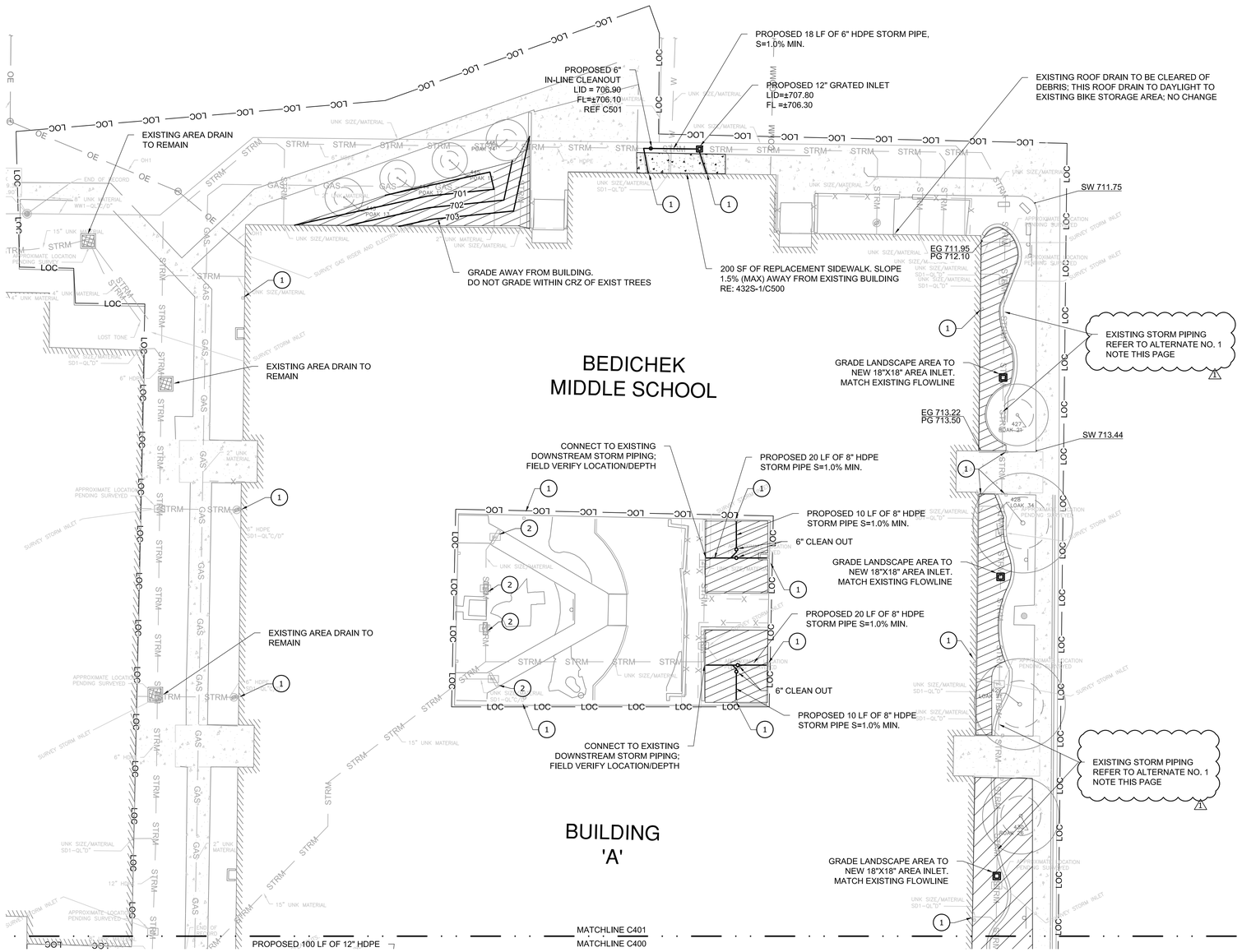
Date	09/04/2020
Job Number	20-0029
Scale	1" = 30'-0"
Drawn	RH
Checked	GF
Approved	

TITLE

CIVIL DEMOLITION PLAN

SHEET

C300



1 CIVIL ENLARGED GRADING, DRAINAGE, & MAINTENANCE PLAN – NORTH

SCALE: 1" = 20'-0"

20' 10' 0 20' 40'

1"=20'

GRADING NOTES:

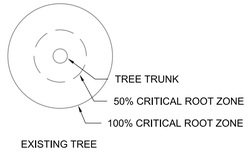
1. ALL TREES 8"Ø OR GREATER ARE TO REMAIN AND BE PROTECTED, U.N.O. NO GRADING OR DISTURBANCE PERMITTED IN THE 50% CRZ OF ANY TREE TO REMAIN.
2. ALL DISTURBED AREAS TO BE RESTORED AND PERMANENTLY VEGETATED. REFER TO SHEET C100 FOR PERMANENT VEGETATION REQUIREMENTS.

KEYNOTES:

1. FLUSH DOWNSPOUTS TO CLEAR DEBRIS & CONNECT / RECONNECT TO UNDERGROUND STORMDRAIN, U.N.O.
2. CLEAR DEBRIS SEDIMENTS FROM EXISTING INLETS. FLUSH STORM LINES BETWEEN INLETS & OUTFALL LOCATIONS.
3. RE-GRADE ALL AREAS WHERE INDICATED THIS SHEET TO POSITIVE SLOPE AWAY FROM BUILDING.

LEGEND

- 712 — EXISTING CONTOUR
- 712 — PROPOSED CONTOUR
- EXISTING FLOW ARROW
- LOC — LOC — LIMITS OF CONSTRUCTION
- SD — EXISTING STORM DRAIN
- SD — PROPOSED STORM DRAIN
- AREA OF RE-GRADING
- EXISTING CONCRETE PAVEMENT
- PROPOSED CONCRETE PAVEMENT REPLACEMENT



EXISTING TREE

Point Table	
Point #	Tree Description
117	26"AELM
427	21"ROAK
428	34"LOAK
429	31"LOAK
430	26"ROAK
431	31"CHOAK
432	34"CHOAK
433	18M"CM
434	27M"CPEAR
435	28.5M"CPEAR
436	9"POAK
437	14"POAK
438	13"POAK
439	10"ROAK

Point Table	
Point #	Tree Description
440	29"CT
441	22"CT
442	33M"CT
443	13"POAK
444	12"POAK
445	12"POAK
446	14"POAK
448	18.5M"ASH
452	20M"CE
453	18.5M"HACKBERRY
454	16"HACKBERRY
455	20"AELM
456	16"AELM
458	25"PALM

CIVIL ALTERNATE NO. 1 :

1. CONTRACTOR TO PROVIDE UNIT PRICING TO CLEAN AND FLUSH EXISTING STORM WATER LINES.

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
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Austin, TX 78750
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Civil + Structural + Mechanical + Electrical
TBPE FIRM F-3

gh hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
GLENN CHRISTOPHER FREY
123856
LICENSED PROFESSIONAL ENGINEER
09-30-2020

REVISIONS

No.	Issue	Date
1	ADDENDUM 4	09-30-2020

SHEET INFORMATION

Date	09/04/2020
Job Number	20-0029
Scale	1" = 20'-0"
Drawn	RH
Checked	GF
Approved	

TITLE

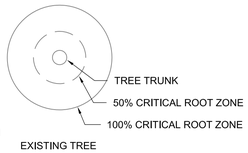
CIVIL ENLARGED GRADING, DRAINAGE, & MAINT. PLAN - NORTH

SHEET

C400

LEGEND

- 712 — EXISTING CONTOUR
- 712 — PROPOSED CONTOUR
- EXISTING FLOW ARROW
- LOC — LOC — LIMITS OF CONSTRUCTION
- SD — EXISTING STORM DRAIN
- SD — PROPOSED STORM DRAIN
- AREA OF RE-GRADING
- EXISTING CONCRETE PAVEMENT
- PROPOSED CONCRETE PAVEMENT REPLACEMENT



EXISTING TREE

GRADING NOTES:

1. ALL TREES 8"Ø OR GREATER ARE TO REMAIN AND BE PROTECTED, U.N.O.
   NO GRADING OR DISTURBANCE PERMITTED IN THE 50% CRZ OF ANY TREE TO REMAIN.

KEYNOTES:

1. FLUSH DOWNSPOUTS TO CLEAR DEBRIS & CONNECT / RECONNECT TO UNDERGROUND STORMDRAIN, U.N.O.
2. CLEAR DEBRIS SEDIMENTS FROM EXISTING INLETS. FLUSH STORM LINES BETWEEN INLETS & OUTFALL LOCATIONS.
3. RE-GRADE ALL AREAS WHERE INDICATED THIS SHEET TO POSITIVE SLOPE AWAY FROM BUILDING.

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430	26"ROAK
431	31"CHOAK
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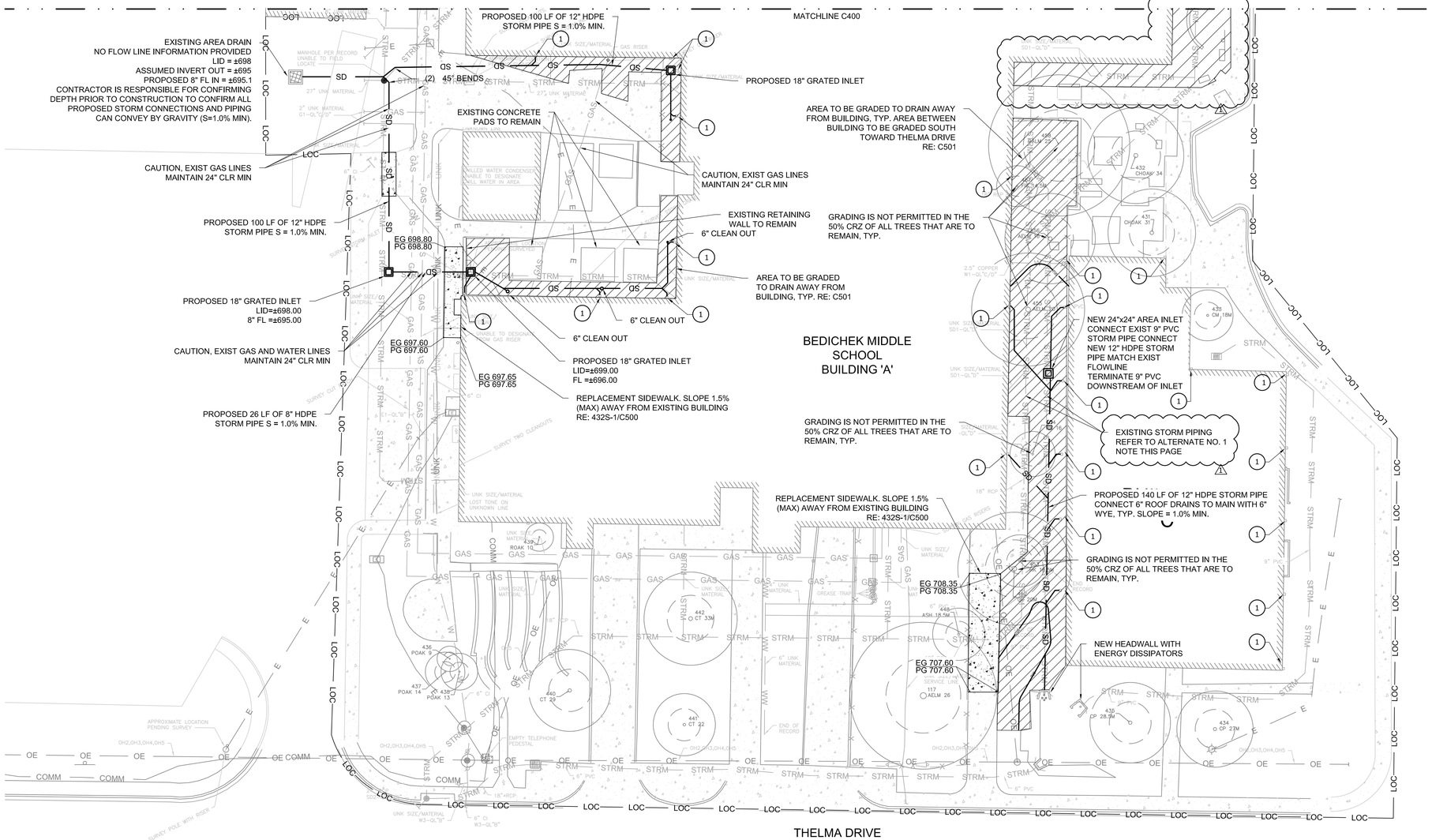

CIVIL ALTERNATE NO. 1 :

1. CONTRACTOR TO PROVIDE UNIT PRICING TO CLEAN AND FLUSH EXISTING STORM WATER LINES.

1 CIVIL ENLARGED GRADING, DRAINAGE, & MAINTENANCE PLAN – SOUTH

SCALE: 1" = 20'-0"

20' 10' 0 20' 40'

1"=20'

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AUSTIN I.S.D.

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BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
GLENN CHRISTOPHER FREY
123856
LICENSED PROFESSIONAL ENGINEER
09-30-2020

REVISIONS

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SHEET INFORMATION

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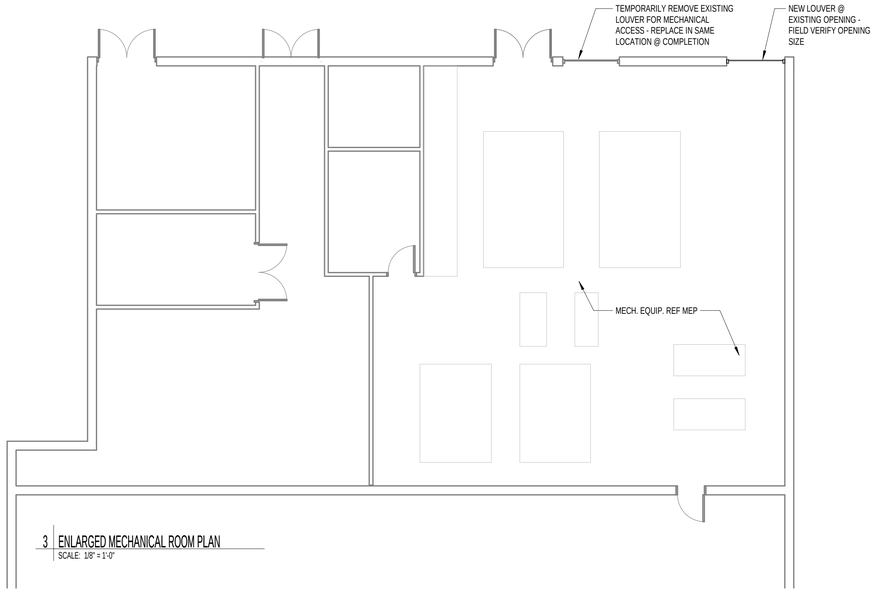
Drawn	RH
Checked	GF
Approved	

TITLE

CIVIL ENLARGED GRADING, DRAINAGE, & MAINT. PLAN - SOUTH

SHEET

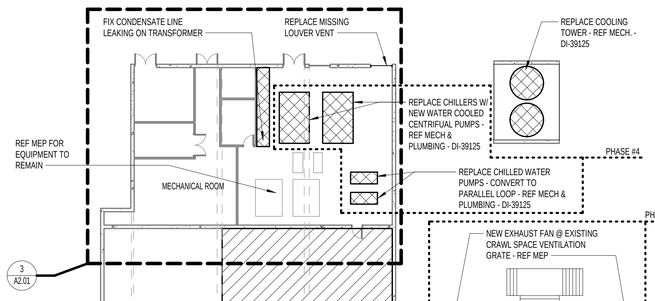
C401

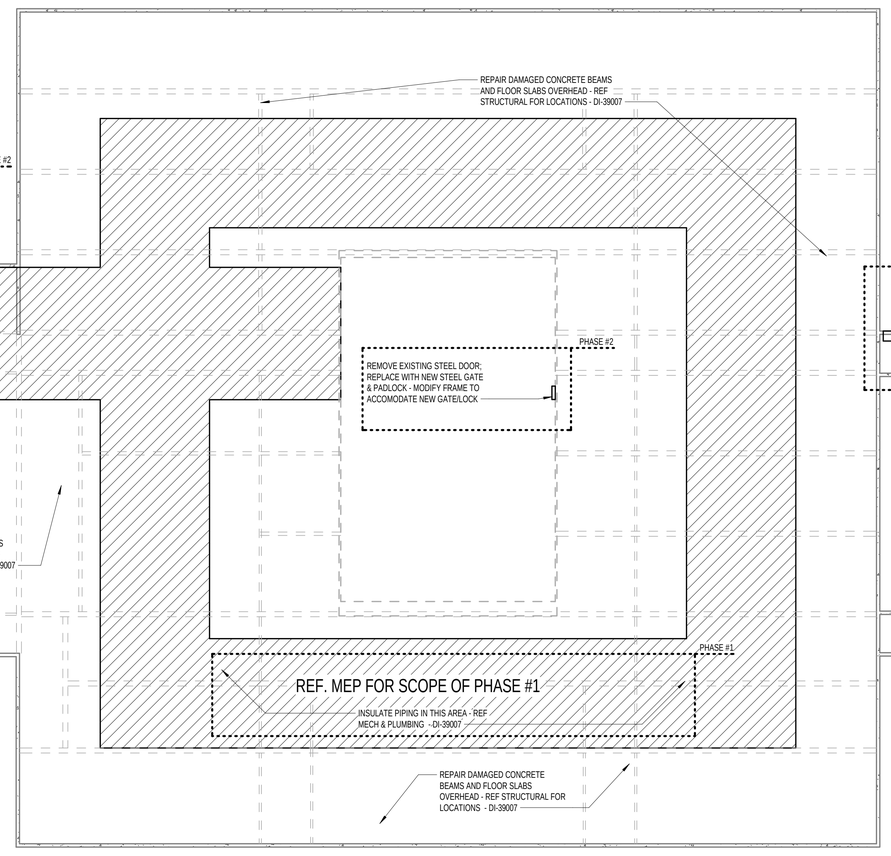


3 ENLARGED MECHANICAL ROOM PLAN
SCALE: 1/8" = 1'-0"

GENERAL NOTES

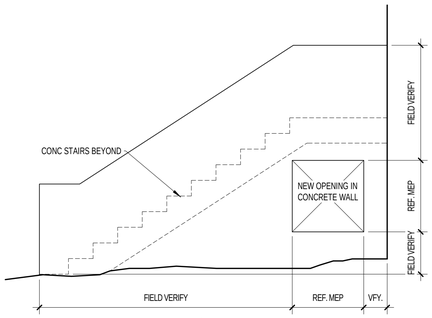
1. FIELD VERIFY ALL EXISTING CONDITIONS AND UTILITIES WITH THE EXISTING PLANS. VARIATIONS SHALL BE REPORTED TO THE A/E TEAM FOR RESOLUTION.
2. ALL PENETRATIONS THROUGH FIRE RATED WALLS SHALL BE SEALED AND CAULKED PER THE REQUIRED RATING AND SPECIFICATIONS.
3. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF BOTH REMOVED MATERIAL AND ALL FINISHES ADJACENT TO WORK SCHEDULE FOR DEMOLITION. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING THE DAMAGE DONE BY ANY AND ALL OPERATIONS UNDER THIS CONTRACT.
4. THE GENERAL CONTRACTOR SHALL MAINTAIN AND PROTECT EXISTING CORRIDOR FLOORING IN RENOVATED AREAS AND ROUTES FOR MATERIAL HANDLING. FLOORING SHALL BE CLEANED TO OWNER'S STANDARD MAINTENANCE PROCEDURES.
5. DEMOLITION INDICATED ON THE DRAWINGS HAS BEEN DETERMINED BY RECORD DRAWINGS AND FIELD OBSERVATIONS. AREAS DESIGNATED FOR DEMOLITION ARE GENERALLY SHOWN. THE GENERAL CONTRACTOR SHALL BEAR RESPONSIBILITY FOR DEMOLITION REQUIRED BY JOB SITE CONDITIONS AND RENOVATION DRAWINGS.
6. REFER TO MEP DRAWINGS FOR INFORMATION CONCERNING THE DEMOLITION OF MECHANICAL, ELECTRICAL, AND PLUMBING ITEMS.
7. THE OWNER SHALL HAVE THE FIRST RITE OF REFUSAL ON ALL ITEMS SCHEDULED FOR DEMOLITION.
8. ALL ITEMS TO BE REMOVED ARE INDICATED WITH DASHED LINES ON DEMOLITION PLAN. DISPOSE OF THESE ITEMS AFTER CHECKING WITH PROJECT MANAGER FOR ITEMS TO BE REUSED.
9. ELECTRICAL AND MECHANICAL INSTALLATIONS MAY REQUIRE WORK IN SOME OF THE EXISTING PARTITIONS.
10. IF ANY CONDUIT OR UTILITY LINE IS CUT WHILE SLEEVING THE SLAB, HAMMER DRILLING OR REMOVING A PARTITION, THE CONTRACTOR SHALL REPAIR IT IMMEDIATELY.
11. THE GENERAL CONTRACTOR SHALL PREPARE SURFACES TO RECEIVE NEW FINISHES.
12. A MINIMUM OF 75% CONSTRUCTION WASTE TO BE DIVERTED FROM LANDFILL IN ACCORDANCE WITH AISD SUSTAINABILITY STANDARDS.
13. DURING DEMOLITION, IN THE EVENT THE CONTRACTOR UNCOVERS MATERIALS CONTAINING ASBESTOS, LEAD, OR MERCURY, CONTRACTOR IS TO NOTIFY THE OWNER IMMEDIATELY AND ENSURE PROPER DISPOSAL PER LOCAL CODES AND ORDINANCES.



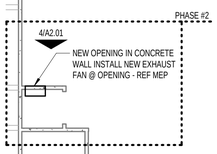


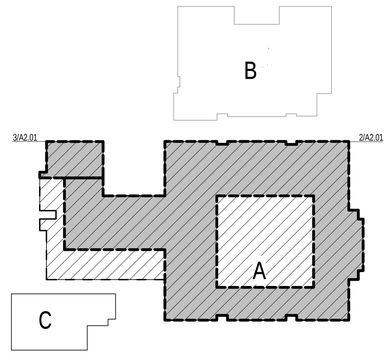
NOTE: REFERENCE ABATEMENT PLAN & SPECIFICATIONS FOR ASBESTOS LOCATIONS & REMEDIATION PROCEDURES
1

2 SUBFLOOR & MECH. ROOM
SCALE: 3/64" = 1'-0"



4 FAN OPENING @ EXTERIOR STAIR - PHASE #2
SCALE: 3/8" = 1'-0"





1 KEY PLAN - MECH. ROOM
SCALE: 1" = 100'-0"

NORTH
PROJECT NORTH

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DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

REGISTERED ARCHITECT STATE OF TEXAS

09/30/2020

REVISIONS

No.	Issue	Date
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1	Addendum #4	09/30/2020

SHEET INFORMATION

Date	09/30/2020
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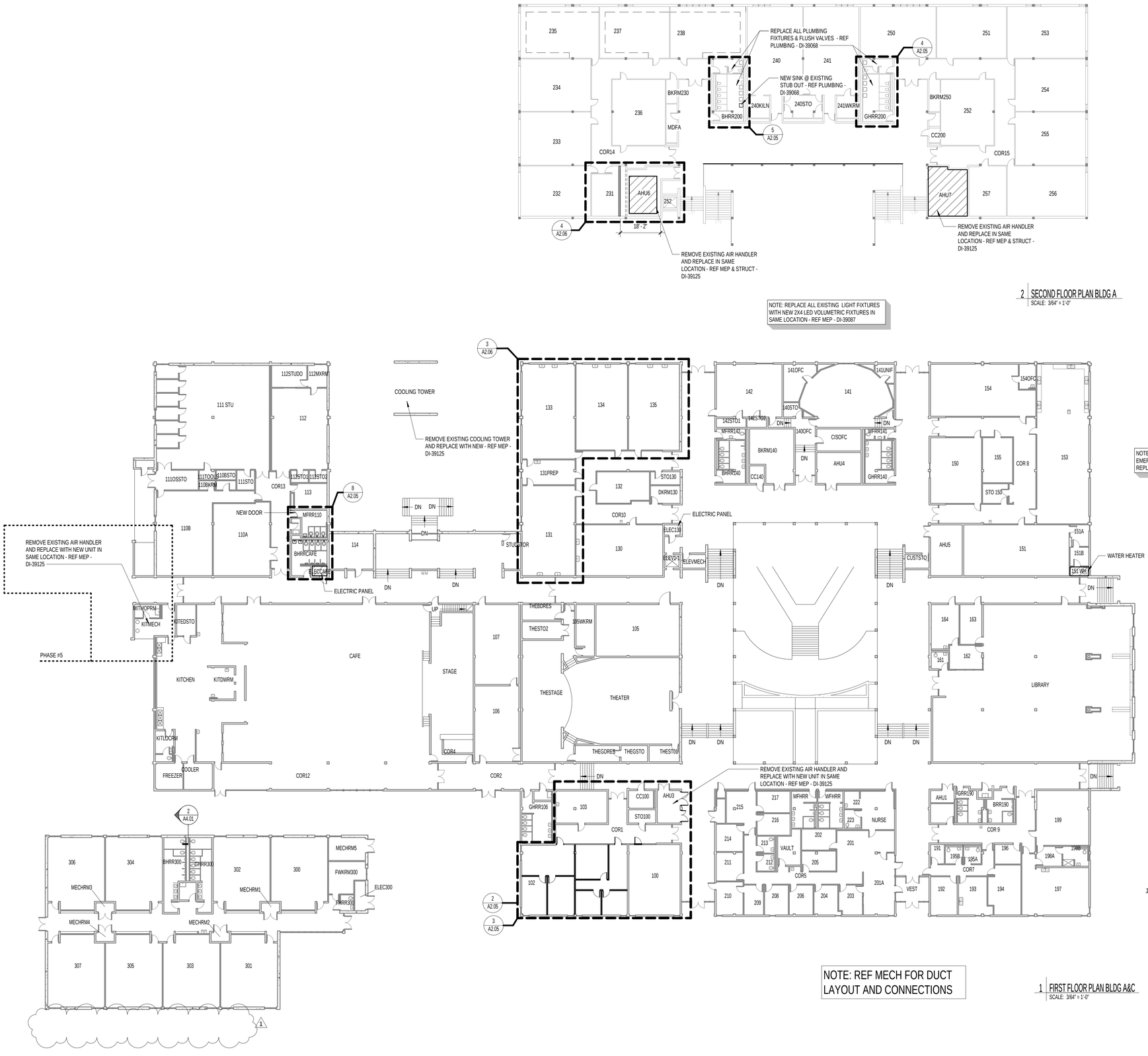
Scale	As indicated
Drawn	CR
Checked	MC
Approved	MC

TITLE

SUBFLOOR PLAN

SHEET

A2.01



2 SECOND FLOOR PLAN BLDG A
SCALE: 3/64" = 1'-0"

1 FIRST FLOOR PLAN BLDG A&C
SCALE: 3/64" = 1'-0"

4 KEY PLAN - OVERALL
SCALE: 1" = 100'-0"

GENERAL NOTES

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BEDICHEK MIDDLE SCHOOL RENOVATIONS

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AISD PROJECT No. 200029-BEDCHK

REGISTERED ARCHITECT — STATE OF TEXAS

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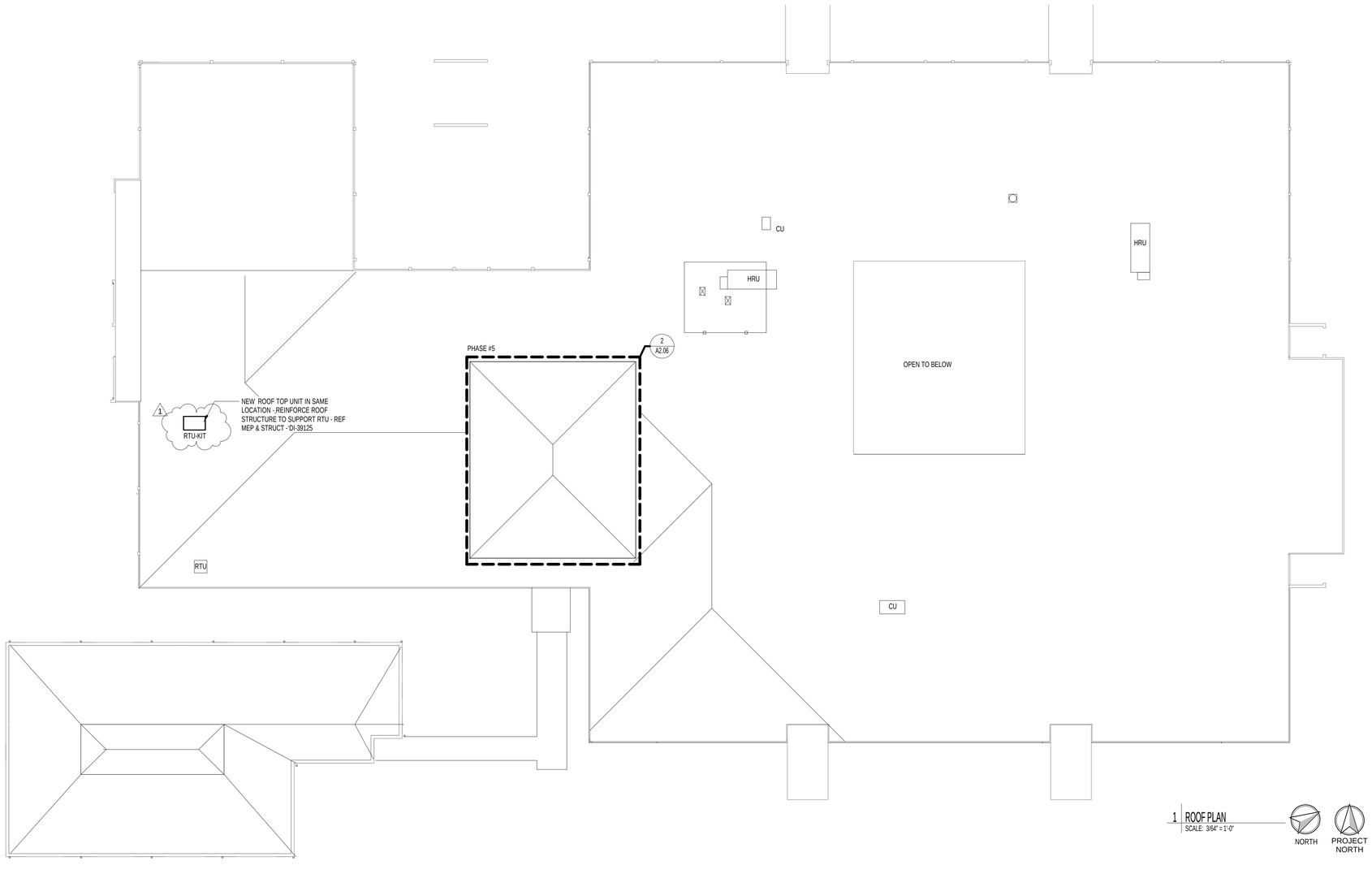
TITLE

FLOOR PLANS

SHEET

A2.02



1 ROOF PLAN
SCALE: 3/64" = 1'-0"

NORTH

PROJECT NORTH

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REGISTERED ARCHITECT MICHAEL CRAIG WILSON STATE OF TEXAS

09/30/2020

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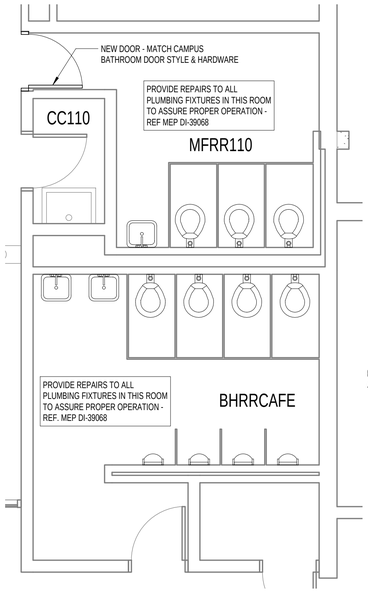
TITLE

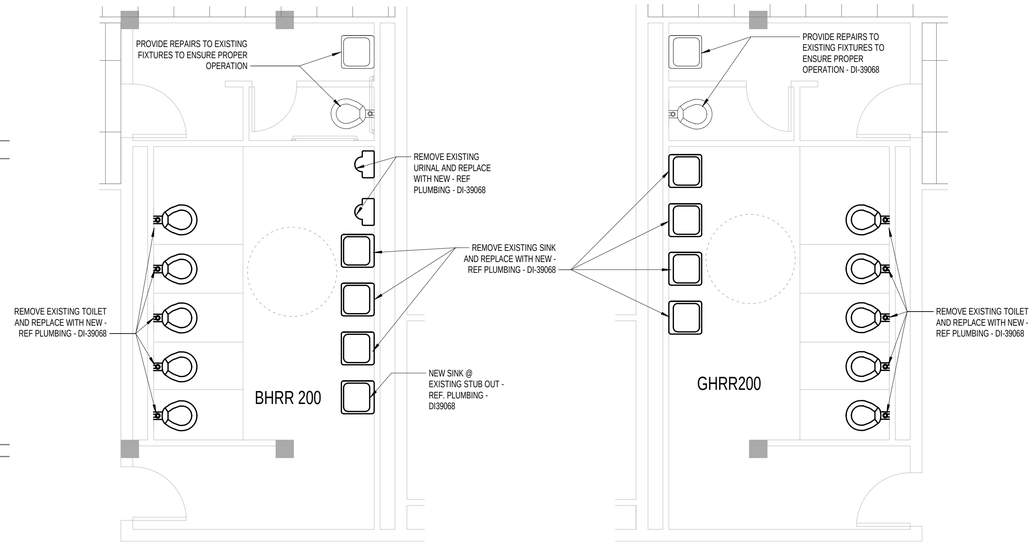
ROOF PLAN - OVERALL

SHEET

A2.04



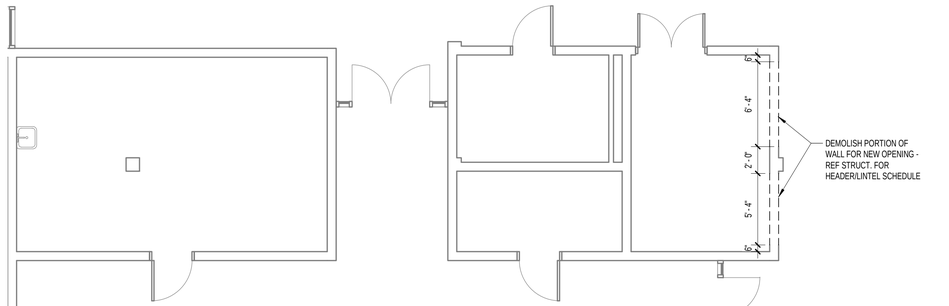
8 FACULTY RESTROOM 110
SCALE: 1/4" = 1'-0"

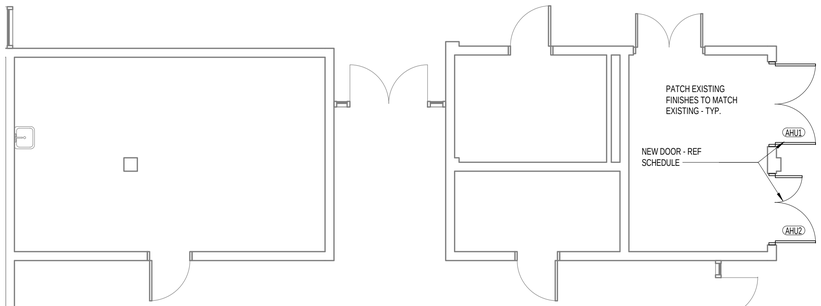


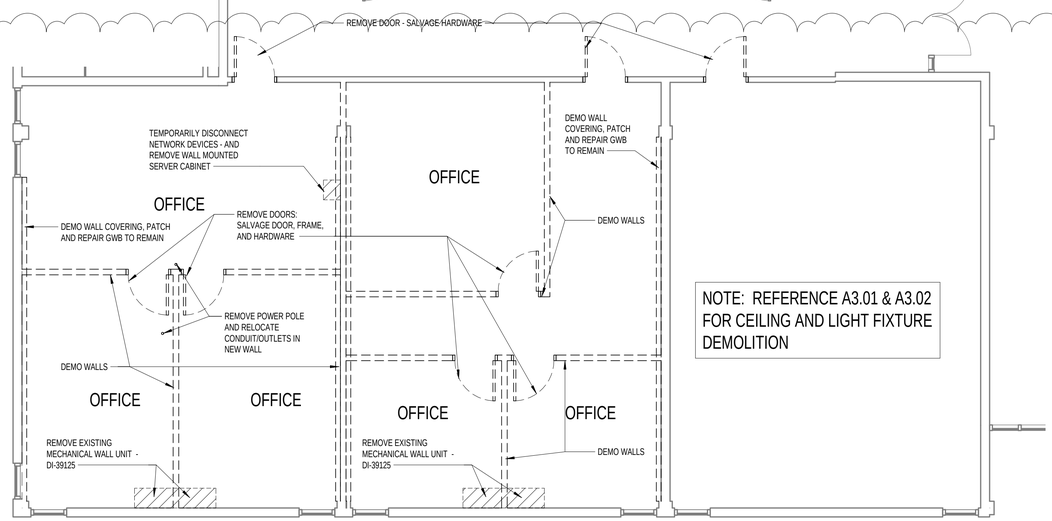
5 BHRR200 ENLARGED PLAN
SCALE: 1/4" = 1'-0"

4 GHRR200 ENLARGED PLAN
SCALE: 1/4" = 1'-0"

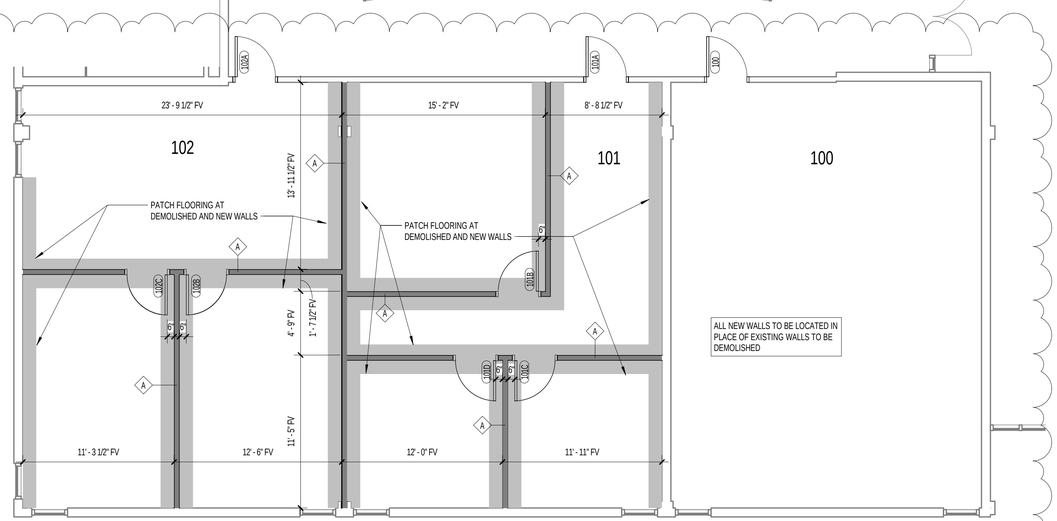
NOTE: REFERENCE ABATEMENT PLAN &
SPECIFICATIONS FOR AESBESTOS
LOCATIONS & REMEDIATION PROCEDURES







2 ADMINISTRATIVE WING ENLARGED DEMO PLAN
SCALE: 3/16" = 1'-0"



NOTE: MATCH EXISTING VCT FLOORING
MATCH EXISTING WALL PAINT AND BASE

3 ADMINISTRATIVE WING ENLARGED PLAN
SCALE: 3/16" = 1'-0"

GENERAL NOTES:

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2. ALL PENETRATIONS THROUGH FIRE RATED WALLS SHALL BE SEALED AND CAULKED PER THE REQUIRED RATING AND SPECIFICATIONS.
3. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF BOTH REMOVED MATERIAL AND ALL FINISHES ADJACENT TO WORK SCHEDULE FOR DEMOLITION. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING THE DAMAGE DONE BY ANY AND ALL OPERATIONS UNDER THIS CONTRACT.
4. THE GENERAL CONTRACTOR SHALL MAINTAIN AND PROTECT EXISTING CORRIDOR FLOORING IN RENOVATED AREAS AND ROUTES FOR MATERIAL HANDLING. FLOORING SHALL BE CLEANED TO OWNER'S STANDARD MAINTENANCE PROCEDURES.
5. DEMOLITION INDICATED ON THE DRAWINGS HAS BEEN DETERMINED BY RECORD DRAWINGS AND FIELD OBSERVATIONS. AREAS DESIGNATED FOR DEMOLITION ARE GENERALLY SHOWN. THE GENERAL CONTRACTOR SHALL BEAR RESPONSIBILITY FOR DEMOLITION REQUIRED BY JOB SITE CONDITIONS AND RENOVATION DRAWINGS.
6. REFER TO MEP DRAWINGS FOR INFORMATION CONCERNING THE DEMOLITION OF MECHANICAL, ELECTRICAL, AND PLUMBING ITEMS.
7. THE OWNER SHALL HAVE THE FIRST RITE OF REFUSAL ON ALL ITEMS SCHEDULED FOR DEMOLITION.
8. ALL ITEMS TO BE REMOVED ARE INDICATED WITH DASHED LINES ON DEMOLITION PLAN. DISPOSE OF THESE ITEMS AFTER CHECKING WITH PROJECT MANAGER FOR ITEMS TO BE REUSED.
9. ELECTRICAL AND MECHANICAL INSTALLATIONS MAY REQUIRE WORK IN SOME OF THE EXISTING PARTITIONS.
10. IF ANY CONDUIT OR UTILITY LINE IS CUT WHILE SLEEVING THE SLAB, HAMMER DRILLING OR REMOVING A PARTITION, THE CONTRACTOR SHALL REPAIR IT IMMEDIATELY.
11. THE GENERAL CONTRACTOR SHALL PREPARE SURFACES TO RECEIVE NEW FINISHES.
12. A MINIMUM OF 75% CONSTRUCTION WASTE TO BE DIVERTED FROM LANDFILL IN ACCORDANCE WITH AISD SUSTAINABILITY STANDARDS.
13. DURING DEMOLITION, IN THE EVENT THE CONTRACTOR UNCOVERS MATERIALS CONTAINING ASBESTOS, LEAD, OR MERCURY, CONTRACTOR IS TO NOTIFY THE OWNER IMMEDIATELY AND ENSURE PROPER DISPOSAL PER LOCAL CODES AND ORDINANCES.

LEGEND:

EXISTING WALLS TO REMAIN

NEW CONSTRUCTION -
REF PARTITION TYPES

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

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KINGS STRUCTURAL ENGINEERING

TBPE Firm #10701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813 - 855 - 3330
Fax: 727 - 726 - 9070

Jose I. Guerra, Inc
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holloncannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745
AISD PROJECT No. 200029-BEDCHK

REGISTERED ARCHITECT STATE OF TEXAS

09/30/2020

REVISIONS

No.	Issue	Date
0	Issued for Bid & Permit	09/04/2020
1	Addendum #4	09/30/2020

SHEET INFORMATION

Date	09/30/2020
Job Number	20-0029
Scale	As indicated
Drawn	CR
Checked	MC
Approved	MC

TITLE

ENLARGED PLANS

SHEET

A2.05

GENERAL NOTES:

1. FIELD VERIFY ALL EXISTING CONDITIONS AND UTILITIES WITH THE EXISTING PLANS. VARIATIONS SHALL BE REPORTED TO THE A/E TEAM FOR RESOLUTION.
2. ALL PENETRATIONS THROUGH FIRE RATED WALLS SHALL BE SEALED AND CAULKED PER THE REQUIRED RATING AND SPECIFICATIONS.
3. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF BOTH REMOVED MATERIAL AND ALL FINISHES ADJACENT TO WORK SCHEDULE FOR DEMOLITION. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING THE DAMAGE DONE BY ANY AND ALL OPERATIONS UNDER THIS CONTRACT.
4. THE GENERAL CONTRACTOR SHALL MAINTAIN AND PROTECT EXISTING CORRIDOR FLOORING IN RENOVATED AREAS AND ROUTES FOR MATERIAL HANDLING. FLOORING SHALL BE CLEANED TO OWNER'S STANDARD MAINTENANCE PROCEDURES.
5. DEMOLITION INDICATED ON THE DRAWINGS HAS BEEN DETERMINED BY RECORD DRAWINGS AND FIELD OBSERVATIONS. AREAS DESIGNATED FOR DEMOLITION ARE GENERALLY SHOWN. THE GENERAL CONTRACTOR SHALL BEAR RESPONSIBILITY FOR DEMOLITION REQUIRED BY JOB SITE CONDITIONS AND RENOVATION DRAWINGS.
6. REFER TO MEP DRAWINGS FOR INFORMATION CONCERNING THE DEMOLITION OF MECHANICAL, ELECTRICAL, AND PLUMBING ITEMS.
7. THE OWNER SHALL HAVE THE FIRST RITE OF REFUSAL ON ALL ITEMS SCHEDULED FOR DEMOLITION.
8. ALL ITEMS TO BE REMOVED ARE INDICATED WITH DASHED LINES ON DEMOLITION PLAN. DISPOSE OF THESE ITEMS AFTER CHECKING WITH PROJECT MANAGER FOR ITEMS TO BE REUSED.
9. ELECTRICAL AND MECHANICAL INSTALLATIONS MAY REQUIRE WORK IN SOME OF THE EXISTING PARTITIONS.
10. IF ANY CONDUIT OR UTILITY LINE IS CUT WHILE SLEEVING THE SLAB, HAMMER DRILLING OR REMOVING A PARTITION, THE CONTRACTOR SHALL REPAIR IT IMMEDIATELY.
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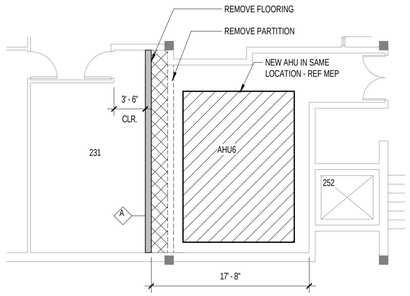
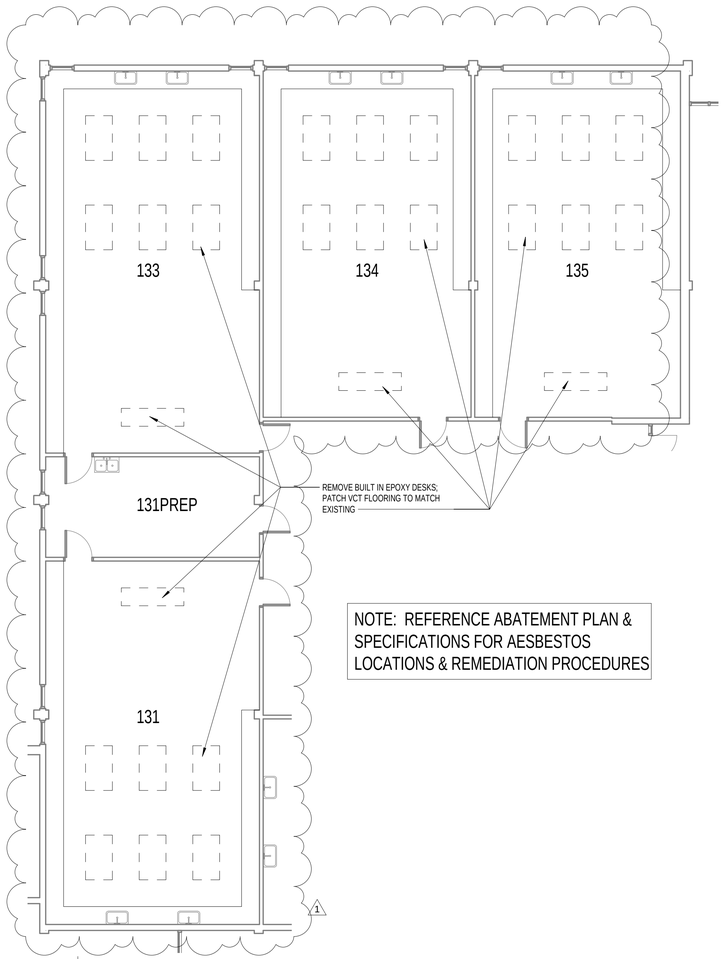


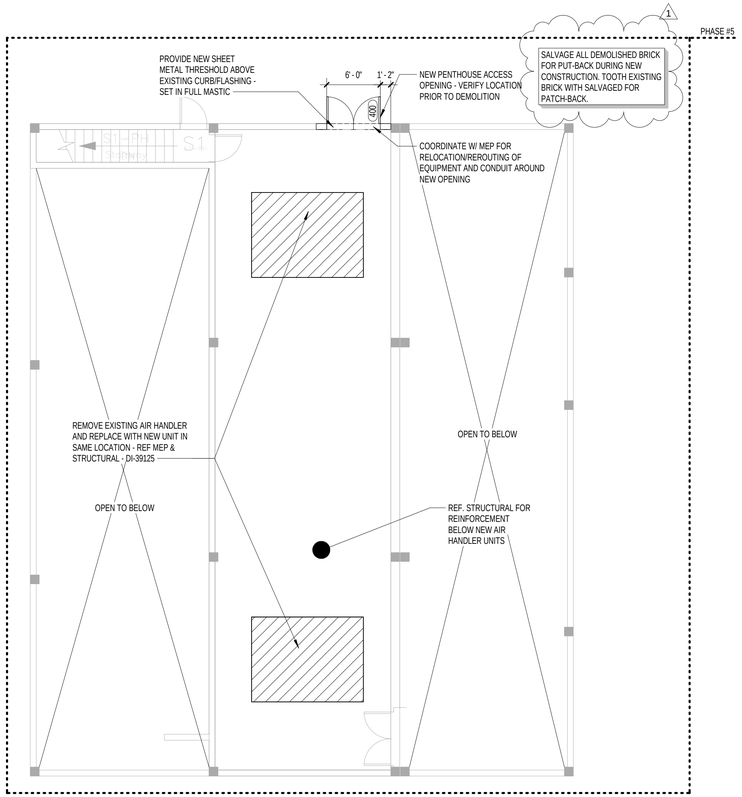
4 AHU-6 ENLARGED PLAN
SCALE: 1/8" = 1'-0"

NOTE: PATCH AND REPAIR ALL FLOOR FINISHES AND CEILINGS ADJACENT TO DEMOLITION OR NEW CONSTRUCTION



NOTE: REFERENCE ABATEMENT PLAN & SPECIFICATIONS FOR AESBESTOS LOCATIONS & REMEDIATION PROCEDURES

3 ROOMS 131-135 ENLARGED PLAN
SCALE: 1/8" = 1'-0"



2 PENTHOUSE PLAN
SCALE: 1/8" = 1'-0"

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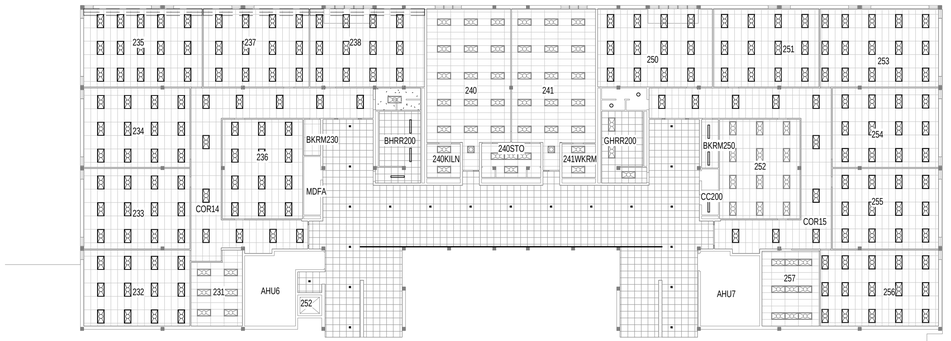
ENLARGED PLANS

SHEET

A2.06



2 RCP BUILDING A SECOND FLOOR
SCALE: 3/64" = 1'-0"

1 RCP BUILDINGS A&C
SCALE: 3/64" = 1'-0"

NORTH

PROJECT NORTH

GENERAL NOTES:

NOTE: CEILING PLANS SHOWN FOR INFORMATION ONLY. REFERENCE ELECTRICAL DRAWINGS FOR NEW LIGHTING SCHEDULES AND INSTALLTION NOTES.

1. ALL PENETRATIONS THROUGH FIRE RATED WALL SHALL BE SEALED CAULKED PER THE REQUIRED RATING AND SPECIFICATION.
2. ALL AREAS SCHEDULED TO RECEIVE NEW FINISHES ARE TO BE INSPECTED FOR ANY PATCHING THAT MAY BE REQUIRED DUE TO EXISTING CONDITIONS. PERFORM ALL PATCHING AS REQUIRED PRIOR TO APPLICATION OF NEW FINISHES.
3. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS. DRAWN INFORMATION SHALL NOT SUPERSEDE ACTUAL CONDITIONS.
4. COORDINATE THE LOCATION OF THE LIGHTS WITH THE DUCTWORK, FIRE SUPRESSION SYSTEM, AND OTHER CEILING ELEMENTS. REF MEP.
5. ALL DIMENSIONS ARE TO FACE OF FRAMING, UNLESS OTHERWISE NOTED.

REFLECTED CEILING PLAN LEGEND:

- EXISTING WALLS TO REMAIN
- NEW CONSTRUCTION - REF PARTITION TYPES
- 1 HOUR RATED WALL CONSTRUCTION
- EXISTING CEILING TILE AND GRID TO REMAIN PROTECT EXISTING DURING CONSTRUCTION
- EXISTING CEILING TILE AND GRID TO BE REMOVED AND DISCARDED
- NEW 2'X4' ACOUSTIC CEILING TILE AND GRID - ACT-1
- NOTE: CEILINGS ARE CENTERED IN THE ROOM UNLESS NOTED OTHERWISE
- NEW 2'X2' ACOUSTIC CEILING TILE AND GRID - ACT-1
- NEW 2'X4' LIGHT FIXTURE - REF ELEC
- NEW SQUARE LIGHT FIXTURE - REF ELEC
- NEW EXIT SIGN - REF ELEC
- NEW SUPPLY AIR DIFFUSER - REF MECH
- NEW RETURN AIR GRILLE - REF MECH
- NEW DIRECTIONAL CAN LIGHT - REF ELEC

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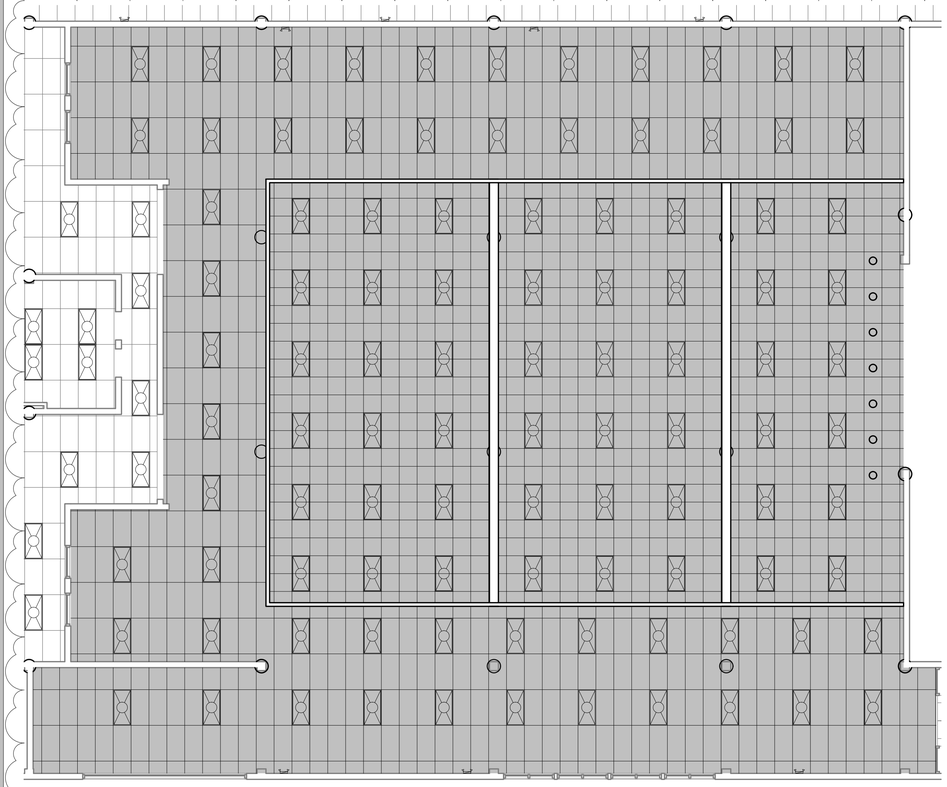
OVERALL RCP

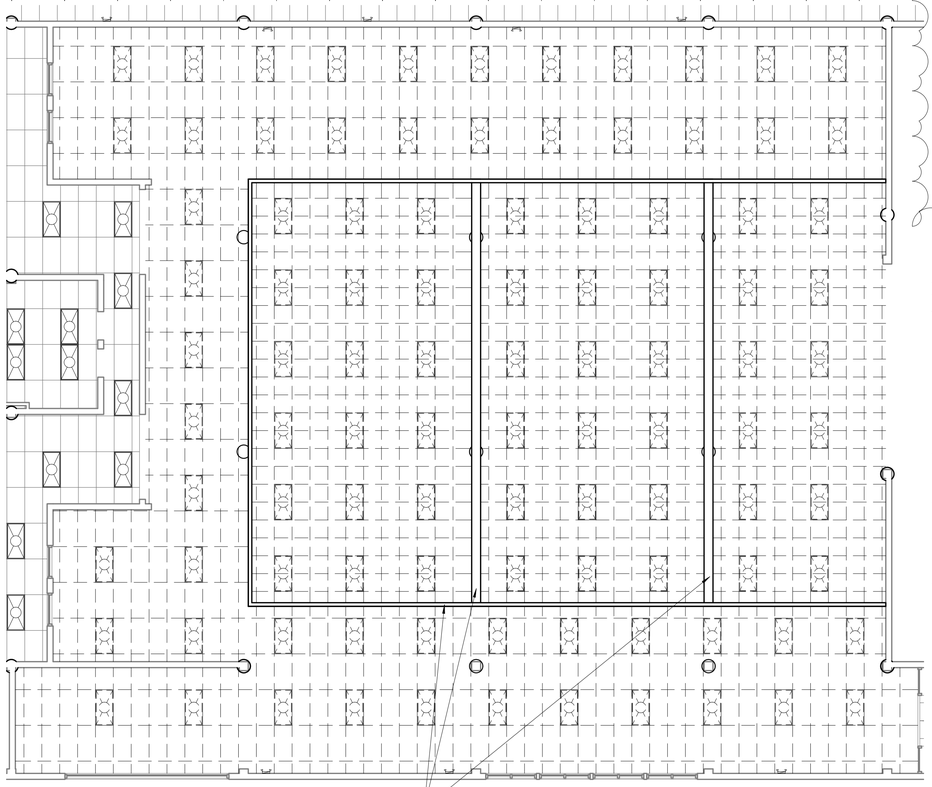
SHEET

A3.01



ALL EXISTING CABLING ABOVE NEW CEILING TO BE TIED BACK TO STRUCTURE ABOVE.

4 RCP - CAFETERIA - PHASE #3
SCALE: 1/8" = 1'-0"



EXISTING PAINTED SOFFITS TO REMAIN. PATCH, REPAIR & PAINT AS REQUIRED FOR NEW CEILING INSTALLATION.

3 DEMO RCP - CAFETERIA - PHASE #3
SCALE: 1/8" = 1'-0"

NOTE: CEILING PLANS SHOWN FOR INFORMATION ONLY. REF ELEC FOR NEW LIGHTING SCHEDULES AND INSTALLATION NOTES.

GENERAL NOTES:

NOTE: CEILING PLANS SHOWN FOR INFORMATION ONLY. REFERENCE ELECTRICAL DRAWINGS FOR NEW LIGHTING SCHEDULES AND INSTALLTION NOTES.

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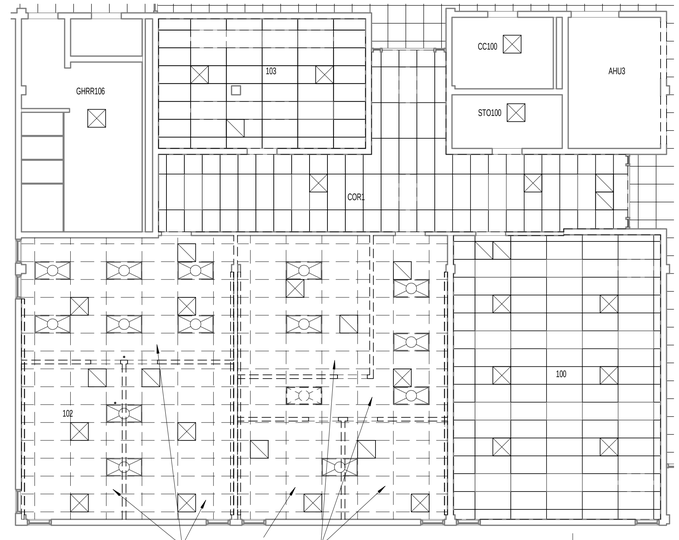
3. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS. DRAWN INFORMATION SHALL NOT SUPERSEDE ACTUAL CONDITIONS.
4. COORDINATE THE LOCATION OF THE LIGHTS WITH THE DUCTWORK, FIRE SUPRESSION SYSTEM, AND OTHER CEILING ELEMENTS. REF MEP.
5. ALL DIMENSIONS ARE TO FACE OF FRAMING, UNLESS OTHERWISE NOTED.

REFLECTED CEILING PLAN LEGEND:

- EXISTING WALLS TO REMAIN
- NEW CONSTRUCTION - REF PARTITION TYPES
- 1 HOUR RATED WALL CONSTRUCTION
- EXISTING CEILING TILE AND GRID TO REMAIN PROTECT EXISTING DURING CONSTRUCTION
- EXISTING CEILING TILE AND GRID TO BE REMOVED AND DISCARDED
- NEW 2'X4' ACOUSTIC CEILING TILE AND GRID - ACT-1
- NOTE: CEILINGS ARE CENTERED IN THE ROOM UNLESS NOTED OTHERWISE
- NEW 2'X2' ACOUSTIC CEILING TILE AND GRID - ACT-1
- NEW 2'X4' LIGHT FIXTURE - REF ELEC
- NEW SQUARE LIGHT FIXTURE - REF ELEC
- NEW EXIT SIGN - REF ELEC
- NEW SUPPLY AIR DIFFUSER - REF MECH
- NEW RETURN AIR GRILLE - REF MECH
- NEW DIRECTIONAL CAN LIGHT - REF ELEC

ALL EXISTING CABLING ABOVE NEW CEILING TO BE TIED BACK TO STRUCTURE ABOVE.

2 RCP ROOMS 100-106
SCALE: 1/8" = 1'-0"



REMOVE CEILING GRID & TILES

1 DEMO RCP ROOMS 100-106
SCALE: 1/8" = 1'-0"

1

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2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

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78745
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TITLE

ENLARGED RCP

SHEET

A3.02

DOOR SCHEDULE

MARK	DOOR TYPE	WIDTH	HEIGHT	THICKNESS	DOOR MATERIAL	DOOR FINISH	FRAME TYPE	FRAME MATERIAL	FRAME FINISH	HARDWARE SET	HEAD	JAMB	SILL	RATING	COMMENTS
100	A	3'-0"	7'-0"	0'-1 3/4"	WOOD	MATCH EXISTING	A	REUSE EXISTING	MATCH EXISTING	REUSE EXISTING	5/A4.01	5/A4.01		20 MIN	BASE BID
101A	A	3'-0"	7'-0"	0'-1 3/4"	WOOD	MATCH EXISTING	A	REUSE EXISTING	MATCH EXISTING	REUSE EXISTING	5/A4.01	5/A4.01		20 MIN	BASE BID
101B	A	3'-0"	7'-0"	0'-1 3/4"	EXISTING	EXISTING	A	REUSE EXISTING	MATCH EXISTING	REUSE EXISTING	5/A4.01	5/A4.01			BASE BID
101C	A	3'-0"	7'-0"	0'-1 3/4"	EXISTING	EXISTING	A	REUSE EXISTING	MATCH EXISTING	REUSE EXISTING	5/A4.01	5/A4.01			BASE BID
101D	A	3'-0"	7'-0"	0'-1 3/4"	EXISTING	EXISTING	A	REUSE EXISTING	MATCH EXISTING	REUSE EXISTING	5/A4.01	5/A4.01			BASE BID
102A	A	3'-0"	7'-0"	0'-1 3/4"	WOOD	MATCH EXISTING	A	REUSE EXISTING	MATCH EXISTING	REUSE EXISTING	5/A4.01	5/A4.01		20 MIN	BASE BID
102B	A	3'-0"	7'-0"	0'-1 3/4"	EXISTING	EXISTING	A	REUSE EXISTING	MATCH EXISTING	REUSE EXISTING	5/A4.01	5/A4.01			BASE BID
102C	A	3'-0"	7'-0"	0'-1 3/4"	EXISTING	EXISTING	A	REUSE EXISTING	MATCH EXISTING	REUSE EXISTING	5/A4.01	5/A4.01			BASE BID
AHU1	B	6'-2"	7'-0"	0'-1 3/4"	HM	MATCH EXISTING	B	HM	MATCH EXISTING	210R	4/A4.01 SIM	4/A4.01 SIM		45 MIN	BASE BID
AHU2	C	5'-0"	7'-0"	0'-1 3/4"	HM	MATCH EXISTING	C	HM	MATCH EXISTING	214	4/A4.01 SIM	4/A4.01 SIM		45 MIN	BASE BID
400	B	6'-2"	7'-0"	0'-1 3/4"	HM	MATCH EXISTING	B	HM	MATCH EXISTING	214	4/A4.01	4/A4.01			PHASE #5

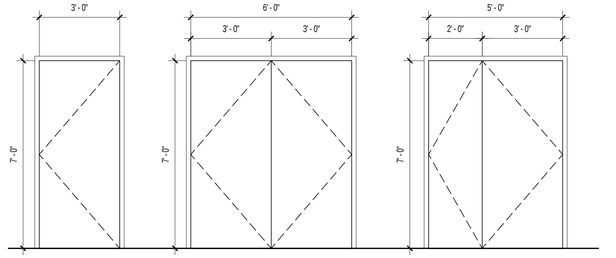
HARDWARE SCHEDULE

HARDWARE GROUP NO. 210R

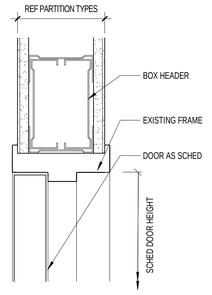
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	SET	CONSTANT LATCHING FLUSH BOLTS	FB51P	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	MA581-L/C SG	626	FAL
1	EA	CORE (CORMAX)	AS REQD	626	BES
1	EA	CYLINDER	AS REQUIRED	626	BES
1	EA	COORDINATIOR	COR	628	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH X SNB	689	LCN
1	SET	SEALS	5050	B	NGP
1	EA	ASTRAGAL	139SP X 5050	600	NGP

HARDWARE GROUP NO. 214

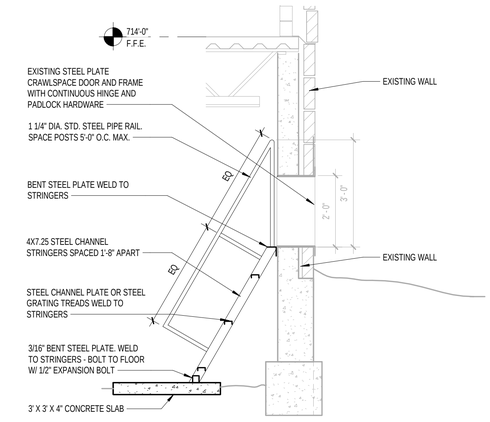
QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458-12" (24" TOP BOLT)	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	MA581-L/C SG	626	FAL
1	EA	CORE (CORMAX)	AS REQD	626	BES
1	EA	CYLINDER	AS REQUIRED	626	BES
1	EA	OH STOP	705 X SIZE AS REQ	626	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH X SNB	689	LCN
1	EA	DRIP CAP	16A	CL	NGP
1	SET	SEALS	120NA H&J	CL	NGP
1	EA	ASTRAGAL	139SP X 5050	600	NGP
2	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	425 SIA	CL	NGP



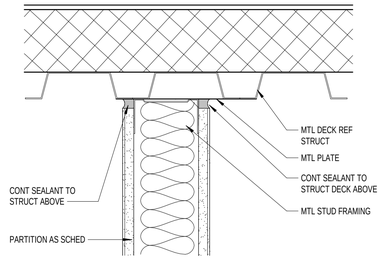
1 DOOR AND FRAME TYPES
SCALE: 3/8" = 1'-0"



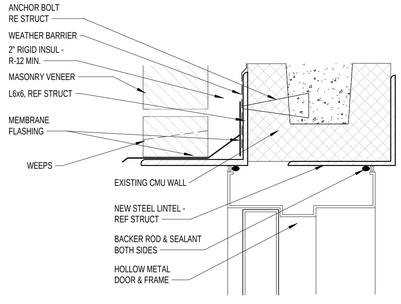
5 INTERIOR DOOR HEAD/JAMB
SCALE: 3" = 1'-0"



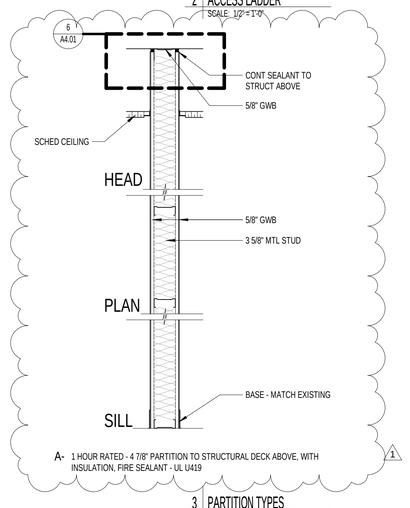
2 ACCESS LADDER
SCALE: 1/2" = 1'-0"



6 PARTITION TO DECK DETAIL
SCALE: 3" = 1'-0"



4 DOOR HEAD/JAM SIM
SCALE: 3" = 1'-0"



3 PARTITION TYPES
SCALE: 1" = 1'-0"

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DOOR SCHEDULE & DETAILS

SHEET

A4.01

NEW KITCHEN ROOFTOP UNIT SCHEDULE

REMARKS:

1 * WEIGHT IS APPROXIMATE AND DOES NOT INCLUDE ROOF CURB, UNIT ACCESSORIES OR OPTIONS.

MARK.	FAN CFM	MIN. O.A. CFM	MAX. O.A. CFM	EXT. SP "WC"	TSP "WC"	COOLING DATA							NATURAL GAS HEATING DATA				ELECTRICAL DATA								UNIT BASE WEIGHT (lbs) *	UNIT EER/ IEER/ SEER	MANUFACTURER	NOTES
						ENTERING AIR TEMP.		LEAVING AIR TEMP.		AMBIENT	TOTAL CAP BTUH	SENS. CAP BTUH	OUTPUT BTUH	HEATING EAT(°F)	HEATING LAT(°F)	STAGES	V/Φ	FANS			COMPRESSORS		UNIT					
						(°F) DB	(°F) WB	(°F) DB	(°F) WB	(°F) DB								S.A.	F.L.A.	COND.	RLA/CKT.	LRA	MCA	MOCP				
RTU-KIT	6,390	0	1,200	0.75"	1.6"	80°F	63°F	58°F	54°F	97°F	177,120	154,460	200,000	70.0	98.0	2	480/3	1@3 HP	1.30	2@0.94W DIRECT DRIVE	12.20	2@0.94W	35.00	45.00	2,700	12.1/ 14.00/ 14.00	TRANE YHD180G4RL 15-TON DX COOLING GAS HEAT	1, 2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

NOTES:

1. PROVIDE NEW 14" TALL ROOF CURB FOR NEW KITCHEN RTU-KIT. PROVIDE DISCONNECT, 120V CONVENIENCE GFCI RECEPTACLE, DUCT-MOUNTED SMOKE DETECTOR IN SUPPLY AIR DISCHARGE AND MERV 8 FILTERS. PROVIDE WITH 119.40 MBH OF HOT GAS REHEAT AND LOW LEAK ENTHALPY ECONOMIZER WITH MOTORIZED DAMPERS AND BAROMETRIC RELIEF. 1
2. NEW KITCHEN RTU-KIT SHALL BE TIED INTO THE EXPANDED TRIDIUM JACE BACNET CONTROLS. PROVIDE WITH ON-BOARD BACNET CONTROLLER. ALL CONTROLS TO BE INSTALLED BY AISD CONTROL'S CONTRACTOR.

NEW COOLING TOWER SCHEDULE

MARK	FAN MOTOR		EWT°F	LWT°F	GPM	NO. CELLS	OUTDOOR °F DESIGN WB	MTR. RPM	MANUFACTURER	OVERALL DIMENSIONS	WEIGHT	REMARKS
	HP	V/PH										
CT-1	2@ 15 EA.	480/3	95	85	1200	2 @ 900 GPM EA.	78	1800	MARLEY NC8403PAN	23'-3"L X 18'-2"W X 15'H	33,600 LBS	NOTE 1

NOTES:

1. EXISTING CONCRETE BASIN TO REMAIN. EXISTING CONCRETE BASIN (WITH CURB WALLS) DIMENSIONS APPROXIMATELY = 200"W X 212" L. INSTALL NEW STAINLESS STEEL TOWER ON NEW STEEL BEAMS THAT SPAN THE EXISTING BASIN CURB WALLS. CRANE WILL BE REQUIRED TO PLACE TOWER INTO EXISTING ENCLOSURE. PROVIDE WITH OSHA LADDER, GUARDRAIL, KNEERAIL, TOEBOARD, PLENUM WALKWAY.

NEW AIR HANDLING UNIT SCHEDULE - 4-PIPE

REMARKS:

* WEIGHT IS APPROXIMATE AND DOES NOT INCLUDE ROOF CURB, UNIT ACCESSORIES OR OPTIONS.

MARK.	AREA SERVED	TOTAL CFM	MIN. O.A. CFM (15% MAX)	MAX. O.A. CFM	EXT. SP "WC"	COOLING DATA										HEATING DATA						ELECTRICAL DATA		TYPE	WEIGHT	NOTES
						ENTERING AIR TEMP.		LEAVING AIR TEMP.		AMBIENT	TOTAL CAP BTUH	SENS. CAP BTUH	GPM/ #ROWS	EWT(°F)/ LWT(°F)	MAX. PD (FEET)	ENTERING AIR TEMP.	LEAVING AIR TEMP.	TOTAL CAP BTUH	GPM	EWT(°F)/ LWT(°F)	MAX. PD (FEET)	V/Φ	MOTOR HP			
						(°F) DB	(°F) WB	(°F) DB	(°F) WB	(°F) DB						(°F) DB										
AHU-3	CLASSROOMS	8000	225	1500	1.5	80.0	66.1	54.4	53.36	98	302,500	219,600	60/6	44/54	20.7	64.0	90.14	226,700	18	180/150	5.0	480/3	5	PLENUM FAN	4,000 lbs.	TRANE 2-DECK CUSTOM MULTIZONE, WITH VFD (4 ZONES) 1 2 3
AHU-6	SCIENCE & CLASSROOMS	18,600	690	4550	0.77	80.0	66.1	54.4	53.2	98	743,100	537,600	144.4/6	44/54	15.0	64.0	89.51	514,700	41	180/150	5.0	480/3	7.5 X 2	PLENUM FAN	6,900 lbs.	TRANE 2-DECK CUSTOM MULTIZONE, WITH VFD (10 ZONES) 1 2 3
AHU-7	CLASSROOMS	10,560	480	3200	0.83	80.0	66.1	54.2	52.98	98	408,400	296,800	79.7/6	44/54	13.1	64.0	110.0	526,900	42	180/150	7.0	480/3	5 X 2	PLENUM FAN	5,000 lbs.	TRANE 2-DECK CUSTOM MULTIZONE, WITH VFD (8 ZONES) 1 2 3
–	–	–	– 1	–	–	–	–	–	–	–	–	–	–	– 1	–	–	–	–	–	– 1	–	–	–	– –	–	– –
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	– –	–	– –

NOTES:

1. VFD MUST CONFORM TO AISD DESIGN STANDARDS. AHU ALTERNATE ACCEPTABLE MANUFACTURER AND MODEL – JCI SOLUTION.
2. PROVIDE UNIT WITH ENTHALPY ECONOMIZER. PROVIDE MOTORIZED RA AND OUTSIDE AIR DAMPERS, HOWEVER, CONTROLS FOR ENTHALPY ECONOMIZER TO BE PROVIDED BY AISD CONTROL'S CONTRACTOR AND NOT BY EQUIPMENT MANUFACTURER.
3. NEW AHU'S SHALL NOT HAVE FACTORY-INSTALLED CONTROLS. ALL CONTROLS TO BE BY AISD CONTROLS CONTRACTOR. 1

EXISTING CHILLER SCHEDULE - FOR INFORMATION ONLY

REMARKS:

EXISTING CHILLERS TO REMAIN IN BASE BID. SCHEDULE PROVIDED FOR INFORMATIONAL PURPOSES ONLY. DO NOT PROVIDE NEW CHILLERS UNDER BASE BID SCOPE OF WORK.

MARK.	CAPACITY (TONS)	FOULING FACTORS	CHILLER			CONDENSER			ELECTRICAL DATA					MANUFACTURER	NOTES
			GPM	EWT/LWT	MAX PD	GPM	EWT/LWT	MAX PD	V/Φ/HZ	MAX KW	KW/TON	MCA	MOCP		
CHILLER 1	APPROX.200	0.00025	960	54/49	5 FT.	600	85/95	12 FT.	480/3/60	135	0.65	263	300	TRANE RTHB215FMF	EXISTING TO REMAIN
CHILLER 2	APPROX.200	0.00025	960	49/44	5 FT.	600 1	85/95	12 FT.	480/3/60	135	0.70	263	300	TRANE RTHB215FMF	EXISTING TO REMAIN

EXISTING PUMP SCHEDULE - FOR INFORMATION ONLY

MARK	SYSTEM	GPM	HEAD (FT.)	PUMP RPM	MOTOR HP	MOTOR V/Φ	WEIGHT LBS	MANUFACTURER	ACCESSORIES
CHWP-1 CHWP-2	CHILLED WATER	960	85	1750	30	480/3	---	FLEX COUPLED-BASE MOUNTED EXISTING TO REMAIN	---
CWP-1 CWP-2	CONDENSER WATER	600	50	1750	10	480/3	---	VERTICAL TURBINE EXISTING TO REMAIN	---

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd, Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

hcg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL
RENOVATIONS
6800 Bill Hughes Rd. Austin, TX
78745
AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

Date	09/04/2020
Job Number	20-0029
Scale	AS NOTED
Drawn	W&G
Checked	W&G
Approved	W&G

TITLE

NEW MECHANICAL EQUIPMENT SCHEDULES

SHEET

M0.2

PHASE 2 - NEW FAN SCHEDULE

REMARKS:

MARK	SERVICE	LOCATION	CFM	EXT. SP "WG	MOTOR HP	MOTOR V/ϕ	MAX RPM	DRIVE TYPE	WEIGHT	INTERLOCK	BASIS OF DESIGN	ACCESSORIES
CSEF-1	CRAWL SPACE EXHAUST	CRAWL SPACE SIDEWALL	4,000	0.125	1/4	120/1	1160	DIRECT	50 lbs	HUMIDISTAT	GREENHECK SE1-18 OR APPROVED EQUAL	①②③
CSEF-2	CRAWL SPACE EXHAUST	CRAWL SPACE SIDEWALL	4,000	0.125	1/4	120/1	1160	DIRECT	50 lbs	HUMIDISTAT	GREENHECK SE1-18 OR APPROVED EQUAL	①②③
CSEF-3	CRAWL SPACE EXHAUST	CRAWL SPACE SIDEWALL	6,300	0.125	3/4	208/3	1160	DIRECT	65 lbs	HUMIDISTAT	GREENHECK SE1-24 OR APPROVED EQUAL	①②④

ACCESSORIES:

① PER CODE, FAN SHALL BE AUTOMATICALLY CONTROLLED TO OPERATE WHEN THE RELATIVE HUMIDITY IN THE SPACE EXCEEDS 60 PERCENT.

② PROVIDE WITH FULL OSHA WALL HOUSING & GUARDS WITH MOTOR & DRIVE ACCESSED FROM CRAWL SPACE. INSTALL FLUSH WITH EXTERIOR WALL. PROVIDE WITH BACKDRAFT DAMPER (GRAVITY OPERATED), DAMPER GUARD & 45° WEATHERHOOD. PROPELLERS SHALL BE FABRICATED ALUMINUM.

③ FAN SHALL BE INSTALLED IN EXISTING 48"X24" SIDEWALL OPENING IN CRAWL SPACE. FAN SIZE = 24"W X 24"H X 14"D. REFER TO M2.2A.

④ FAN SHALL BE INSTALLED UNDER EXISTING STAIRWELL IN CRAWL SPACE IN NEW OPENING. REFER TO M2.2A AND ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION. FAN SIZE = 34"W X 34"H X 20"D.

PHASE 4 - NEW CHILLER SCHEDULE

REMARKS:
REFRIGERANT: R-134A
CHILLERS TO RUN IN PARALLEL. EACH CHILLER IS SIZED FOR APPROXIMATELY 50% OF THE DIVERSIFIED TOTAL COOLING LOAD ON THE SCHOOL.

MARK	CAPACITY (TONS)	FOULING FACTORS EVAP/ COND.	CHILLER (EVAPORATOR)			CONDENSER			ELECTRICAL DATA							MANUFACTURER	NOTES
			GPM: DESIGN/ MIN	EWT/LWT	MAX PD	GPM: DESIGN/ MIN	EWT/LWT	MAX PD	V/ϕ/HZ	MAX LRA	NPLV KW/TON	FULL LOAD EFFICIENCY KW/TON	MCA	MOCP	TOTAL POWER		
CHILLER 1	200	0.00010/ 0.00025	477.8/ 166.6	54/44	15 FT.	600/ 297.0	85/95	15 FT.	480/3/60	850.0	0.3534	0.5787	208	350	115.7 KW	TRANE HDWA	OPERATING WEIGHT = 12,000 LBS. W/ 10-YR. WARRANTY. NOTE 1.
CHILLER 2	200	0.00010/ 0.00025	477.8/ 166.6	54/44	15 FT.	600/ 290.0	85/95	15 FT.	480/3/60	850.0	0.3534	0.5787	208	350	115.7 KW	TRANE HDWA	OPERATING WEIGHT = 12,000 LBS. W/ 10-YR. WARRANTY. NOTE 1.

NOTES:

1. PROVIDE WITH NEW VFD MOUNTED ON CHILLER AND BACNET INTERFACE. REFRIGERANT CHARGE PER CHILLER = 525.0 LBS., R-134A.

PHASE 4 - NEW PUMP SCHEDULE

MARK	SYSTEM	GPM	HEAD (FT.)	PUMP RPM	MAX MOTOR HP	MOTOR V/ϕ	INLET	OUTLET	WEIGHT LBS	EFFICIENCY @ DESIGN	TYPE	MANUFACTURER	ACCESSORIES
NEW CHWP-1,2	CHILLED WATER	1003.8	85	1750	30	480/3	6"	5"	815	85.4%	END SUCTION	BELL & GOSSETT E-1510	PROVIDE NEW 30HP VFD FOR CHWP-1 & CHWP-2 (YASKAWA W/BYPASS), WITH BACNET INTERFACE (CHWP-2 IS 100% BACKUP FOR CHWP-1)

PHASE 5 - NEW AIR HANDLING UNIT SCHEDULE - 4-PIPE

REMARKS:

* WEIGHT IS APPROXIMATE AND DOES NOT INCLUDE ROOF CURB, UNIT ACCESSORIES OR OPTIONS.

MARK.	AREA SERVED	TOTAL CFM	MIN. O.A. CFM (15% MAX)	MAX. O.A. CFM	EXT. SP "WC"	COOLING DATA									HEATING DATA					ELECTRICAL DATA		TYPE	WEIGHT	NOTES
						ENTERING AIR TEMP.		LEAVING AIR TEMP.		AMBIENT	TOTAL CAP BTUH	SENS. CAP BTUH	GPM/ #ROWS	EWT(°F)/ LWT(°F)	MAX. PD (FEET)	ENTERING AIR TEMP.	LEAVING AIR TEMP.	TOTAL CAP BTUH	GPM/ #ROWS	EWT(°F)/ LWT(°F)	MAX. PD (FEET)	V/ϕ	MOTOR HP			
						(°F) DB	(°F) WB	(°F) DB	(°F) WB	(°F) DB						(°F) DB	(°F) DB									
AHU-13	THEATER	8900	95	625	0.73	80.0	66.1	51.2	50.9	98	292,300	216,500	58/6	44/54	15.3	64.0	95.04	299,600	23/1	180/150	5.0	480/3	7.5	PLENUM FAN	4,400 lbs.	TRANE 2-DECK CUSTOM MULTIZONE (4 ZONES) WITH VFD ①②③
AHU-14	CAFETERIA	23,950	935	6230	0.78	80.0	66.1	51.2	50.8	98	1,066,000	748,800	211.3/8	44/54	19.8	39.4	95.96	1,472,000	112/2	180/150	6.0	480/3	10 x 2	PLENUM FAN	8,800 lbs.	TRANE 2-DECK CUSTOM MULTIZONE (6 ZONES) WITH VFD ①②③

NOTES:

① VFD MUST CONFORM TO AISD DESIGN STANDARDS. AHU ALTERNATE ACCEPTABLE MANUFACTURER AND MODEL – JCI SOLUTION.

② PROVIDE UNIT WITH ENTHALPY ECONOMIZER. PROVIDE MOTORIZED RA AND OUTSIDE AIR DAMPERS, HOWEVER, CONTROLS FOR ENTHALPY ECONOMIZER TO BE PROVIDED BY AISD CONTROL'S CONTRACTOR AND NOT BY EQUIPMENT MANUFACTURER.

③ NEW AHU'S SHALL NOT HAVE FACTORY-INSTALLED CONTROLS. ALL CONTROLS TO BE BY AISD CONTROLS CONTRACTOR.

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MECHANICAL SCHEDULES FOR PHASES 2, 4, 5

SHEET

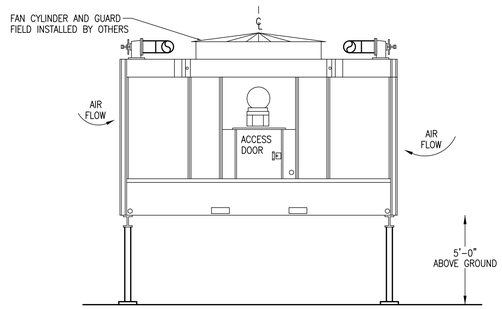
M0.2.1 PHASES 2, 4, & 5

NEW AIR DISTRIBUTION SCHEDULE

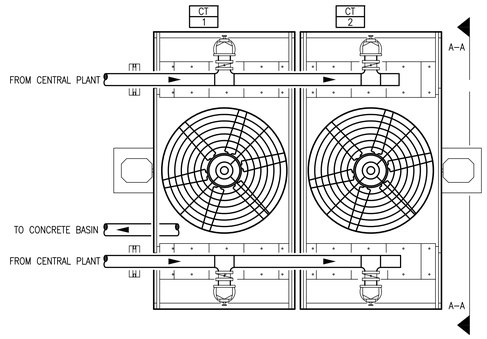
REMARKS:
1. COORDINATE FRAME & BORDER TYPE WITH CEILING TYPE. REFER TO ARCHITECTURAL PLANS.
2. COORDINATE WITH BLDG MGT FOR BLDG STANDARDS.
3. NOT ALL MARKS/TYPES MAY BE USED.

MARK	CFM	NECK SIZE (INCHES)	FACE SIZE (INCHES)	BASIS OF DESIGN	ACCESSORIES
A	0–140	6"ø	24"x24"	SUPPLY DIFFUSER EQUAL TO TITUS MODEL TMS–AA. INSULATE BACK OF ALL DIFFUSERS. ALUMINUM WITH WHITE FINISH.	
	141–250	8"ø	24"x24"		
	251–350	10"ø	24"x24"		
	351–450	12"ø	24"x24"		
	451–550	14"ø	24"x24"		
	551–650	16"ø	24"x24"		
B	0–140	6"X6"	24"x24"	RETURN/EXHAUST GRILLE EQUAL TO TITUS MODEL PAR–AA. ALUMINUM WITH WHITE FINISH.	
	141–260	8"X8"	24"x24"		
	261–420	10"X10"	24"x24"		
	421–650	12"X12"	24"x24"		
	651–850	14"X14"	24"x24"		
	851–1150	16"X16"	24"x24"		
	1151–1450	18"X18"	24"x24"		
	1451–1800	20"X20"	24"x24"		
	1801–2200	22"X22"	24"x24"		
C	0–40	4"ø	12"X12"	SUPPLY DIFFUSER EQUAL TO TITUS MODEL TMS TO MATCH EXISTING. INSULATE BACK OF ALL DIFFUSERS. STEEL WITH WHITE FINISH.	
	41–100	6"ø	12"X12"		
D	0–40	6"X6"	12"X12"	RETURN/EXHAUST GRILLE EQUAL TO TITUS MODEL PAR TO MATCH EXISTING. INSULATE BACK OF ALL DIFFUSERS. STEEL WITH WHITE FINISH.	
	41–100	6"X6"	12"X12"		
E	0–130	6"x6"	7.75"x7.75"	SIDEWALL SUPPLY EQUAL TO TITUS 301FL. 35° DOWN DEFLECTION, WITH WHITE FINISH.	OPPOSED BLADE DAMPERS
	131–200	10"x6"	11.75"x7.75"		
	201–375	18"x6"	19.75"x7.75"		
	376–700	18"x12"	19.75"x13.75"		
	701–1000	24"x12"	25.75"x13.75"		
F	0–130	6"x6"	7.75"x7.75"	SIDEWALL RETURN/EXHAUST EQUAL TO TITUS 350FL. 35° DOWN DEFLECTION, WITH WHITE FINISH.	OPPOSED BLADE DAMPERS
	131–200	10"x6"	11.75"x7.75"		
	201–375	18"x6"	19.75"x7.75"		
	376–700	18"x12"	19.75"x13.75"		
	701–1000	24"x12"	25.75"x13.75"		
G	0–120	6"ø	13.5"ø	TITUS TMRA–AA ROUND SUPPLY DIFFUSER WITH WHITE FINISH. ADJUSTABLE VERTICAL TO HORIZONTAL DISCHARGE PATTERS.	
	121–210	8"ø	18"ø		
	211–320	10"ø	22.5"ø		
	321–450	12"ø	27"ø		
	451–600	14"ø	31.5"ø		
	601–800	16"ø	36"ø		
	801–1000	18"ø	40.5"ø		

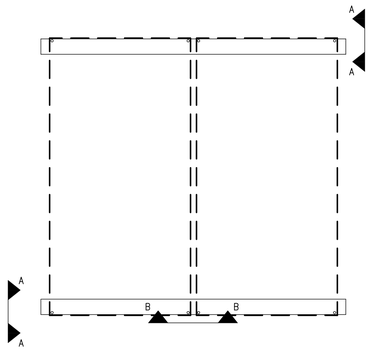
1

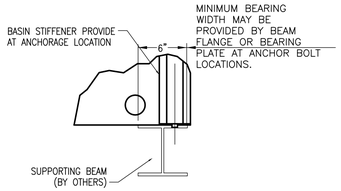


SIDE ELEVATION A–A



PLAN VIEW





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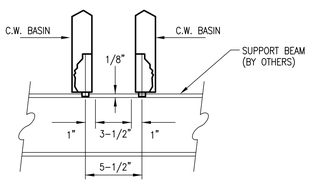
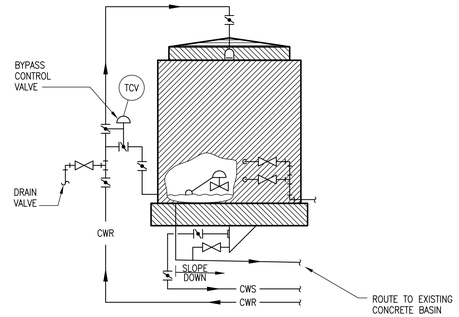


VIEW B–B



COOLING TOWER PIPING DETAIL

SHIPPING WEIGHT		DESIGN OPERATING LOADS	
PER TOWER	PER CELL	PER TOWER	PER CELL
16,733	8,367	33,543	16,772

NOTES:

SUPPORTING STEEL: THE SUPPORTING STEEL IS TO BE DESIGNED, CONSTRUCTED AND FURNISHED BY THE CUSTOMER. IT SHALL INCLUDE CUSTOMER SUPPLIED ANCHOR BOLTS, 3/4" DIAMETER, TO SUIT THE GENERAL DIMENSIONS OF THIS DRAWING AND OF THE OUTLET PIPING DETAILS DRAWING. THE TOP SURFACE OF THE SUPPORTING STEEL MUST BE FRAMED FLUSH AND LEVEL. THE MAXIMUM BEAM DEFLECTION SHALL BE LIMITED TO 1/360 OF SPAN, NOT TO EXCEED 1/2" AT THE ANCHOR BOLTS IN ORDER TO ASSURE THAT THE COOLING TOWER IS LEVEL AND PLUMB.

DESIGN OPERATION LOADS: THE DESIGN OPERATING LOADS SHOWN IN THE ABOVE TABLE ARE BASE UPON THE VOLUME OF WATER THE COLLECTION BASIN AT SHUTDOWN. THE SHUTDOWN WATER LEVEL HAS BEEN SIZED TO ACCOMMODATE THE MAXIMUM ALLOWABLE FLOW RATES. THE DESIGN LOADS ARE SHOWN FOR YOUR USE AS A QUICK REFERENCE. THE ACTUAL OPERATION LOAD IS VARIABLE, AND DEPENDENT UPON THE DESIGN FLOW RATE PER CELL. DESIGN LOADS ARE ALL BASED UPON THE RECOMMENDED OPERATING WATER LEVEL. OPERATING LEVELS IN EXCESS OF THAT RECOMMENDED WILL RESULT IN LOADS EXCEEDING THE VALUES STATED. CONSULT A MARLEY REPRESENTATIVE FOR GREATER DETAIL ON THIS OR ANY OTHER SUBJECT.

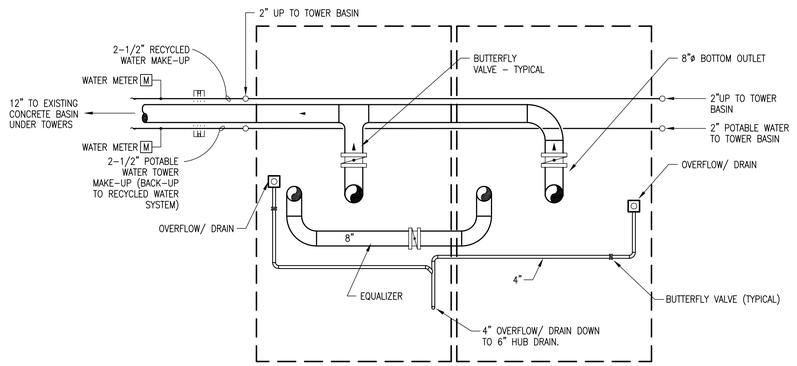
SHIPPING WEIGHTS AND MAXIMUM OPERATION LOADS: VALUES SHOWN IN TABLE DO INCLUDE THE OPTIONAL EQUIPMENT WEIGHTS.

NON–STANDARD ANCHORAGE LOCATION: THE ANCHOR BOLT DIMENSION SHOWN CAN BE VARIED UPON REQUEST. CONSULT REPRESENTATIVE FOR SPECIFICS AND TO INSURE THAT THE APPROPRIATE MODIFICATIONS ARE ADDED TO THE STRUCTURE.

PIER SUPPORTS: THE TOWER MAY BE SUPPORTED FROM PIERS AT EACH ANCHOR BOLT LOCATION AS AN ALTERNATE. A PIER SHOULD BE AT LEAST 6" X 6".

VIBRATION ISOLATORS: THE TOWERS WILL BE SUPPORTED ON VIBRATION ISOLATORS. THE ISOLATORS MUST BE PLACED UNDER THE SUPPORTING STEEL BEAMS AND NOT BETWEEN THE SUPPORT BEAMS AND THE TOWER.

THE TOWER ASSEMBLY TOLERANCE APPLICABLE TO ALL DIMENSIONS IS + OR – 1/8" CONSULT SUPPLIERS OF SUPPORTING STRUCTURE FOR CONSTRUCTION TOLERANCES.



TOWER BASIN PIPING (BELOW TOWER)

1. COOLING TOWER GENERAL DETAILS

NTS

1

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd, Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

hcg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL
RENOVATIONS
6800 Bill Hughes Rd. Austin, TX
78745
AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
01/30/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

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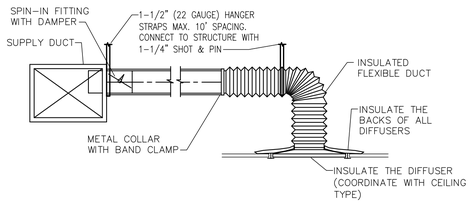
Drawn	W&G
Checked	W&G
Approved	W&G

TITLE

NEW MECHANICAL EQUIPMENT SCHEDULES & DETAILS 1

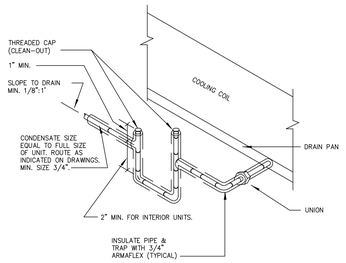
SHEET

M0.3



1. SUPPLY DIFFUSER FLEX SUPPORT DETAIL

NTS



2. CONDENSATE P-TRAP DETAIL

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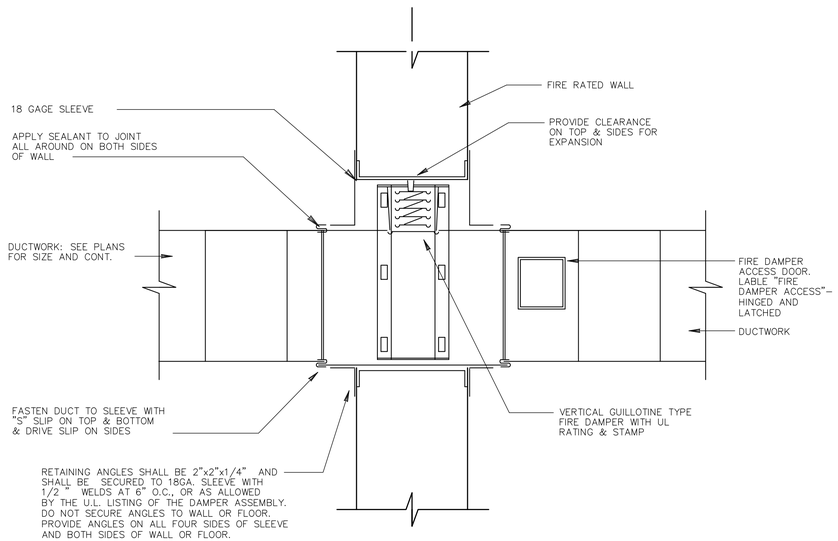
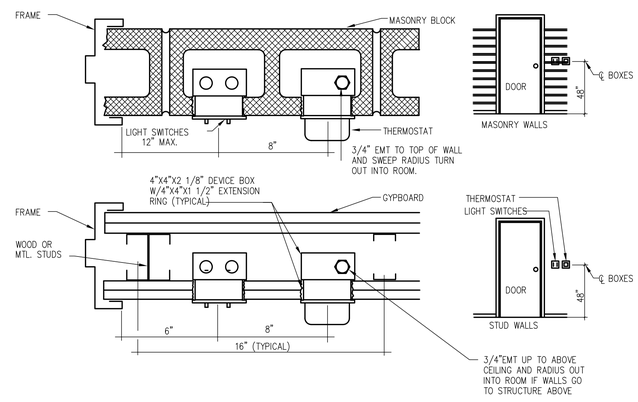


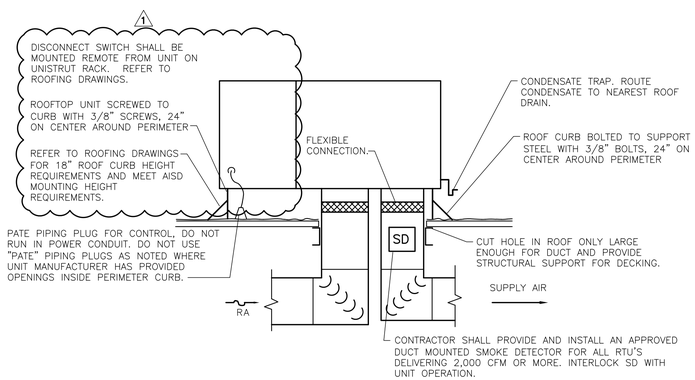
3. DUCT PENETRATION THRU FIRE RATED WALL

NTS



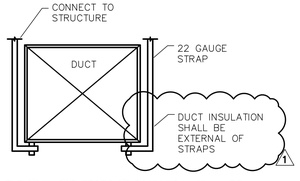
4. LIGHT SWITCH & ROOM THERMOSTAT DETAIL

NTS



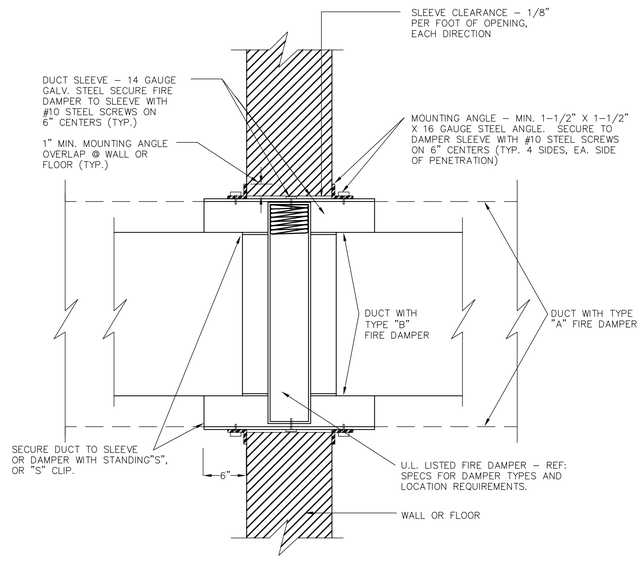
5. ROOFTOP UNIT DETAIL

NTS



6. DUCT SUPPORT DETAIL

NTS

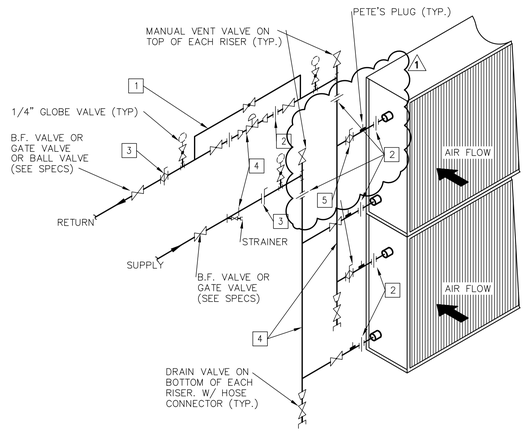


NOTES:

1. ALL FIRE AND FIRE/SMOKE DAMPERS TO BE PROVIDED WITH FACTORY SLEEVE.
2. ALL COLLAR, DAMPER & DUCT CONNECTIONS SHALL BE AS SHOWN IN THE SMACNA MANUAL FOR UL DAMPERS OR AS RECOMMENDED BY DAMPER MANUFACTURER FOR UL DAMPERS.
3. EACH DAMPER INSTALLATION SHALL COMPLY WITH UL STANDARD 555.

7. FIRE AND FIRE/SMOKE DAMPER DETAIL

NTS



1. PROVIDE BYPASS & BALL VALVE, FULL SIZE OF CONTROL VALVE AT ALL AIR HANDLING UNITS OVER 10,000 CFM.
2. PROVIDE PIPE UNIONS OR FLANGES AS REQUIRED BY PIPE SIZE & SPECIFICATIONS (TYP.).
3. PROVIDE BALANCING VALVES & FLOW SENSORS AS REQUIRED BY PIPE SIZE & SPECIFICATIONS. INSTALL, FLOW SENSOR PER MANUFACTURER'S REQUIREMENTS FOR STRAIGHT RUN OF PIPE. BALANCE FLOW THROUGH COIL WITH CONTROL VALVE IN FULL OPEN POSITION.
4. MOUNT CONTROL VALVE, PIPING AND ACCESSORIES IN A MANNER TO NOT INTERFERE WITH COIL PULL AREAS AND UNIT ACCESS.
5. BALANCE FOR EQUAL FLOW THROUGH EACH COIL.

NOTE: ALL CONTROL VALVES ACTUATORS SHALL BE MANUFACTURED BY BELIMO

8. MULTIPLE WATER COIL CONNECTION WITH 2-WAY CONTROL VALVE

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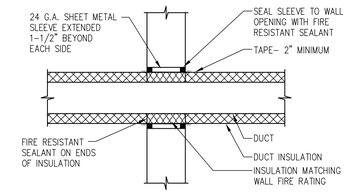
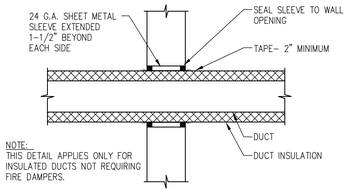
MECHANICAL DETAILS

SHEET

M0.4



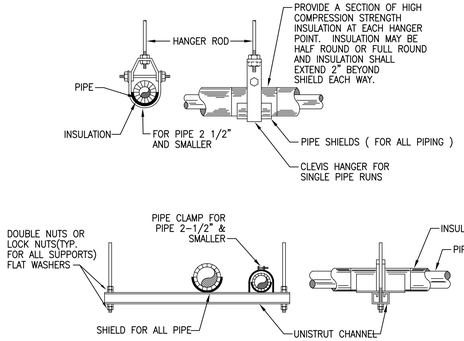
FIRE RATED WALL



NON-RATED WALL

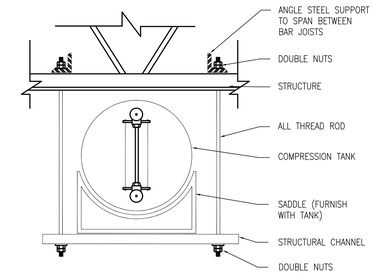
1. DUCT PENETRATION THRU INTERIOR WALL

NTS



2. WATER PIPING HANGERS AND SUPPORTS

NTS

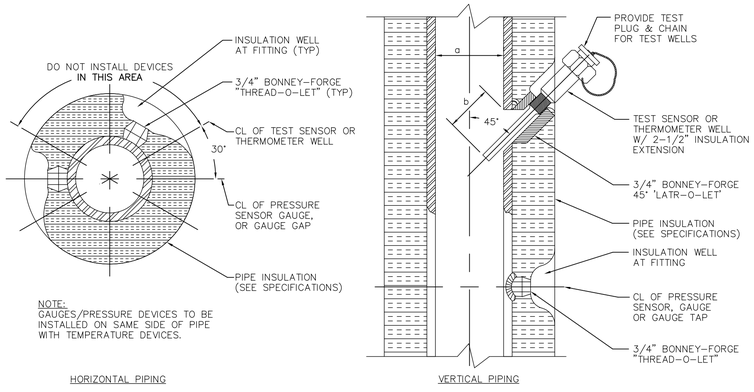


3. EXPANSION TANK SUPPORT

NTS

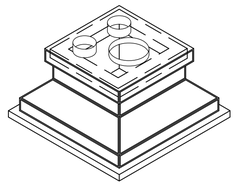
NOTE: ALL PLUGS, NIPPLES, VALVES, ETC., TO BE BRASS

INSERTION LENGTH SCHEDULE	
a=PIPE DIAMETER	b=INSERTION LENGTH
3", 4", 5" AND 6"	5"
8" AND 10"	8"
12" AND LARGER	14"

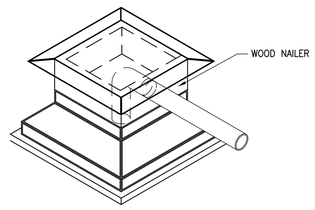


4. INSTRUMENT TAPS IN PIPE DETAIL

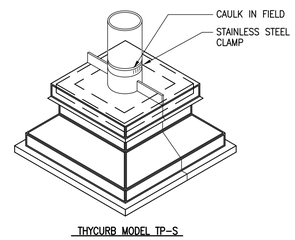
NTS



THYCURB MODEL TCC-3



THYCURB MODEL TP-2

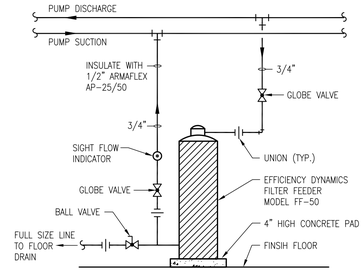


THYCURB MODEL TP-S

REFER TO ROOFING CONSULTANT'S DRAWINGS FOR ADDITIONAL INFORMATION AND ROOFING DETAILS.

5. PIPE PENETRATION DETAILS

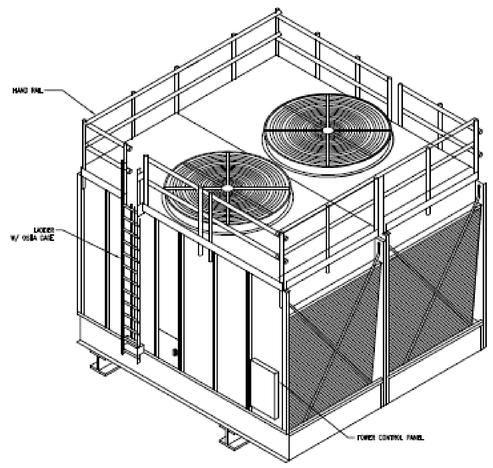
NTS



NOTE: INSULATE FILTER FEEDER AND ALL ASSOCIATED PIPING WITH 1/2" ARMAFLEX AP-25/50

6. CHEMICAL FILTER FEEDER DETAIL

NTS



1

REFER TO M0.11 FOR ADDITIONAL COOLING TOWER DETAILS.

7. COOLING TOWER GENERAL ISOMETRIC

NTS 1

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MECHANICAL DETAILS

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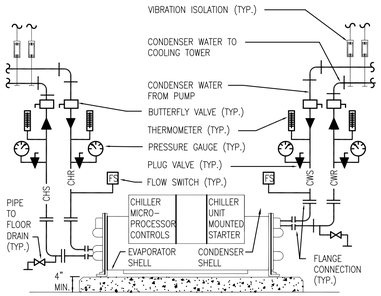
M0.5

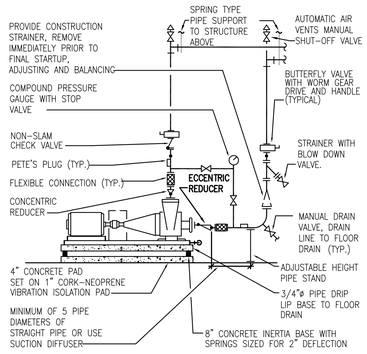


1. PIPE ALL REFRIGERANT RELIEF DEVICES DIRECTLY AND INDEPENDENTLY OUTDOORS.
2. PIPE OIL PUMP COOLER AS REQUIRED. (PROVIDE ACCESS FOR REMOVAL.)
3. PROVIDE ELASTOMERIC ISOLATION PADS. 4. CHILLER AND ALL APPURTENANCES SHALL BE INSTALLED PER MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.

NOTE: PROVIDE AIR BLEED PORTS (BALL VALVE) ON TOP OF CHILLER BARRELS.

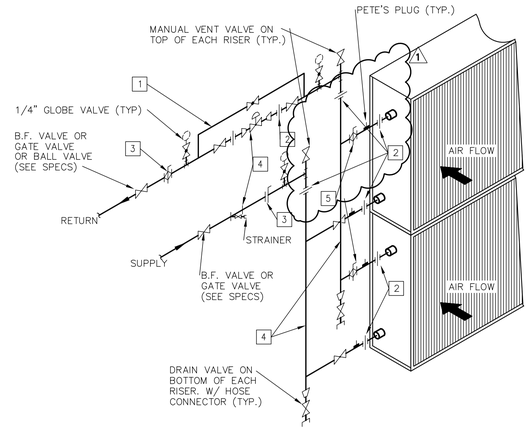
1. PHASE 4 - WATER COOLED CHILLER PIPING DETAIL

NTS



2. PHASE 4 - END SUCTION PUMP W/INERTIA BASE DETAIL

NTS



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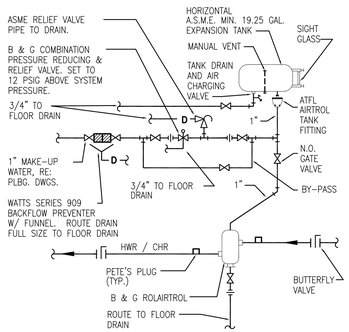
NOTE: ALL CONTROL VALVES ACTUATORS SHALL BE MANUFACTURED BY BELIMO

3. PHASE 5 - MULTIPLE WATER COIL CONNECTION WITH 2-WAY CONTROL VALVE

NTS



4. PHASE 4 - EXPANSION TANK DETAIL

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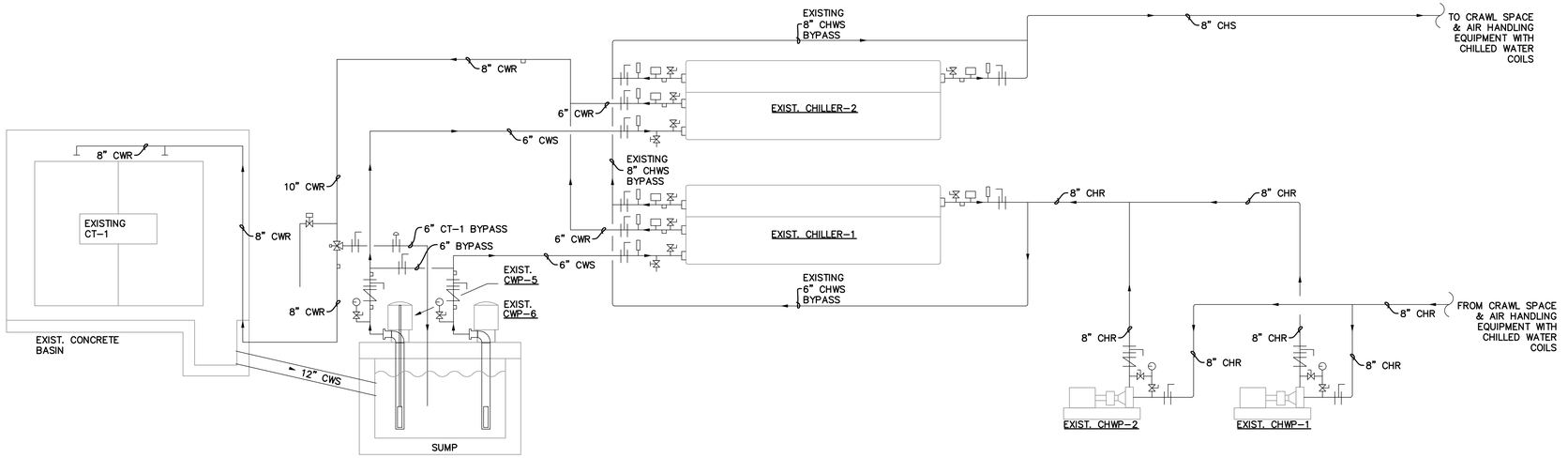
MECHANICAL DETAILS - PHASE 4

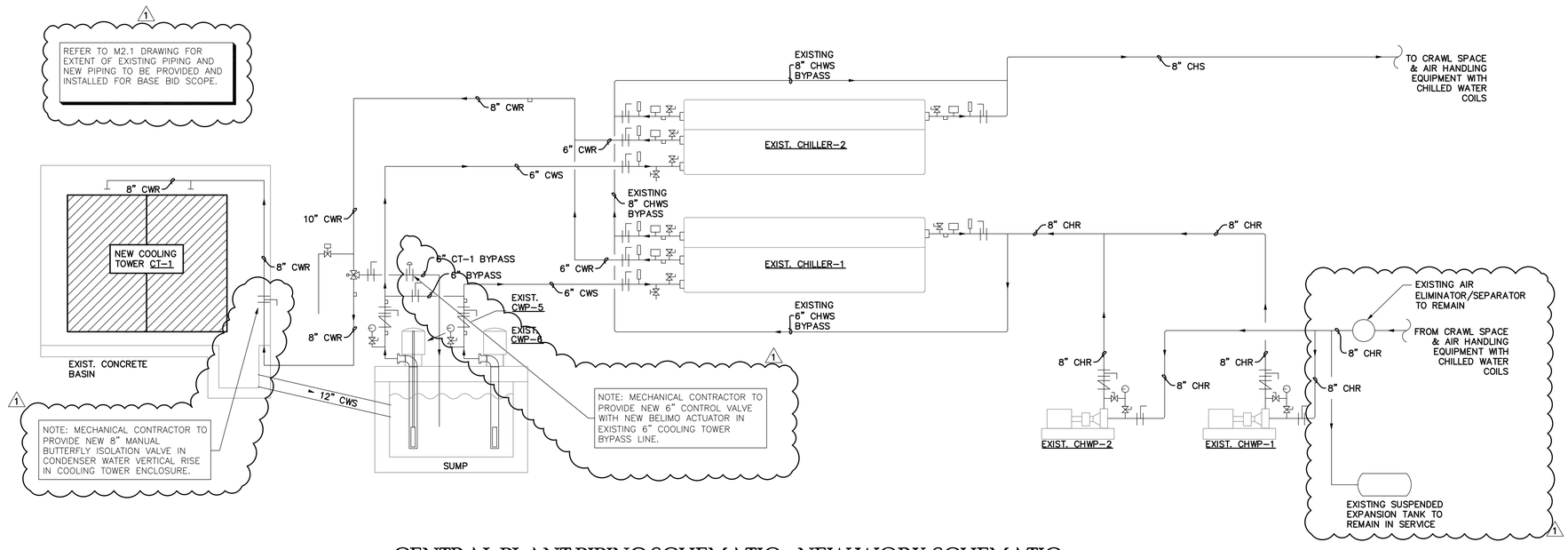
SHEET

M0.6 PHASE 4



CENTRAL PLANT PIPING SCHEMATIC -EXISTING

NTS



CENTRAL PLANT PIPING SCHEMATIC - NEW WORK SCHEMATIC

NTS

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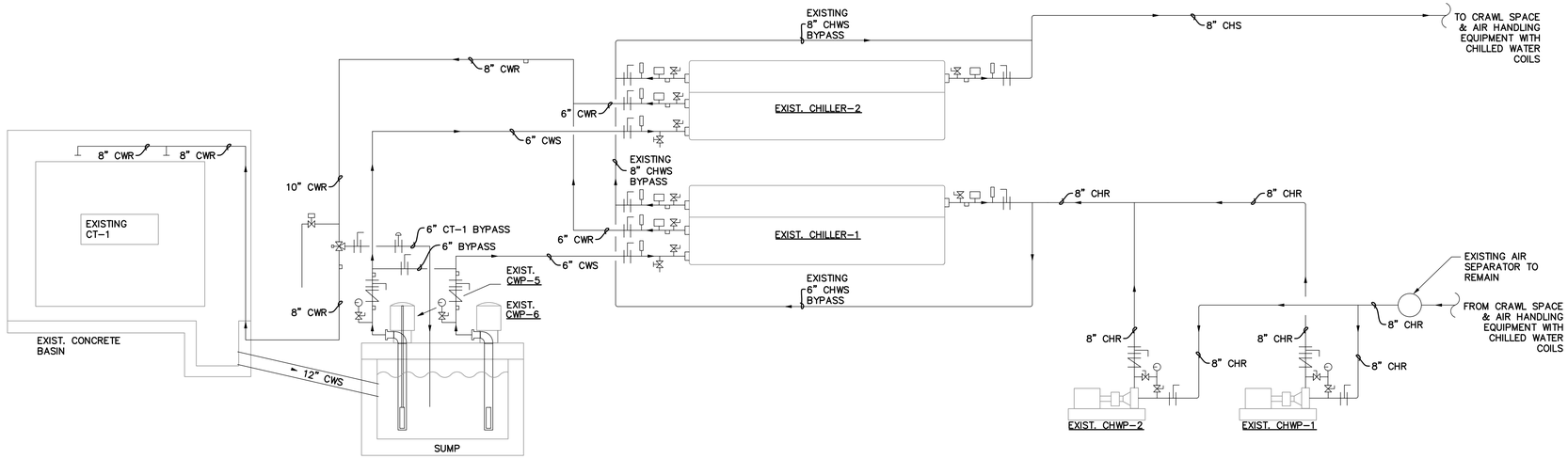
CONDENSER & CHILLED WATER PIPING SCHEMATIC

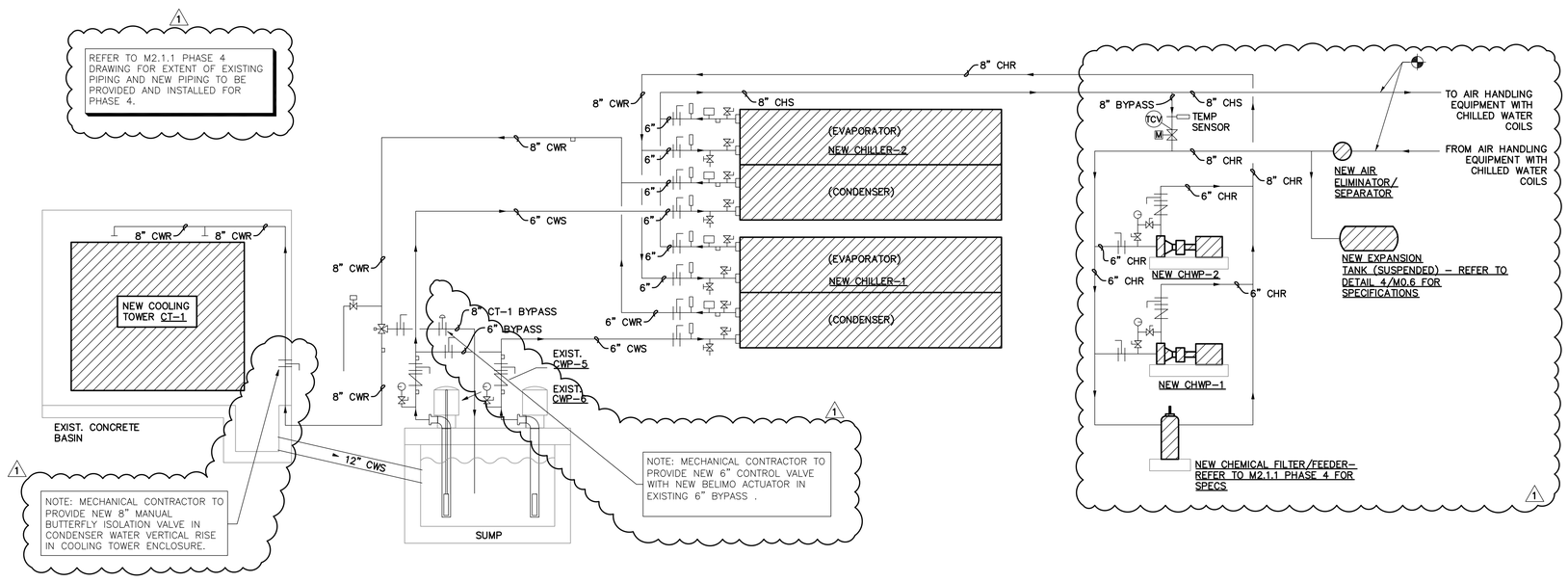
SHEET

M0.7



CENTRAL PLANT PIPING SCHEMATIC -EXISTING

NTS



CENTRAL PLANT PIPING SCHEMATIC - PHASE 4 - NEW WORK SCHEMATIC

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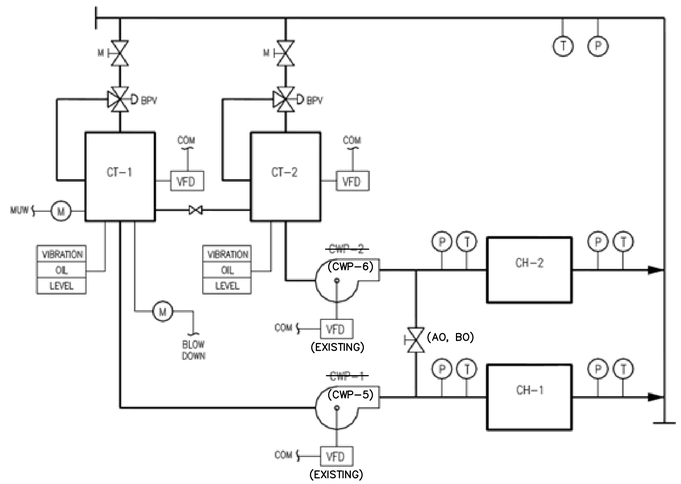
CONDENSER & CHILLE WATER PIPING SCHEMATIC - PHASE 4

SHEET

M0.7.1 PHASE 4

PER AISD PDM, CONTRACTOR SHALL PROVIDE HEAT TRACING WITH CONSTANT POWER SOURCE AT ISOLATION VALVES TO EACH CELL OF THE COOLING TOWER.

COOLING TOWER BASINS SHALL DRAIN TO THE INDOOR SUMP PIT.



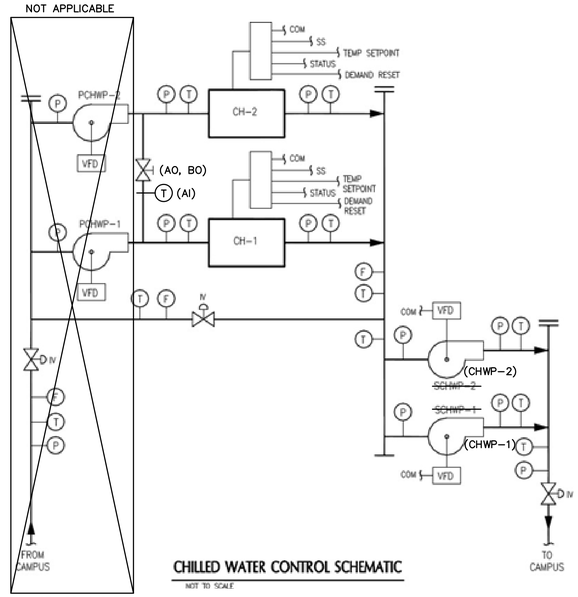
CONDENSER WATER CONTROL SCHEMATIC

NOT TO SCALE

OUTDOOR TEMP/HUMIDITY SENSOR

COONECT TEMP AND HUMIDITY SENSORS TO EXISTING AVAILABLE SPACES ON THE TRIDIUM SYSTEM.

NOT APPLICABLE



CHILLED WATER CONTROL SCHEMATIC

NOT TO SCALE

NOT APPLICABLE

Issued:05/31/2019

Cooling Towers (2 Or More Chillers)

1. Guideline sequence:
   - A. Cooling tower fans operation using the following performance criteria:
     - i. Enable cooling towers using chilled water plant enable command. The number of cooling towers enabled is independent of the number of chiller or pumps enabled.
     - ii. Cooling Stage-1: Condenser water over all towers.
     - iii. Cooling Stage-2: Enable lead fan at variable speed to maintain leaving water temperature set-point in the common header.
     - iv. Cooling Stage-3: Modulate fans in unison to maintain leaving water temperature set-point in the common header.
     - v. Control cooling tower fans to slow down to minimum speed prior to disable.
     - vi. Cooling tower bypass valve to remain closed unless leaving water temperature drops below allowable limit. Modulate cooling tower bypass valve to maintain low limit set-point temperature.
     - vii. Building Automation System will continuously monitor make-up water and blow down water.
   - B. Condenser water pumps operation using the following performance criteria:
     - i. Enable condenser water pump with signal from the respective chiller using appropriate delays.
     - ii. Control lead/lag sequence for the condenser water pumps to follow the chillers lead/lag sequence.
2. Control points
   - A. Provide the following control points for the cooling tower and condenser water pumps:
     - i. Cooling tower:
       - a. Condenser water return temperature -common
       - b. Condenser water supply temperature –each chiller (BACnet)
       - c. Condenser water return temperature –each chiller (BACnet)
       - d. Bypass valve command –each
       - e. Make-up water flow rate
       - f. Blow down water flow rate
       - g. Cold water basin level –each
       - h. Vibration switch –each
       - a. Oil level -each
     - ii. Cooling tower fans:
       - a. On/Off (hardwired)
       - b. Speed command (VFD/BACnet)
       - c. Speed feedback (VFD/BACnet)
     - iii. Condenser water pumps:
       - a. On/Off (hardwired from chiller)
       - b. Status (hardwired)
       - c. VFD control –optional (EXISTING)

Chiller Plants (2 Or More Chillers)

1. Guideline sequence:
   - A. Cooling plant operation using the following performance criteria:
     - i. Enable cooling plant based on outside air limit (60°F, adjustable) and call for cooling from chilled water air handler or fan-coil units. Determine the call for cooling based on a number of air handlers or fan-coil units generating a call for cooling. The number of units required to generate a call for cooling based on the minimal load required to avoid chiller plant short-cycling.
     - ii. Cooling plant enable point to be commanded and overridden on and off from the local control and the WANHMI.
     - iii. Do not control the cooling enable point using the occupancy schedule.
     - iv. Specify freeze-protection sequences for plant and air handlers.
   - B. Secondary pumps operation using the following performance criteria:
     - i. Initiate the secondary pump lead/lag sequence using the cooling plant enable command.
     - ii. Control number of pumps and pump speed to maintain differential pressure setpoint.
     - iii. Provide pump VFD parameters in the WANHMI via BACnet card.
   - C. Chillers and primary pumps operation using the following performance criteria:
     - i. Initiate chiller and primary pump sequence using the cooling plant enable command.
     - ii. Enable primary pump with signal from the respective chiller using appropriate delays.
     - iii. Program lead/lag sequence for the chillers and primary pumps as follows:
       - a. Enable the lag chiller in the event the secondary loop supply or return water temperatures is unable to maintain supply temperature for a given time period
       - a. Disable the lag chiller if return temperature in the secondary loop drops below the design value for a given time period.
     - ii. Program chillers to maintain supply water temperature setpoints with setpoint adjust via BACnet card.
   - B. Chiller control parameters accessible to WANHMI via BACnet card.
2. Control points:
   - A. Provide the following control points for the chilled water plant:
     - i. Plant enable/disable (virtual point)
     - ii. Chillers:
       - a. On/Off (hardwired)
       - b. Status (BACnet)
       - c. Supply water temperature setpoint (BACnet)
       - d. Supply water temperature (BACnet)
       - e. Return water temperature (BACnet)
       - f. Differential pressure (BACnet)
     - iii. Primary pumps:
       - a. On/Off (hardwired from chiller control)
       - b. Status (hardwired)
       - c. VFD control - optional
     - iv. Secondary pumps:
       - a. On/Off (hardwired)
       - b. Speed command (VFD BACnet)
       - c. Speed feedback (VFD BACnet)
       - d. Secondary supply water temperature
       - e. Secondary return water temperature
       - f. Differential pressure sensor
       - g. Return water flow rate
       - h. Bypass water temperature
       - i. Bypass water flow rate

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #10701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

htg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

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MECHANICAL CONTROLS

SHEET

M0.8

1

CHILLED WATER PLANT - SYSTEM POINTS LIST

CONTROLLER: BACNET/IACE	POINT TYPE							ALARMS								
SYSTEM POINT DESCRIPTION	GRAPHIC	HARDWARE INPUT	HARWARE OUTPUT	SOFTWARE POINT	HARDWARE INTERLOCK	WIRELESS	NETWORK	DEFAULT VALUE	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL	DIAGNOSTICS	NOTES
TOWER 1 VIBRATION DETECTION LOCAL	X				X											
TOWER 2 VIBRATION DETECTION LOCAL					X											
CHILLER 1 EVAPORATOR WATER DIFFERENTIAL PRESSURE	X	AI							X	X						
CHILLER 2 EVAPORATOR WATER DIFFERENTIAL PRESSURE	X	AI							X	X						
COMMON CONDENSER WATER DIFFERENTIAL PRESSURE	X	AI							X	X						
OUTDOOR AIR RELATIVE HUMIDITY LOCAL	X	AI							X	X						
OUTDOOR AIR TEMPERATURE LOCAL	X	AI											X		SENSOR FAILURE	
SYSTEM CHILLED WATER DIFFERENTIAL PRESSURE	X	AI							X	X						
SYSTEM CHILLED WATER RETURN TEMPERATURE	X	AI							X	X						
SYSTEM CHILLED WATER SUPPLY TEMPERATURE	X	AI														NOTE 1
SYSTEM CHILLED WATER SUPPLY TEMPERATURE	X	AI							X							
TOWER 1 LEAVING WATER TEMPERATURE	X	AI							X	X						
TOWER 1 SUMP WATER TEMPERATURE	X	AI														NOTE 1
TOWER 2 LEAVING WATER TEMPERATURE	X	AI							X	X						
TOWER 2 SUMP WATER TEMPERATURE	X	AI														NOTE 1
CHILLER 1 CHILLED WATER FLOW STATUS OPEN	X	BI														
CHILLER 1 CHILLED WATER PUMP REQUEST LOCAL		BI														
CHILLER 1 CONDENSER ISOLATION VALVE CLOSED STATUS		BI														
CHILLER 1 CONDENSER ISOLATION VALVE OPEN STATUS		BI														
CHILLER 1 CONDENSER WATER FLOW STATUS OPEN	X	BI														
CHILLER 1 CONDENSER WATER PUMP REQUEST LOCAL		BI														
CHILLER 1 EVAPORATOR ISOLATION VALVE OPEN STATUS		BI														
CHILLER 2 CHILLED WATER FLOW STATUS OPEN	X	BI														
CHILLER 2 CHILLED WATER PUMP REQUEST LOCAL	X	BI														
CHILLER 2 CONDENSER ISOLATION VALVE CLOSED STATUS		BI														
CHILLER 2 CONDENSER ISOLATION VALVE OPEN STATUS		BI														
CHILLER 2 CONDENSER WATER FLOW STATUS OPEN	X	BI														
CHILLER 2 CONDENSER WATER PUMP REQUEST LOCAL	X	BI														
CHILLER 2 EVAPORATOR ISOLATION VALVE OPEN STATUS		BI														NOTE 1
CONDENSER WATER PUMP 1 STATUS	X	BI									X	X			PUMP FAILURE	
CONDENSER WATER PUMP 2 STATUS	X	BI									X	X			PUMP FAILURE	
PRIMARY CHILLED WATER PUMP 1 STATUS	X	BI									X	X			PUMP FAILURE	
PRIMARY CHILLED WATER PUMP 2 STATUS	X	BI									X	X			PUMP FAILURE	
TOWER 1 FAN 1 STATUS	X	BI														NOTE 1
TOWER 1 RETURN ISOLATION VALVES CLOSED STATUS		BI														
TOWER 1 RETURN ISOLATION VALVES OPEN STATUS		BI														
TOWER 1 SUMP LEVEL INDICATION LEVEL 1	X	BI														NOTE 1
TOWER 1 SUMP LEVEL INDICATION LEVEL 3	X	BI														NOTE 1
TOWER 1 SUPPLY ISOLATION VALVES CLOSED STATUS		BI														
TOWER 1 SUPPLY ISOLATION VALVES OPEN STATUS		BI														
TOWER 2 FAN 1 STATUS	X	BI														NOTE 1
TOWER 2 RETURN ISOLATION VALVES CLOSED STATUS		BI														
TOWER 2 RETURN ISOLATION VALVES OPEN STATUS		BI														
TOWER 2 SUMP LEVEL INDICATION LEVEL 1	X	BI														NOTE 1
TOWER 2 SUMP LEVEL INDICATION LEVEL 3	X	BI														NOTE 1
TOWER 2 SUPPLY ISOLATION VALVES CLOSED STATUS		BI														
TOWER 2 SUPPLY ISOLATION VALVES OPEN STATUS		BI														
CHILLED WATER BYPASS VALVE OUTPUT	X		AO													
CONDENSER PUMP 1 VFD SPEED OUTPUT	X		AO													
CONDENSER PUMP 2 VFD SPEED OUTPUT	X		AO													
PRIMARY CHILLED WATER PUMP 1 VFD SPEED OUTPUT	X		AO													
PRIMARY CHILLED WATER PUMP 2 VFD SPEED OUTPUT	X		AO													
TOWER 1 FAN 1 VFD SPEED OUTPUT	X		AO													NOTE 1
TOWER 2 FAN 1 VFD SPEED OUTPUT	X		AO													NOTE 1
TOWER BYPASS VALVE OUTPUT	X		AO													
CHILLER 1 CHILLED WATER PUMP REQUEST OUT			BO													
CHILLER 1 CONDENSER WATER ISOLATION VALVE SIGNAL	X		BO													
CHILLER 1 CONDENSER WATER PUMP REQUEST OUT			BO													
CHILLER 1 EVAPORATOR ISOLATION VALVE OUTPUT SIGNAL	X		BO													
CHILLER 2 CHILLED WATER PUMP REQUEST OUT	X		BO													
CHILLER 2 CONDENSER ISOLATION VALVE SIGNAL	X		BO													
CHILLER 2 CONDENSER WATER PUMP REQUEST OUT	X		BO													
CHILLER 2 EVAPORATOR ISOLATION VALVE OUTPUT SIGNAL	X		BO													
CONDENSER PUMP 1 START STOP OUTPUT	X		BO													
CONDENSER PUMP 2 START STOP OUTPUT	X		BO													
PRIMARY CHILLED WATER PUMP 1 START STOP OUTPUT	X		BO													
PRIMARY CHILLED WATER PUMP 2 START STOP OUTPUT	X		BO													
TOWER 1 FAN 1 START STOP OUTPUT	X		BO													NOTE 1
TOWER 1 RETURN ISOLATION VALVE OUTPUT SIGNAL	X		BO													
TOWER 1 SUMP HEATER START STOP OUTPUT COMMAND	X		BO													NOTE 1
TOWER 1 SUPPLY ISOLATION VALVE OUTPUT SIGNAL	X		BO													
TOWER 2 FAN 1 START STOP OUTPUT	X		BO													NOTE 1
TOWER 2 RETURN ISOLATION VALVE SIGNAL	X		BO													
TOWER 2 SUMP HEATER START STOP OUTPUT COMMAND	X		BO													NOTE 1
TOWER 2 SUPPLY ISOLATION VALVE SIGNAL	X		BO													
CHILLER PLANT ENABLE				X				OFF								
CHILLED WATER SUPPLY TEMPERATURE SETPOINT				X				42.0 deg. F-55.0 deg. F								
OUTSIDE AIR TEMPERATURE ENABLE SETPOINT				X				60.0 deg. F								
BAS COMMUNICATION STATE				X										X		NOTE 1
CONTROLLER SPARE HARDWARE POINTS																
ANALOG INPUT(S)		10														
UNIVERSAL INPUT(S)		15														
ANALOG OUTPUT(S)			10													
REFRIGERANT DETECTION SYSTEM POINTS	X	AI	A0						X	X						
GENERAL NOTES	1. DISPLAYED AT THE BAS USER INTERFACE															

1

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2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

htg hollon+cannon group, llc

AUSTIN I.S.D.

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STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
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TITLE

MECHANICAL CONTROLS

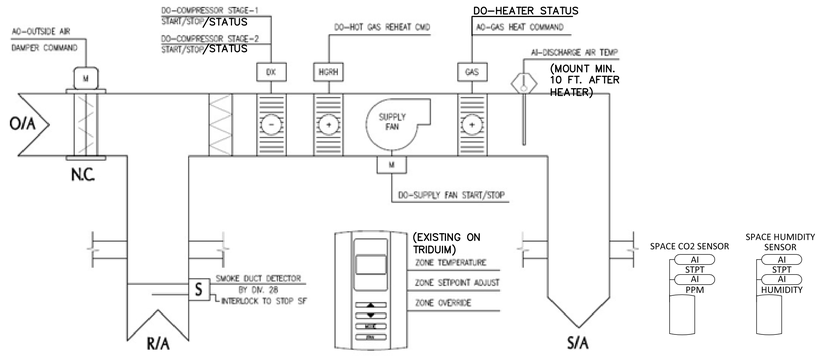
SHEET

M0.8.1

1

1

RTU-KIT
(PACKAGED DX, GAS HEAT)



DUAL STAGE PACKAGED UNIT WITH HOT-GAS REHEAT AND MODULATING GAS HEAT

NOT TO SCALE

Issued:05/31/2019

Packaged Direct Expansion

1. Description:
   A. This guideline applies to a stand-alone, air-cooled, packaged direct expansion system with one or more stages of direct expansion cooling, heat pump or natural gas heating and hot gas reheat. These systems apply mostly to retrofit applications where it is not possible to provide hydronic units to serve single studios. Systems will be vertical self-contained indoor units, or rooftop mounted pending approval by Owner.
   B. Controls provided by equipment manufacturer with BACnet communications protocol to interface with Owner's WANHMI. Design team will coordinate with equipment manufacturer to verify that controls provided are able to meet these guidelines, and to develop detailed sequences and interface requirements for integration to Owner's WANHMI.
2. Guideline sequence:
   A. Enable packaged direct expansion system using one or more of the following:
      i. Occupancy schedule
      ii. Unoccupied setback/setup
      iii. Local override at zone thermostat
      iv. Remote override at WANHMI
      v. Fan control:
         a. Fan shall run continuously during occupied hours.
         b. For units with variable speed fan, fan speed will vary to maintain space temperature and relative humidity.
      vi. Temperature control:
         a. Program unit controls with adjustable discrete occupied and unoccupied heating and cooling setpoints with appropriate dead-bands.
         b. Cycle compressor(s) to meet space temperature.
         c. For units with variable speed compressors, modulate compressors to maintain space temperature and relative humidity.
         d. Modulate gas heat (or enable heat pump reversing valve) to maintain space temperature setpoint upon a drop-in space temperature below the heating setpoint.
      i. Ventilation control:
         a. Module decoupled OA damper to maintain CO_2 levels within limits established by the design team.
         b. Close outside air damper during unoccupied hours.
      ii. Controls shall allow outside air damper to be commanded from the HMI.
      iii. Dehumidification control:
         a. Enable hot gas reheat to maintain relative humidity below set-point during occupied hours.
         b. Disable hot gas reheat when unit is in cooling or heating mode.
      iv. Economizer:
         a. Provide on-board economizer controls.
2. Control points:
   A. All control points provided by manufacturer. Points indicated with (HMI) shall be accessible to the Owner via BACnet communications protocol for monitoring and control.
   B. Provide the following control points for a package direct expansion system using the following performance criteria
      i. Unit start/stop (HMI)
      ii. Unit schedule override (at sensor)
      iii. Outside air damper command (HMI)
      iv. Compressor stage 1 (or modulation)
      v. Compressor stage 2
      vi. Hot gas reheat
      vii. Modulating gas heat/heat pump reversing valve/electric heat
      viii. Space temperature (HMI)
      ix. Space temperature setpoint adjust (HMI)
      x. Space relative humidity (HMI)
      xi. Space CO_2 (HMI)

1

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

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KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
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Jose I. Guerra, Inc
Consulting Engineers

hcg hollon+cannon group, llc

AUSTIN I.S.D.

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RENOVATIONS
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78745
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STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
01/30/2020

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MECHANICAL CONTROLS

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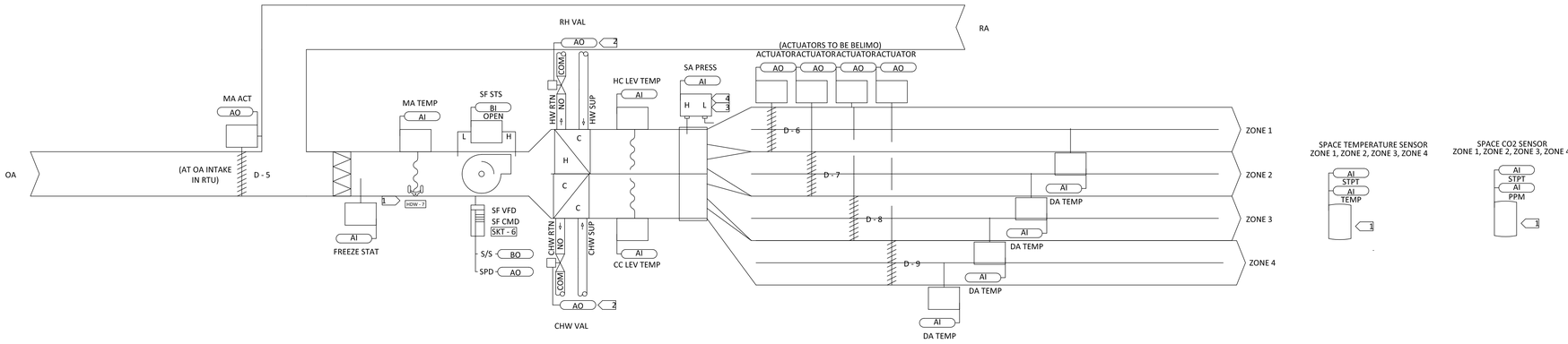
M0.8.2

1

AHU - 3



SPACE TEMPERATURE SENSOR
ZONE 1, ZONE 2, ZONE 3, ZONE 4

SPACE CO2 SENSOR
ZONE 1, ZONE 2, ZONE 3, ZONE 4

5 CONTROLS CONTRACTOR TO MOUNT SENSOR IN CONTROLLED SPACE.

4 CONTROLS CONTRACTOR TO RUN 1/4" POLY TUBING FROM DUCT STATIC TIP MOUNTED IN DISCHARGE OF FAN TO STATIC PRESSURE TRANSDUCER CONNECTED TO CONTROLLER.

3 CONTROLS CONTRACTOR TO HARDWIRE N.C. CONTACTS OF HIGH STATIC PRESSURE SWITCH TO MOTOR CONTROLLER (IN SERIES WITH N.C. LOW LIMIT THERMOSTAT) AND INDEPENDENT OF H-O-A POSITION.

2 VALVE SHIPPED LOOSE. CONTROLS CONTRACTOR TO FIELD INSTALL VALVE AND CONNECT CABLE. FOLLOW MANUFACTURER'S PIPING INSTRUCTIONS.

1 CONTROLS CONTRACTOR TO USE A MINIMUM OF THREE (3) MOUNTING CLIPS PER AVERAGING SENSOR.

Multi-Zone, Variable Air Volume, Air Hander (MZ)

1. Control points:
   A. Provide the following control points for a multi-zone, 4-pipe air hander using the following performance criteria:
      i. On/Off (hardwired)
      ii. Speed command (VFD BACnet)
      iii. Speed feedback (VFD BACnet)
      iv. Return section chilled water control valve
      v. Ventilation chilled water control valve
      vi. Ventilation hot water control valve
      vii. Main hot water control valve
      viii. Outside air damper
      ix. Return air damper
      x. Space temperature – for each zone
      xi. Space/return relative humidity – for each zone
      xii. Space CO_2 – for each zone
      xiii. Return air temperature
      xiv. Mixed air temperature
      xv. Main cooling coil discharge air temperature
      xvi. Ventilation heating coil discharge air temperature
      xvii. Ventilation cooling coil discharge air temperature
      xviii. Unit supply air temperature
      xix. Duct smoke detector (monitor hand-wired point)

Multi-Zone, Variable Air Volume, Air Hander (MZ)

1. Description:
   A. This guideline applies to multi-zone hydronic air handlers serving large areas with variable occupancy no decoupled outside air unit.
2. Guideline sequence:
   A. Enabled multi- zone, variable air volume, air hander by one or more of the following:
      i. Occupancy schedule
      ii. Unoccupied setback/setup
      iii. Local override at zone thermostat
      iv. Remote override at WANHMI
      v. Call for override from another unit –in response to need to create plant load
   B. Cooling/heating mode determined by deviation from space temperature setpoint.
   C. Control cooling mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan modulates to maintain space temperature
      ii. Chilled water valve maintains supply air temperature to control space relative humidity
      iii. When fan reaches minimal speed, enable supply air reset and/or reheat to prevent overcooling
   D. Control heating mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan operates at constant speed as determined by design team to ensure adequate throw
      ii. Hot water coil modulates to maintain space temperature
   E. Control ventilation for multi- zone, variable air volume, air hander using the following performance criteria:
      i. Decoupled OA (normally closed) and RA (normally open) dampers
      ii. OA and RA dampers modulate to maintain space CO_2
      iii. Barometric relief dampers as required to relieve excess space pressure
   i. Implement a pre-freeze sequence that will protect coils while allowing unit to continue in operation with reduced/no ventilation air, without tripping freeze-stat.
   ii. Implement a freeze-protection sequence that will protect coils and shutdown the system.
   B. Provide the following safeties:
      i. Smoke detection shutdown.

HADDON+COWAN ARCHITECTS
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STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
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MECHANICAL CONTROLS

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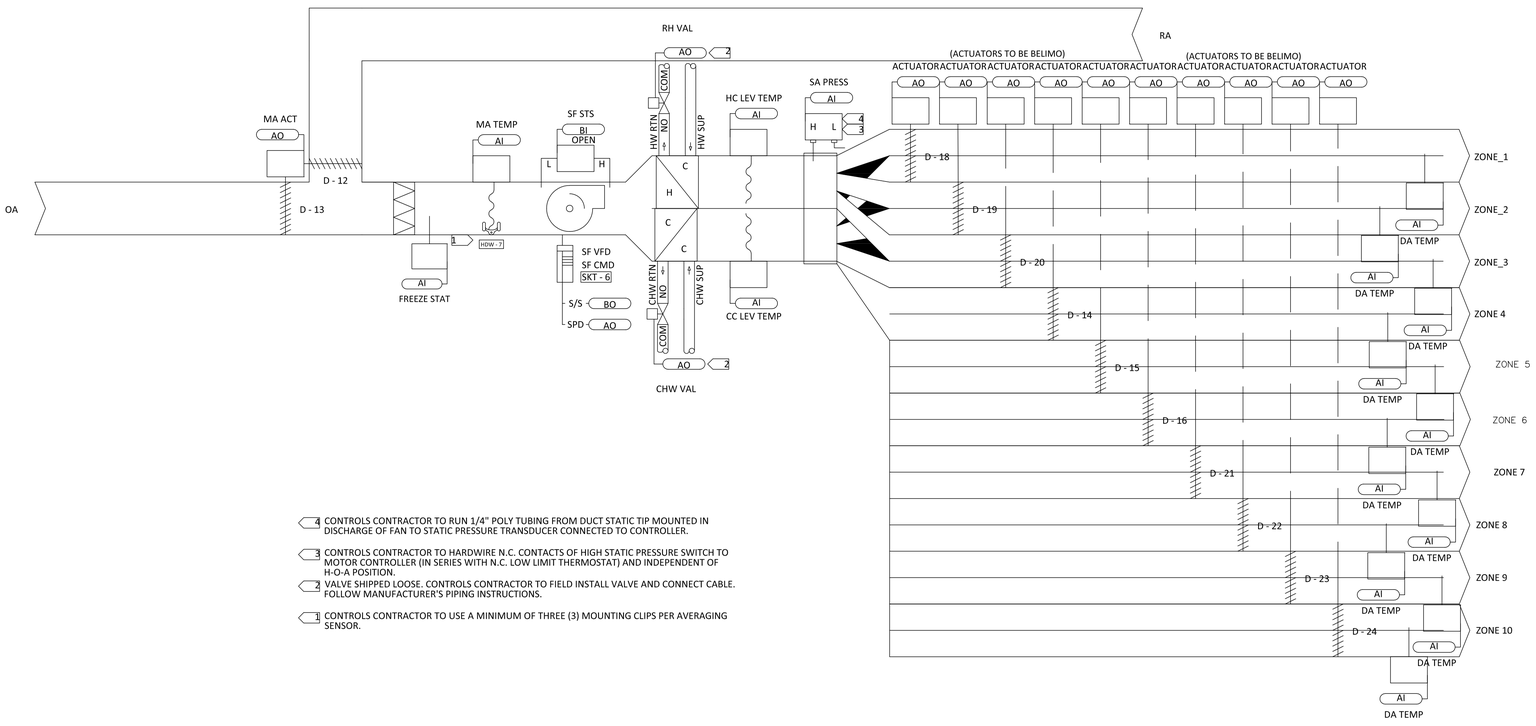
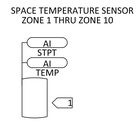
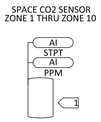
M0.8.3

AHU-6
(MULTIZONE AHU)







4 CONTROLS CONTRACTOR TO RUN 1/4" POLY TUBING FROM DUCT STATIC TIP MOUNTED IN DISCHARGE OF FAN TO STATIC PRESSURE TRANSDUCER CONNECTED TO CONTROLLER.

3 CONTROLS CONTRACTOR TO HARDWIRE N.C. CONTACTS OF HIGH STATIC PRESSURE SWITCH TO MOTOR CONTROLLER (IN SERIES WITH N.C. LOW LIMIT THERMOSTAT) AND INDEPENDENT OF H-O-A POSITION.

2 VALVE SHIPPED LOOSE. CONTROLS CONTRACTOR TO FIELD INSTALL VALVE AND CONNECT CABLE. FOLLOW MANUFACTURER'S PIPING INSTRUCTIONS.

1 CONTROLS CONTRACTOR TO USE A MINIMUM OF THREE (3) MOUNTING CLIPS PER AVERAGING SENSOR.

1. Control points:
   A. Provide the following control points for a multi-zone, 4-pipe air hander using the following performance criteria:
      i. On/Off (hardwired)
      ii. Speed command (VFD BACnet)
      iii. Speed feedback (VFD BACnet)
      iv. Return section chilled water control valve
      v. Ventilation chilled water control valve
      vi. Ventilation hot water control valve
      vii. Main hot water control valve
      viii. Outside air damper
      ix. Return air damper
      x. Space temperature – for each zone
      xi. Space/return relative humidity – for each zone
      xii. Space CO_2 – for each zone
      xiii. Return air temperature
      xiv. Mixed air temperature
      xv. Main cooling coil discharge air temperature
      xvi. Ventilation heating coil discharge air temperature
      xvii. Ventilation cooling coil discharge air temperature
      xviii. Unit supply air temperature
      xix. Duct smoke detector (monitor hand-wired point)

Multi-Zone, Variable Air Volume, Air Hander (MZ)

1. Description:
   A. This guideline applies to multi-zone hydronic air handlers serving large areas with variable occupancy no decoupled outside air unit.
2. Guideline sequence:
   A. Enabled multi- zone, variable air volume, air hander by one or more of the following:
      i. Occupancy schedule
      ii. Unoccupied setback/setup
      iii. Local override at zone thermostat
      iv. Remote override at WANHMI
      v. Call for override from another unit –in response to need to create plant load
   B. Cooling/heating mode determined by deviation from space temperature setpoint.
   C. Control cooling mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan modulates to maintain space temperature
      ii. Chilled water valve maintains supply air temperature to control space relative humidity
      iii. When fan reaches minimal speed, enable supply air reset and/or reheat to prevent overcooling
   D. Control heating mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan operates at constant speed as determined by design team to ensure adequate throw
      ii. Hot water coil modulates to maintain space temperature
   E. Control ventilation for multi- zone, variable air volume, air hander using the following performance criteria:
      i. Decoupled OA (normally closed) and RA (normally open) dampers
      ii. OA and RA dampers modulate to maintain space CO_2
      iii. Barometric relief dampers as required to relieve excess space pressure

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2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

hcg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX
78745
AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
07/31/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

Date	09/04/2020
Job Number	20-0029
Scale	AS NOTED
Drawn	W&G
Checked	W&G
Approved	W&G

TITLE

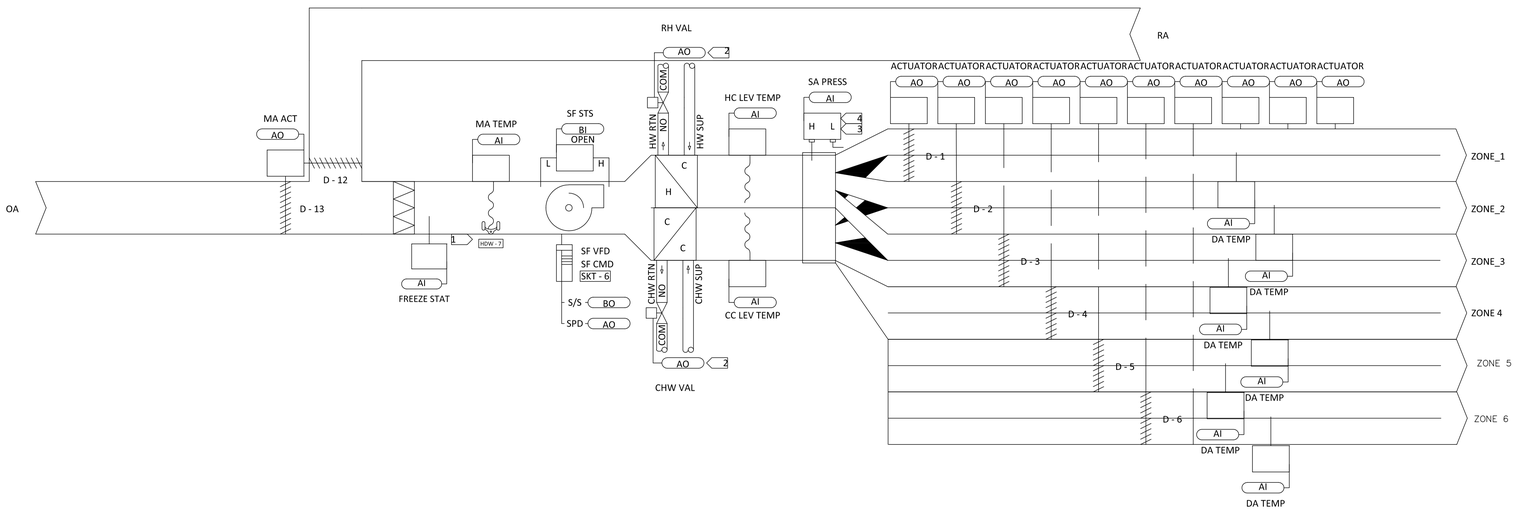
MECHANICAL CONTROLS

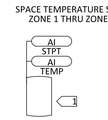
SHEET

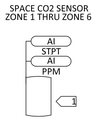
M0.8.4

1

AHU-7
(MULTIZONE AHU)







4 CONTROLS CONTRACTOR TO RUN 1/4" POLY TUBING FROM DUCT STATIC TIP MOUNTED IN DISCHARGE OF FAN TO STATIC PRESSURE TRANSDUCER CONNECTED TO CONTROLLER.

3 CONTROLS CONTRACTOR TO HARDWIRE N.C. CONTACTS OF HIGH STATIC PRESSURE SWITCH TO MOTOR CONTROLLER (IN SERIES WITH N.C. LOW LIMIT THERMOSTAT) AND INDEPENDENT OF H-O-A POSITION.

2 VALVE SHIPPED LOOSE. CONTROLS CONTRACTOR TO FIELD INSTALL VALVE AND CONNECT CABLE. FOLLOW MANUFACTURER'S PIPING INSTRUCTIONS.

1 CONTROLS CONTRACTOR TO USE A MINIMUM OF THREE (3) MOUNTING CLIPS PER AVERAGING SENSOR.

1. Control points:
   A. Provide the following control points for a multi-zone, 4-pipe air hander using the following performance criteria:
      i. On/Off (hardwired)
      ii. Speed command (VFD BACnet)
      iii. Speed feedback (VFD BACnet)
      iv. Return section chilled water control valve
      v. Ventilation chilled water control valve
      vi. Ventilation hot water control valve
      vii. Main hot water control valve
      viii. Outside air damper
      ix. Return air damper
      x. Space temperature – for each zone
      xi. Space/return relative humidity – for each zone
      xii. Space CO_2 – for each zone
      xiii. Return air temperature
      xiv. Mixed air temperature
      xv. Main cooling coil discharge air temperature
      xvi. Ventilation heating coil discharge air temperature
      xvii. Ventilation cooling coil discharge air temperature
      xviii. Unit supply air temperature
      xix. Duct smoke detector (monitor hand-wired point)

Multi-Zone, Variable Air Volume, Air Hander (MZ)

1. Description:
   A. This guideline applies to multi-zone hydronic air handlers serving large areas with variable occupancy nodecoupled outside air unit.
2. Guideline sequence:
   A. Enabled multi- zone, variable air volume, air hander by one or more of the following:
      i. Occupancy schedule
      ii. Unoccupied setback/setup
      iii. Local override at zone thermostat
      iv. Remote override at WANHMI
      v. Call for override from another unit —in response to need to create plant load
   B. Cooling/heating mode determined by deviation from space temperature setpoint.
   C. Control cooling mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan modulates to maintainspace temperature
      ii. Chilled water valve maintains supply air temperature to control space relative humidity
      iii. When fan reaches minimal speed, enable supply air reset and/or reheatto prevent overcooling
   D. Control heating mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan operates at constant speed as determined by design team to ensure adequate throw
      ii. Hot water coil modulates to maintain spacetemperature
   E. Control ventilation for multi- zone, variable air volume, air hander using the following performance criteria:
      i. Decoupled OA (normally closed) and RA (normally open) dampers
      ii. OA and RA dampers modulate to maintain space CO_2
      iii. Barometric relief dampers as required to relieve excess space pressure

1

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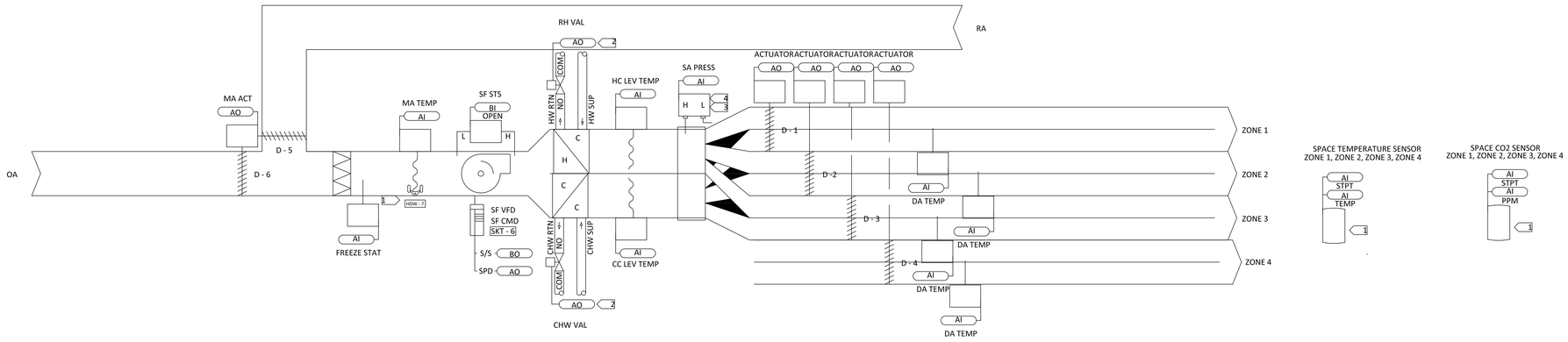
MECHANICAL CONTROLS

SHEET

M0.8.5

AHU - 13



SPACE TEMPERATURE SENSOR
ZONE 1, ZONE 2, ZONE 3, ZONE 4

SPACE CO2 SENSOR
ZONE 1, ZONE 2, ZONE 3, ZONE 4

5 CONTROLS CONTRACTOR TO MOUNT SENSOR IN CONTROLLED SPACE.

4 CONTROLS CONTRACTOR TO RUN 1/4" POLY TUBING FROM DUCT STATIC TIP MOUNTED IN DISCHARGE OF FAN TO STATIC PRESSURE TRANSDUCER CONNECTED TO CONTROLLER.

3 CONTROLS CONTRACTOR TO HARDWIRE N.C. CONTACTS OF HIGH STATIC PRESSURE SWITCH TO MOTOR CONTROLLER (IN SERIES WITH N.C. LOW LIMIT THERMOSTAT) AND INDEPENDENT OF H-O-A POSITION.

2 VALVE SHIPPED LOOSE. CONTROLS CONTRACTOR TO FIELD INSTALL VALVE AND CONNECT CABLE. FOLLOW MANUFACTURER'S PIPING INSTRUCTIONS.

1 CONTROLS CONTRACTOR TO USE A MINIMUM OF THREE (3) MOUNTING CLIPS PER AVERAGING SENSOR.

1. Control points:
   A. Provide the following control points for a multi-zone, 4-pipe air hander using the following performance criteria:
      i. On/Off (hardwired)
      ii. Speed command (VFD BACnet)
      iii. Speed feedback (VFD BACnet)
      iv. Return section chilled water control valve
      v. Ventilation chilled water control valve
      vi. Ventilation hot water control valve
      vii. Main hot water control valve
      viii. Outside air damper
      ix. Return air damper
      x. Space temperature – for each zone
      xi. Space/return relative humidity – for each zone
      xii. Space CO_2 – for each zone
      xiii. Return air temperature
      xiv. Mixed air temperature
      xv. Main cooling coil discharge air temperature
      xvi. Ventilation heating coil discharge air temperature
      xvii. Ventilation cooling coil discharge air temperature
      xviii. Unit supply air temperature
      xix. Duct smoke detector (monitor hand-wired point)

Multi-Zone, Variable Air Volume, Air Hander (MZ)

1. Description:
   A. This guideline applies to multi-zone hydronic air handlers serving large areas with variable occupancy no decoupled outside air unit.
2. Guideline sequence:
   A. Enabled multi- zone, variable air volume, air hander by one or more of the following:
      i. Occupancy schedule
      ii. Unoccupied setback/setup
      iii. Local override at zone thermostat
      iv. Remote override at WANHMI
      v. Call for override from another unit —in response to need to create plant load
   B. Cooling/heating mode determined by deviation from space temperature setpoint.
   C. Control cooling mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan modulates to maintain space temperature
      ii. Chilled water valve maintains supply air temperature to control space relative humidity
      iii. When fan reaches minimal speed, enable supply air reset and/or reheat to prevent overcooling
   D. Control heating mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan operates at constant speed as determined by design team to ensure adequate throw
      ii. Hot water coil modulates to maintain space temperature
   E. Control ventilation for multi- zone, variable air volume, air hander using the following performance criteria:
      i. Decoupled OA (normally closed) and RA (normally open) dampers
      ii. OA and RA dampers modulate to maintain space CO_2
      iii. Barometric relief dampers as required to relieve excess space pressure

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TITLE

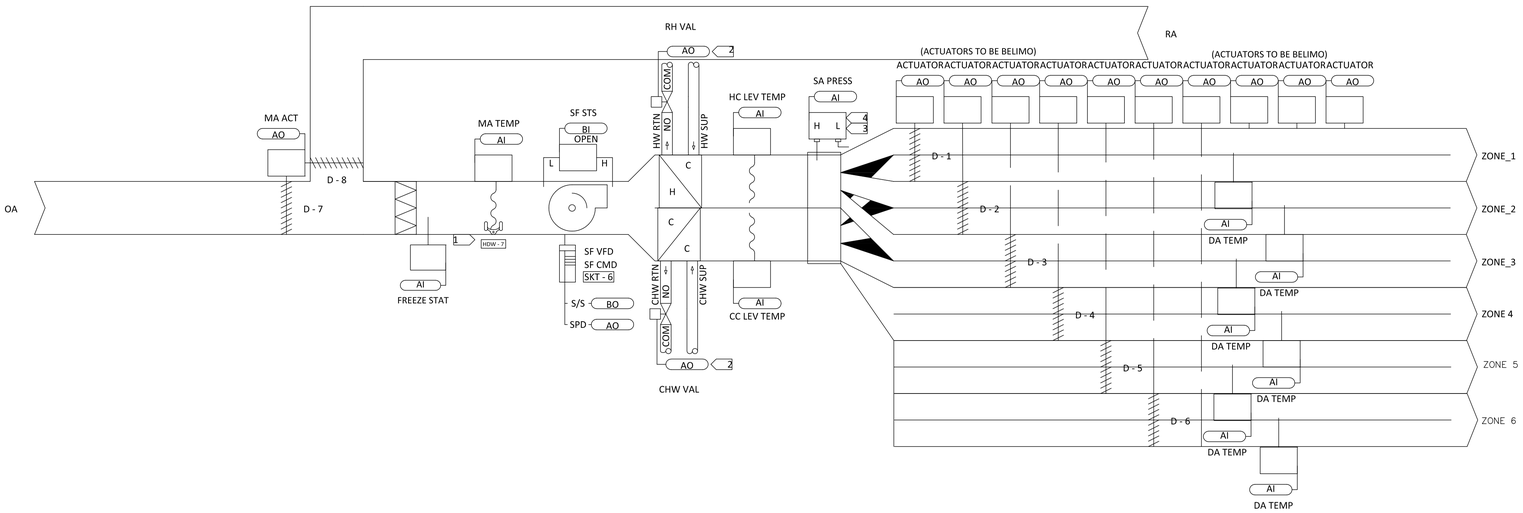
MECHANICAL CONTROLS - PHASE 5

SHEET

M0.8.6 PHASE 5

1

AHU-14
(MULTIZONE AHU)



SPACE TEMPERATURE SENSOR
ZONE 1 THRU ZONE 6

SPACE CO2 SENSOR
ZONE 1 THRU ZONE 6

4 CONTROLS CONTRACTOR TO RUN 1/4" POLY TUBING FROM DUCT STATIC TIP MOUNTED IN DISCHARGE OF FAN TO STATIC PRESSURE TRANSDUCER CONNECTED TO CONTROLLER.

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1. Control points:
   A. Provide the following control points for a multi-zone, 4-pipe air hander using the following performance criteria:
      i. On/Off (hardwired)
      ii. Speed command (VFD BACnet)
      iii. Speed feedback (VFD BACnet)
      iv. Return section chilled water control valve
      v. Ventilation chilled water control valve
      vi. Ventilation hot water control valve
      vii. Main hot water control valve
      viii. Outside air damper
      ix. Return air damper
      x. Space temperature – for each zone
      xi. Space/return relative humidity – for each zone
      xii. Space CO_2 – for each zone
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      xiv. Mixed air temperature
      xv. Main cooling coil discharge air temperature
      xvi. Ventilation heating coil discharge air temperature
      xvii. Ventilation cooling coil discharge air temperature
      xviii. Unit supply air temperature
      xix. Duct smoke detector (monitor hand-wired point)

Multi-Zone, Variable Air Volume, Air Hander (MZ)

1. Description:
   A. This guideline applies to multi-zone hydronic air handlers serving large areas with variable occupancy no decoupled outside air unit.
2. Guideline sequence:
   A. Enabled multi- zone, variable air volume, air hander by one or more of the following:
      i. Occupancy schedule
      ii. Unoccupied setback/setup
      iii. Local override at zone thermostat
      iv. Remote override at WANHMI
      v. Call for override from another unit –in response to need to create plant load
   B. Cooling/heating mode determined by deviation from space temperature setpoint.
   C. Control cooling mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan modulates to maintainspace temperature
      ii. Chilled water valve maintains supply air temperature to control space relative humidity
      iii. When fan reaches minimal speed, enable supply air reset and/or reheat to prevent overcooling
   D. Control heating mode for multi-zone, variable air volume, air hander using the following performance criteria:
      i. Supply fan operates at constant speed as determined by design team to ensure adequate throw
      ii. Hot water coil modulates to maintain spacetemperature
   E. Control ventilation for multi- zone, variable air volume, air hander using the following performance criteria:
      i. Decoupled OA (normally closed) and RA (normally open) dampers
      ii. OA and RA dampers modulate to maintain space CO_2
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TITLE

MECHANICAL CONTROLS

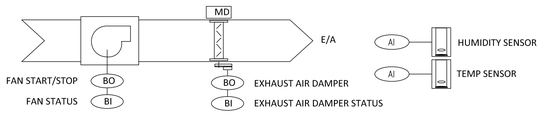
SHEET

M0.8.7 PHASE 5

1

1

NEW CRAWL SPACE EXHAUST FANS



System Operation - When system start-up has been initiated, the following sequences shall be implemented:
The ventilation exhaust fan shall be integrated with the EMCS to monitor fan status. A space humidity and temperature sensor shall monitor the crawl space relative humidity and temperature. When the crawl space humidity reaches 60% or higher, the exhaust air damper shall open. The exhaust fan shall start only after the damper status has proven the damper is open. The exhaust air damper shall open anytime the crawl space exhaust fan runs and shall close anytime the unit stops. When the humidity sensor reads 45% for a minimum of 30 minutes (adjustable), the exhaust fan shall stop. The exhaust air damper shall close 30 sec (adj.) after the fan stops. This sequence shall hold true when the temperature sensor reads 40°F or higher. Once the temperature sensor reads below 40°F or lower, the fans shall remain off.

System Setpoints - The setpoints for the system shall be set as follows:
The design airflow rates shall be set at the values given in the Mechanical Drawings.

Fan Status
The controller shall monitor the fan status.
Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan In Hand: Commanded off, but the status is on.
- Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

1

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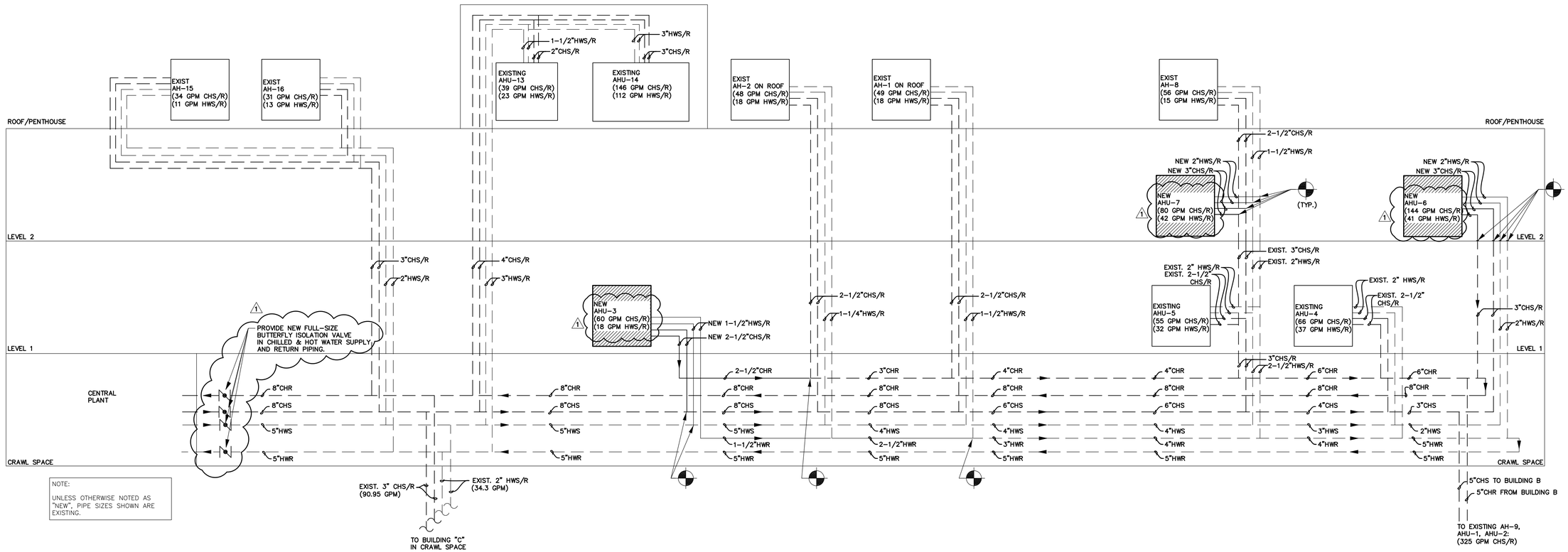
MECHANICAL CONTROLS

SHEET

M0.8.8 PHASE 2

1



NOTE:

UNLESS OTHERWISE NOTED AS "NEW", PIPE SIZES SHOWN ARE EXISTING.

CHILLED AND HOT WATER PIPING SCHEMATIC

NTS

HVAC LEGEND:

NEW WORK TO BE PERFORMED. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

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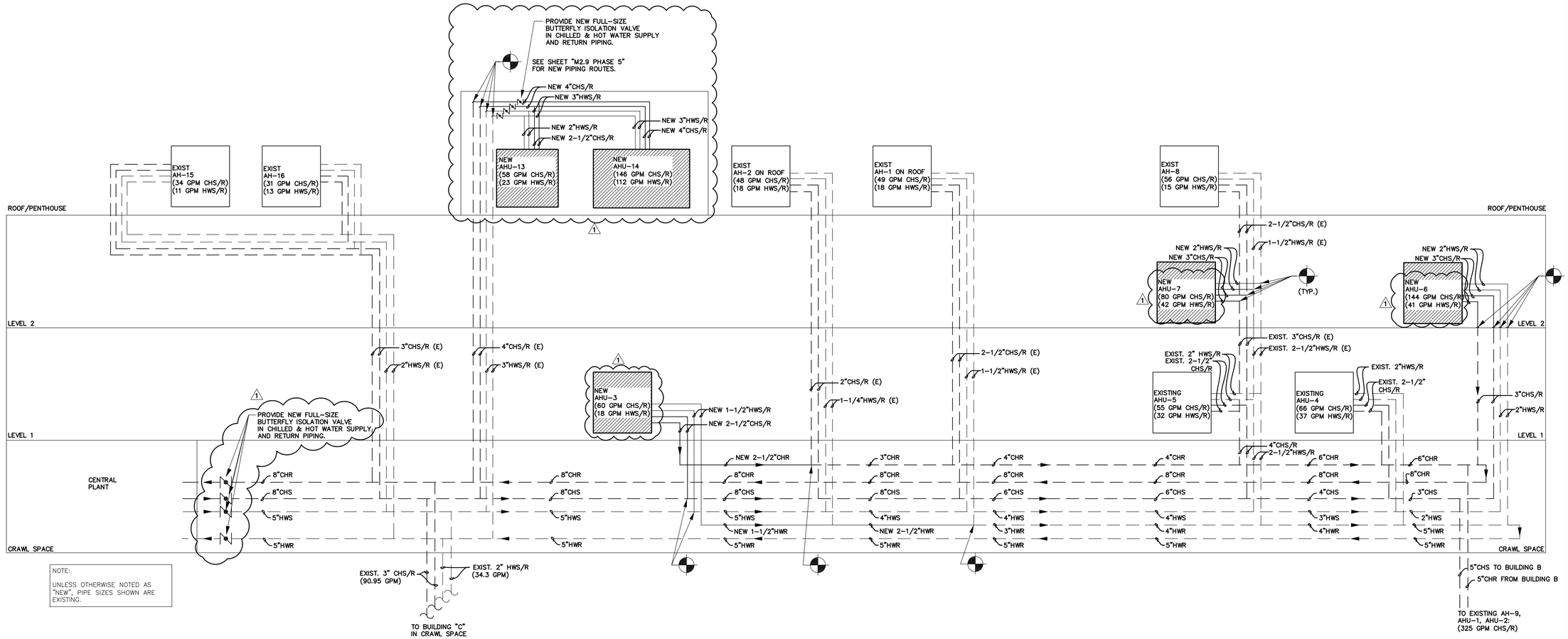
TITLE

CHILLED & HOT WATER PIPING SCHEMATIC

SHEET

M0.9



NOTE:

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CHILLED AND HOT WATER PIPING SCHEMATIC - PHASE 5

NTS

HVAC LEGEND:

NEW WORK TO BE PERFORMED. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

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CHILLED & HOT WATER PIPING SCHEMATIC - PHASE 5

SHEET

M0.9.1 PHASE 5

Left Hand Coil Connections
Left Hand Drain Pan Connections
Left Hand Access Doors
2 Control Dampers - OA & RA -24 x 54

Required Filters:
6@20x20x2
16.7 Sq Ft @8000 CFM = 480 FPM

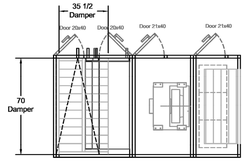
1 New York Blower EZ Plenum Fan
Size 24 ECF-9 @8,000 CFM, 5 HP Motor

1 Cooling Coil - 36 FH x 60 FL x 10 W
1 Heating Coil - 24 FH x 60 FL x 6 W

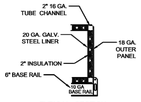
Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

SUBMITTAL

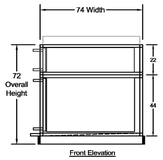
☐ APPROVED
☐ APPROVED PENDING CHANGES
BY:
DATE: / /



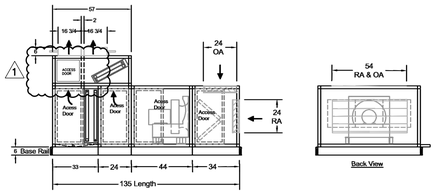
Plan View



TYPICAL SECTION



Front Elevation



Left Elevation View

Back View

Rev.	Int.	Date	Description
			REVISION HISTORY

(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Thybar Custom Air Handling Unit- Indoor- Multizone Replacement Multizone Unit 8000 CFM

Austin ISD Bedichek MS

Qty.: 1 | Job# :Q-1912687
Tag: AHU-3
Drawn: Tim Glines
File: S4495-1
Rev.:
Date: 1/2/20

thybar CORPORATION *Thybar makes it right the first time, every time*

Right Hand Coil Connections
Right Hand Drain Pan Connection
Right Hand Access Doors

(2) Control Dampers - OA & RA - 24 x 80

Required Filters - 2" Thick:
(6) 24 x 20 & (9) 20 x 20
45 Sq Ft @ 18,600 CFM = 413 FPM

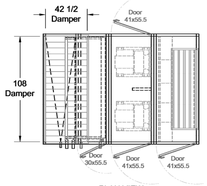
(2) NYB EZ Plenum Fans - Size 22, ECF-9
9400 CFM Each, 7-1/2 HP Motor

(1) Cooling Coil - 49.5 FH x 100 FL x 10 W
(1) Heating Coil - 33 FH x 100 FL x 6 W

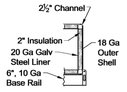
Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

SUBMITTAL

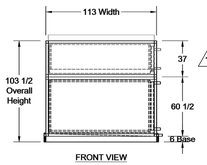
☐ APPROVED
☐ APPROVED PENDING CHANGES
BY:
DATE: / /



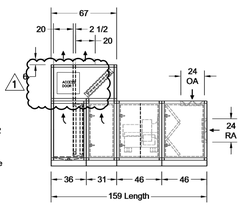
PLAN VIEW



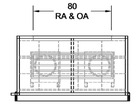
Typical Section



FRONT VIEW



RIGHT ELEVATION



BACK VIEW

Rev.	Int.	Date	Description
			REVISION HISTORY

(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Thybar Custom Air Handling Unit - Indoor - MultiZone Replacement Multi Zone - 18,600 CFM

Trane Austin / Austin ISD Bedichek MS

Qty.: 1 | Job# : Q-1912687
Tag: AHU-6
Drawn: JER
File: S4496-2
Rev.:
Date: 12/30/19

thybar CORPORATION *Thybar makes it right the first time, every time*

Right Hand Coil Connections
Right Hand Drain Pan Connection
Right Hand and Left Hand Access Doors

2 Control Dampers - OA & RA - 24 X 80

Required Filters:
8 @20X25x2
27.8 Sq Ft @10,560 CFM = 380 FPM

2 New York Blower EZ Plenum Fans
Size 20 ECF-9 5280 CFM Each , 5 Hp Motor

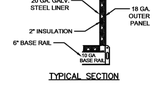
1 Cooling Coil - 42 FH x 68 FL x 10 W
1 Heating Coil - 27 FH x 68 FL x 7.5 W

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

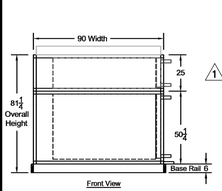
SUBMITTAL

☐ APPROVED
☐ APPROVED PENDING CHANGES
BY:
DATE: / /

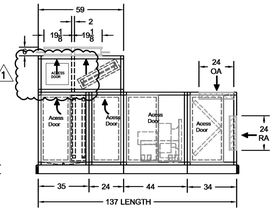
Plan View



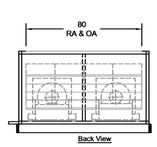
TYPICAL SECTION



Front View



Right Elevation



Back View

Rev.	Int.	Date	Description
			REVISION HISTORY

(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ± 1/16 ± 0.0625 ± 1°

Thybar Custon Air Handling Unit - Indoor - MultiZone Replacement MultiZone - 10,560 CFM

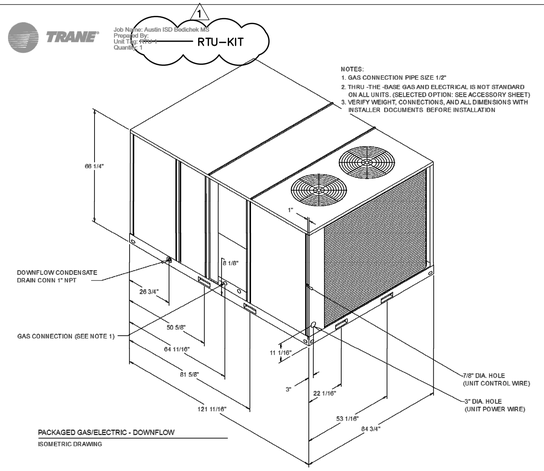
Trane Austin / Austin ISD Bedichek MS

Qty.: 1 | Job# :Q-1912687
Tag: AHU-7
Drawn: TG
File: S4497-3
Rev.:
Date: 1/2/20

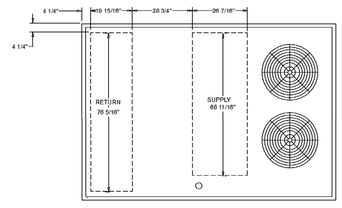
thybar CORPORATION *Thybar makes it right the first time, every time*

TRANE

Job Name: Austin ISD Bedichek MS
Prepared By:
Unit Tag: (AHU-7)
Quantity: 1



PACKAGED GAS/ELECTRIC - DOWNFLOW
ISOMETRIC DRAWING



PACKAGED GAS/ELECTRIC - DOWNFLOW
PLAN VIEW DRAWING

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

hcg hollon+cannon group, llc

AUSTIN I.S.D.
DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX
78745
AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

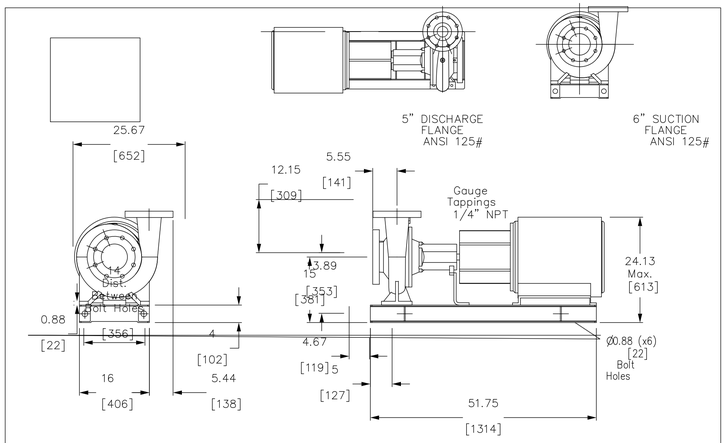
Date	09/04/2020
Job Number	20-0029
Scale	AS NOTED
Drawn	W&G
Checked	W&G
Approved	W&G

TITLE

NEW RTU & AHU'S - PLANS & ELEVATIONS

SHEET

M0.10



8200
N. Austin Ave.
Morton Grove, IL 60053, USA

BG-E1510-5EB-SS-324T-L

Series e-1510 Centrifugal Pumps - Base Mounted
Seal Type: Standard Seal|Motor Frame: 324T|Frame Type: L|Flange: ANSI 125#

NOTE: DO NOT PROVIDE GEARBOX WITH NEW CHILLED WATER PUMPS PER AISD PDM.

Dimensions are subject to change Not to be used for construction unless certified	Dimensions : IN (mm)	Scale : N.T.S.	Submittal # : B-880.36C
Dimensions are subject to change Not to be used for construction unless certified	Dimensions : IN (mm)	Scale : N.T.S.	Submittal # : B-880.36C

Bell & Gossett
a xylem brand

Submittal

Job/Project:	**Representative: Oslin Nation**	
ESP-Systemwize: WIZE-292289 Created On: 01/27/2020	**Phone: (214) 631-5650**	
Location/Tag:	**Email: sales@onco-cx.com**	
Engineer:	**Submitted By:**	**Date:**
Contractor:	**Approved By:**	**Date:**

Base Mounted End Suction Pump

Series: e-1510

Model: 5EB

Features & Design

- ANSI/OSHA Coupling Guard
- Center Drop Out Spacer Coupling
- Fabricated Heavy Duty Baseplate
- Internally Self-Flushing Mechanical Seal

*The Bell & Gossett Series e-1510 is available in 26 sizes and a variety of configuration options that enable customization and flexibility to fit a broad range of operating conditions.

http://bellgossett.com/pumps-circulators/end-suction-pumps/e-1510/

Pump Selection Summary

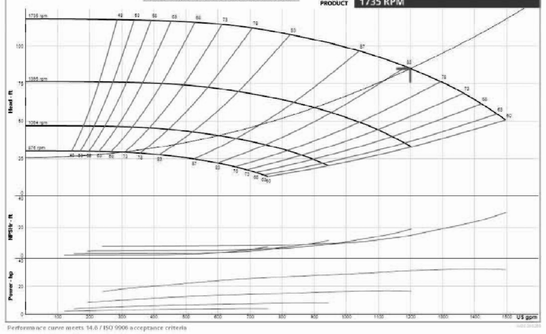
Duty Point Flow	1200 US gpm
Duty Point Head	85 ft
Control Head	25.5 ft
Duty Point Pump Efficiency	82.4%
Part Load Efficiency Value (PLEV)	83.6%
Impeller Diameter	11 in
Motor Power	40 hp
Duty Point Power	31.2 bhp
Motor Speed	1800 rpm
RPM @ Duty Point	1795 rpm
NPSHr	15 ft
Minimum Shutoff Head	118 ft
Minimum Flow at RPM	239 US gpm
Flow @ BEP	1041 US gpm
Fluid Temperature	68 °F
Fluid Type	Water
Weight (approx. - consult rep for exact)	892 lbs
Pump Floor Space Calculation	7.68 ft²

Performance Curve

Energy Efficiency Ratings:
Pump & Motor PEI≤1.0.94 ERDI≤ 6
Pump, Motor & Drive: PEIVI: 0.46 ERVI: 54

PREMIUM EFFICIENCY PRODUCT

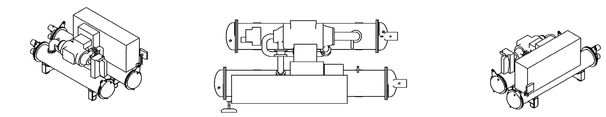
e-1510
5EB
1735 RPM



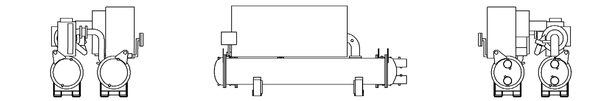
Performance curve meets 14.6 / ISO 9906 acceptance criteria

9/28/2020 Trane Drawing Dated: Version Number:
65223.00 Each
Page 3 of 12
Date Generation Date: 9/28/2020

Model HDWA
Nominal tons 200



TOP VIEW



LEFT SIDE VIEW | FRONT VIEW | RIGHT SIDE VIEW

CUSTOMER NOTES:

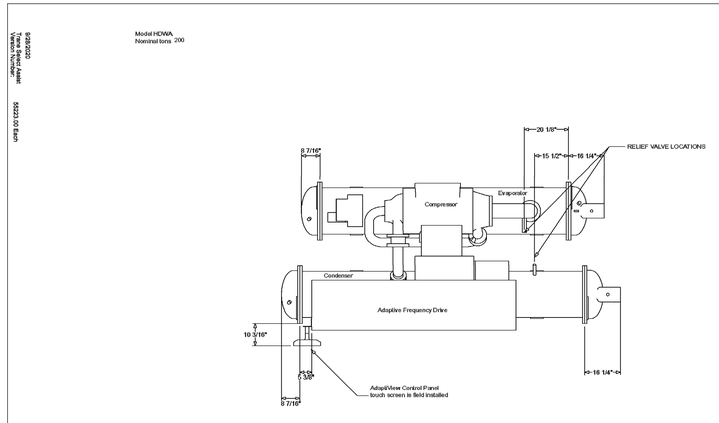
GRAPHICS ON SUBMITTAL ARE SIMPLIFIED TO SHOW MAJOR ENVELOPE COMPONENTS. UNIT STRUCTURE AND SUBCOMPONENTS MAY BE REMOVED FOR CLARITY.

UNLESS OTHERWISE SPECIFIED DIMENSIONAL TOLERANCE +/-1/2". COOLING COND CONNS ARE STRAIGHT OUT THE END OF THE WATER BOX. WATER BOX DRAIN AND VENT LOCATIONS ARE SHOWN ON THE WATER BOX END PLATES.

SHELL TYPE	CONN DIA	CONN TYPE	FLOW DIRECTION
EVAPORATOR	6"	VICTAULIC	IN BOTTOM OUT TOP
CONDENSER	6"	VICTAULIC	IN BOTTOM OUT TOP

TRANE
Job Name: Austin ISD Bedichek MS
Prepared By:
Sales Office:
Unit Tag: CH-1 200 tons
Quantity: 1

1



TOP VIEW

CUSTOMER NOTES:

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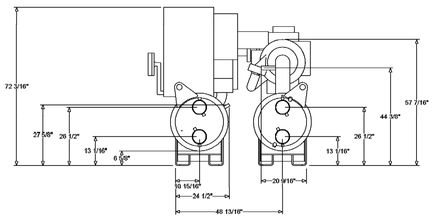
UNLESS OTHERWISE SPECIFIED DIMENSIONAL TOLERANCE +/-1/2". COOLING COND CONNS ARE STRAIGHT OUT THE END OF THE WATER BOX. WATER BOX DRAIN AND VENT LOCATIONS ARE SHOWN ON THE WATER BOX END PLATES.

SHELL TYPE	CONN DIA	CONN TYPE	FLOW DIRECTION
EVAPORATOR	6"	VICTAULIC	IN BOTTOM OUT TOP
CONDENSER	6"	VICTAULIC	IN BOTTOM OUT TOP

9/28/2020 Trane Drawing Dated: Version Number:
65223.00 Each
Page 4 of 12
Date Generation Date: 9/28/2020

Model HDWA
Nominal tons 200



RIGHT SIDE VIEW

CUSTOMER NOTES:

GRAPHICS ON SUBMITTAL ARE SIMPLIFIED TO SHOW MAJOR ENVELOPE COMPONENTS. UNIT STRUCTURE AND SUBCOMPONENTS MAY BE REMOVED FOR CLARITY.

UNLESS OTHERWISE SPECIFIED DIMENSIONAL TOLERANCE +/-1/2". COOLING COND CONNS ARE STRAIGHT OUT THE END OF THE WATER BOX. WATER BOX DRAIN AND VENT LOCATIONS ARE SHOWN ON THE WATER BOX END PLATES.

SHELL TYPE	CONN DIA	CONN TYPE	FLOW DIRECTION
EVAPORATOR	6"	VICTAULIC	IN BOTTOM OUT TOP
CONDENSER	6"	VICTAULIC	IN BOTTOM OUT TOP

TRANE
Job Name: Austin ISD Bedichek MS
Prepared By:
Sales Office:
Unit Tag: CH-1 200 tons
Quantity: 1

9/28/2020 Trane Drawing Dated: Version Number:
65223.00 Each
Page 5 of 12
Date Generation Date: 9/28/2020

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
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AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX

78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

Date	09/04/2020
Job Number	20-0029
Scale	AS NOTED
Drawn	W&G
Checked	W&G
Approved	W&G

TITLE

CENTRAL PLANT NEW EQUIPMENT PLANS - PHASE 4

SHEET

M0.12 PHASE 4

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice.

SUBMITTAL

☐ APPROVED
☐ APPROVED PENDING CHANGES
BY:
DATE: / /

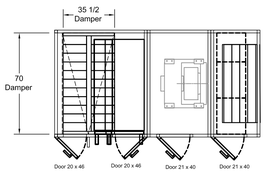
Right Hand Coil Connections
Right Hand Drain Pan Connections
Right Hand Access Doors

2 Control Dampers - OA & RA - 24 x 54

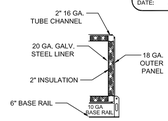
Required Filters - 2" Thick:
(4) 20 x 25 & (2) 20 x 20
19.4 Sq Ft @ 8900 CFM = 458 FPM

1 New York Blower EZ Plenum Fan
Size 22 ECF-9 @8900 CFM ,7 ½ HP Motor

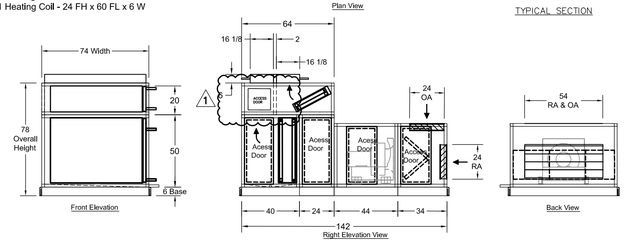
1 Cooling Coil - 42 FH x 60 FL x 12.5 W
1 Heating Coil - 24 FH x 60 FL x 6 W



Plan View



TYPICAL SECTION



Rev.	Int.	Date	Description
REVISION HISTORY			

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ' 1/16 ' 0.0625 ' 1 '

Thybar Custom Air Handling Unit- Indoor - Multizone
Replacement Multi Zone - 8900 CFM

Qty.: 1 | Job# :Q- 1912687
Tag:AHU-13
Drawn: TLG
Date: 1/2/20 | File: S4498-4 | Rev:

Thybar Corporation has a policy of continuous product improvement and reserves the right to change the product design without notice

SUBMITTAL

☐ APPROVED
☐ APPROVED PENDING CHANGES
BY:
DATE: /

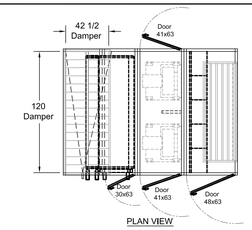
Right Hand Coil Connections
Right Hand Drain Pan Connection
Right Hand Access Doors

(2) Control Dampers - OA & RA - 30 x 96

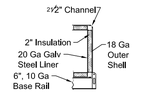
Required Filters:
(15) 24 x 24 x 2" Thick
60 Sq Ft @ 24,000 CFM = 400 FPM

(2) NYB EZ Plenum Fans - Size 27, ECF-9
12,000 CFM Each, 10 HP Motor

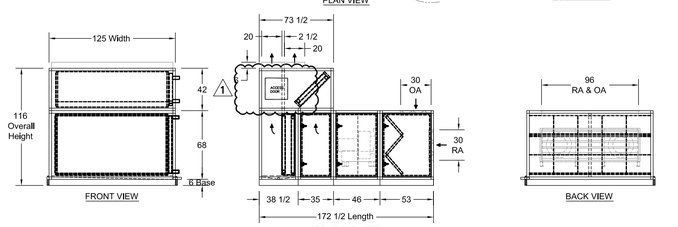
(1) Cooling Coil - 57 FH x 108 FL x 12,5 W
(1) Heating Coil - 39 FH x 108 FL x 7,5 W



PLAN VIEW



Typical Section



Rev.	Int.	Date	Description
REVISION HISTORY			

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(DO NOT SCALE DRAWING) Unless otherwise specified dimensions are in inches tolerances are ' 1/16 ' 0.0625 ' 1 '

Thybar Custom Air Handling Unit - Indoor - MultiZone
Replacement Multi Zone - 24,000 CFM

Trane Austin / Austin ISD Bedchek MS

Qty.: 1 | Job# : Q-1912687
Tag: AHU-14
Drawn: JER
Date: 12/27/19 | File: S4499-5 | Rev:

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | **haddoncowan.com**

In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
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MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
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P.O. Box 1377
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DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX

78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

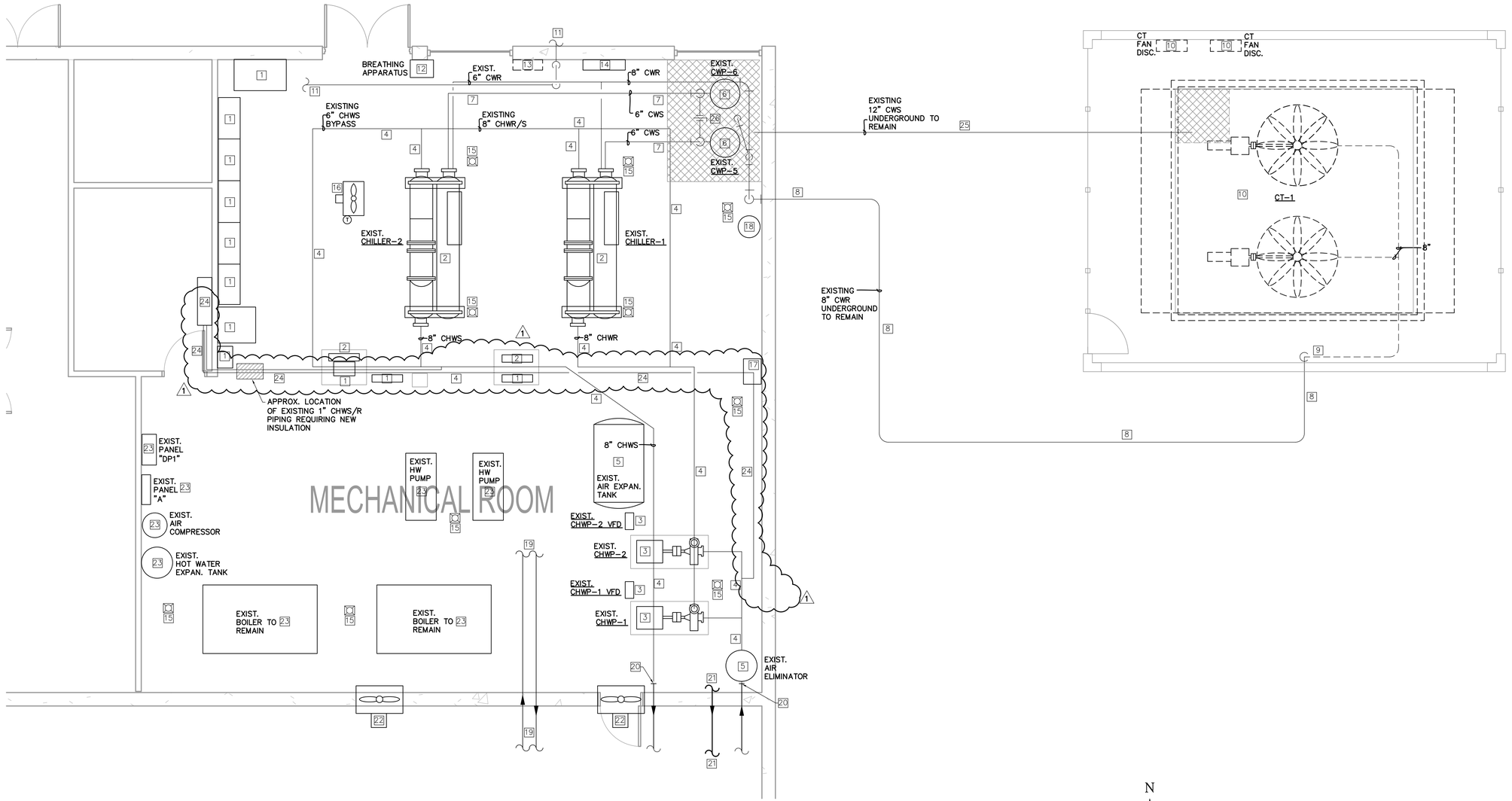
Date	09/04/2020
Job Number	20-0029
Scale	AS NOTED
Drawn	W&G
Checked	W&G
Approved	W&G

TITLE

NEW AHU'S - PLANS & ELEVATIONS - PHASE 5

SHEET

M0.13 PHASE 5



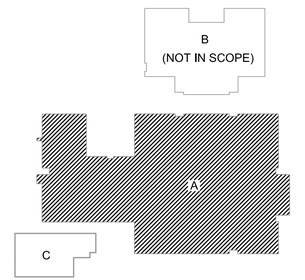
MECHANICAL DEMO PLAN - CENTRAL PLANT

SCALE: 1/4" = 1'-0"

N

KEYED MECHANICAL DEMOLITION NOTES:

1. EXISTING ELECTRICAL EQUIPMENT TO REMAIN IN SERVICE. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL SCOPE OF WORK.
2. EXISTING WATER-COOLED CHILLER AND ASSOCIATED EXISTING PIPING, STARTERS, VALVES, DRAINS, ETC...TO REMAIN IN SERVICE.
3. EXISTING CHILLED WATER PUMP AND ASSOCIATED DISCONNECT AND VFD TO REMAIN IN SERVICE. CONCRETE PUMP BASE TO REMAIN.
4. EXISTING CHILLED WATER PIPING AND PIPE SUPPORTS TO REMAIN IN SERVICE.
5. EXISTING CHILLED WATER AIR EXPANSION TANK AND AIR ELIMINATOR/STRAINER TO REMAIN IN SERVICE.
6. EXISTING CONDENSER WATER PUMP AND ALL ASSOCIATED PIPING AND CONTROLS TO REMAIN IN SERVICE. REFER TO NOTE 26 FOR NEW BYPASS VALVE.
7. EXISTING CONDENSER WATER PIPING FROM CONDENSER WATER PUMP TO EXISTING CHILLER SHALL REMAIN IN SERVICE.
8. EXISTING 8" CONDENSER WATER RETURN PIPING UNDERGROUND FROM CENTRAL PLANT SUMP TO TERMINATION OF PIPING AT COUPLING APPROX. 6 FEET ABOVE GRADE WITHIN THE COOLING TOWER ENCLOSURE SHALL REMAIN.
9. (1) EXISTING 8" CONDENSER WATER RETURN PIPING FROM COUPLING APPROX. 6 FEET ABOVE GRADE AND UP TO BOTH COOLING TOWER CELLS SHALL BE REMOVED AND DEMOLISHED AND PREPPED FOR NEW ISOLATION VALVE AND NEW 8" CONDENSER WATER PIPING.
10. DEMOLISH AND REMOVE EXISTING COOLING TOWER AND ASSOCIATED FANS, MOTORS, DISONNECTS, PIPING, RAILING, LADDER, ETC...THE EXISTING BASIN AND TOWER SUPPORTS WILL REMAIN AND THE NEW TOWER MUST FIT THESE EXISTING CONDITIONS. SUMP AND METAL GRATE BELOW COOLING TOWER IS TO REMAIN IN SERVICE.
11. EXISTING NATURAL GAS LINE AND SERVICE TO REMAIN.
12. EXISTING BREATHING APPARATUS TO REMAIN.
13. EXISTING REFRIGERANT DETECTION SYSTEM TO BE REPLACED IN ITS CURRENT LOCATION. REFER TO M2.1.
14. EXISTING MAKE-UP WATER ASSEMBLY TO REMAIN. MAINTAIN ALL EXISTING MAKE-UP WATER LINES TO EQUIPMENT. PROVIDE NEW CONNECTIONS AS REQUIRED TO NEW EQUIPMENT TO BE INSTALLED ON M2.1.
15. EXISTING FLOOR DRAIN TO REMAIN.
16. EXISTING HOT WATER UNIT HEATER AND ASSOCIATED HOT WATER PIPING AND CONTROLS TO REMAIN.
17. EXISTING WATER FILTER ON WALL TO REMAIN. MAINTAIN ALL EXISTING FILTERED WATER CONNECTIONS TO EQUIPMENT.
18. EXISTING CHEMICAL FEEDER/SOLUTION TANK TO REMAIN AND SERVE NEW COOLING TOWER TO BE INSTALLED ON M2.1.
19. EXISTING HOT WATER PIPING TO/FROM CENTRAL PLANT TO REMAIN.
20. EXISTING 8" CHILLED WATER PIPING FROM THIS POINT AND IN TO CRAWL SPACE TO REMAIN.
21. EXISTING DOMESTIC COLD WATER PIPING IN CENTRAL PLANT AND INTO CRAWL SPACE TO REMAIN.
22. EXISTING CRAWL SPACE VENTILATION FAN TO REMAIN IN SERVICE.
23. EXISTING EQUIPMENT TO REMAIN IN SERVICE. NO WORK.
24. (1) EXISTING CHILLED WATER FAN COIL UNIT TO REMAIN IN SERVICE IN OFFICE. EXISTING CHILLED WATER PIPING IS CURRENTLY NOT INSULATED NEAR THE OFFICE WALL. MECHANICAL CONTRACTOR SHALL INSULATE EXISTING CHILLED WATER SUPPLY AND RETURN PIPING NEAR THE OFFICE.
25. EXISTING CONDENSER WATER SUPPLY PIPING UNDERGROUND FROM COOLING TOWER SUMP TO CONDENSER WATER PUMP SUMP PIT IN CENTRAL PLANT SHALL REMAIN IN SERVICE.
26. EXISTING BYPASS BUTTERFLY VALVE TO BE REMOVED AND REPLACED WITH NEW CONTROL VALVE IN NEW 8" BYPASS WITH BELIMO ACTUATOR.



DEMO HVAC LEGEND:

EXISTING WORK TO REMAIN. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO BE DEMOLISHED. (WORK SHOWN IN DASHED LINES).

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd, Suite 125
Austin, TX 78750
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Office 813-855-3330
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DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
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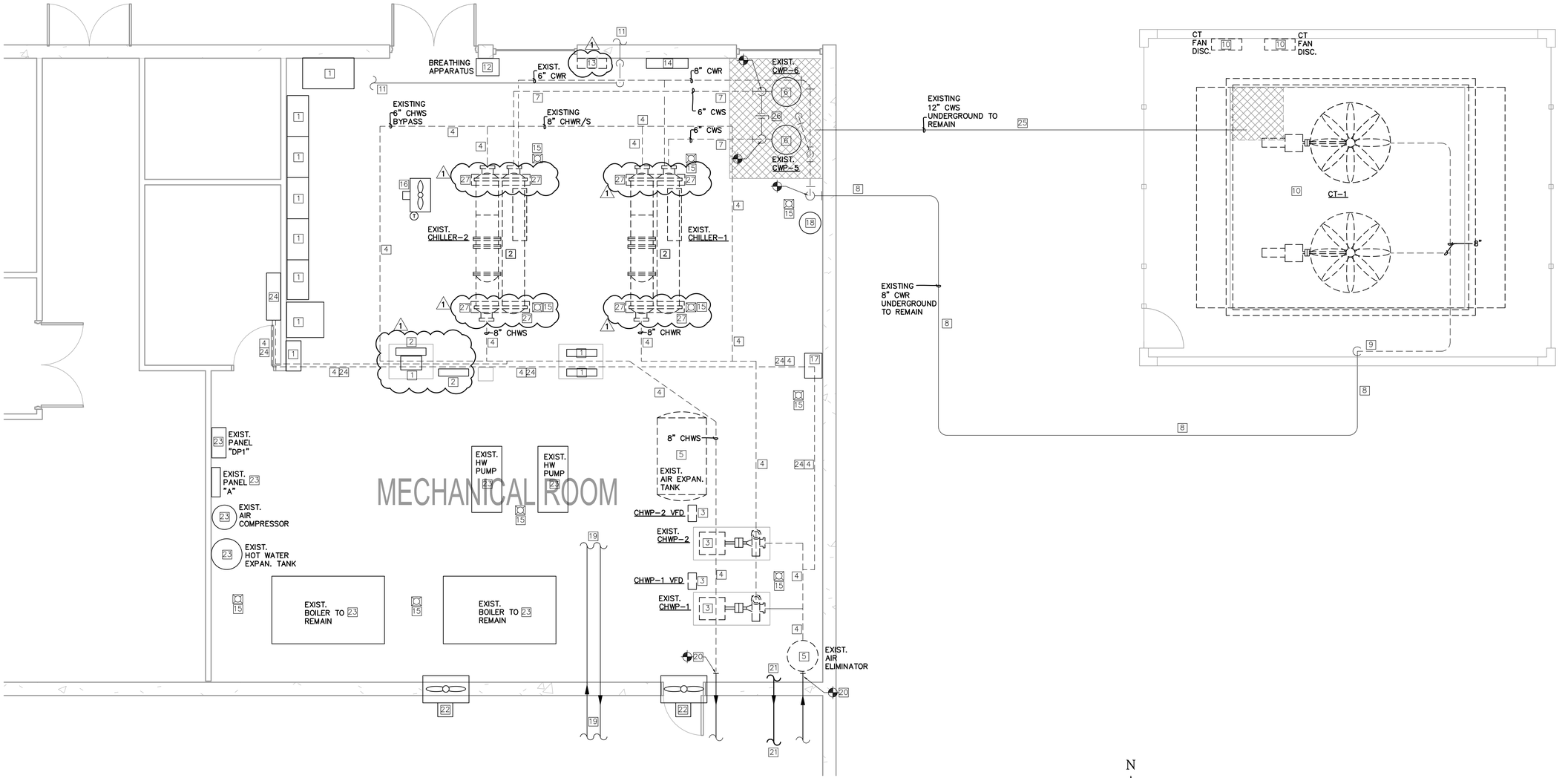
MECHANICAL DEMO PLAN CENTRAL PLANT

SHEET

M1.1



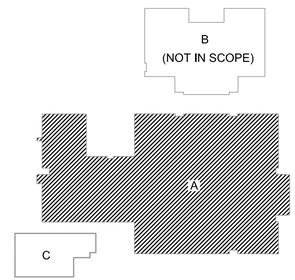
MECHANICAL DEMO PLAN - CENTRAL PLANT

SCALE: 1/4" = 1'-0"

N

KEYED MECHANICAL DEMOLITION NOTES:

1. EXISTING ELECTRICAL EQUIPMENT TO REMAIN IN SERVICE. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL SCOPE OF WORK.
2. EXISTING WATER-COOLED CHILLER AND ASSOCIATED EXISTING PIPING, STARTERS, VALVES, DRAINS, ETC...TO BE REMOVED AND DEMOLISHED.
3. EXISTING CHILLED WATER PUMP AND ASSOCIATED PIPING, DISCONNECT AND VFD TO BE REMOVED AND DEMOLISHED. CONCRETE PUMP BASE TO REMAIN.
4. EXISTING CHILLED WATER PIPING AND PIPE SUPPORTS SHALL BE REMOVED AND DEMOLISHED.
5. EXISTING CHILLED WATER AIR EXPANSION TANK AND AIR ELIMINATOR/STRAINER TO BE REMOVED AND DEMOLISHED.
6. EXISTING CONDENSER WATER PUMP AND ALL ASSOCIATED PIPING AND CONTROLS TO REMAIN IN SERVICE.
7. EXISTING CONDENSER WATER PIPING FROM TOP OF VERTICAL PIPE RISER FROM CONDENSER WATER PUMP TO EXISTING CHILLER SHALL BE REMOVED AND DEMOLISHED.
8. EXISTING 8" CONDENSER WATER RETURN PIPING UNDERGROUND FROM CENTRAL PLANT SUMP TO TERMINATION OF PIPING AT COUPLING APPROX. 6 FEET ABOVE GRADE WITHIN THE COOLING TOWER ENCLOSURE SHALL REMAIN.
9. EXISTING 8" CONDENSER WATER RETURN PIPING FROM COUPLING APPROX. 6 FEET ABOVE GRADE AND UP TO BOTH COOLING TOWER CELLS SHALL BE REMOVED AND DEMOLISHED.
10. DEMOLISH AND REMOVE EXISTING COOLING TOWER AND ASSOCIATED FANS, MOTORS, DISONNECTS, PIPING, RAILING, LADDER, ETC...THE EXISTING BASIN AND TOWER SUPPORTS WILL REMAIN AND THE NEW TOWER MUST FIT THESE EXISTING CONDITIONS. SUMP AND METAL GRATE BELOW COOLING TOWER IS TO REMAIN IN SERVICE.
11. EXISTING NATURAL GAS LINE AND SERVICE TO REMAIN.
12. EXISTING BREATHING APPARATUS TO REMAIN.
13. EXISTING REFRIGERANT DETECTION SYSTEM TO BE REPLACED IN ITS CURRENT LOCATION. REFER TO M2.1 OR M2.1.1 PHASE 4.
14. EXISTING MAKE-UP WATER ASSEMBLY TO REMAIN. MAINTAIN ALL EXISTING MAKE-UP WATER LINES TO EQUIPMENT. PROVIDE NEW CONNECTIONS AS REQUIRED TO NEW EQUIPMENT TO BE INSTALLED ON M2.1.1.
15. EXISTING FLOOR DRAIN TO REMAIN.
16. EXISTING HOT WATER UNIT HEATER AND ASSOCIATED HOT WATER PIPING AND CONTROLS TO REMAIN.
17. EXISTING WATER FILTER ON WALL TO REMAIN. MAINTAIN OR RECONNECT ALL EXISTING FILTERED WATER CONNECTIONS TO EXISTING AND NEW EQUIPMENT.
18. EXISTING CHEMICAL FEEDER/SOLUTION TANK TO REMAIN AND SERVE NEW COOLING TOWER TO BE INSTALLED ON M2.1. AND M2.1.1.
19. EXISTING HOT WATER PIPING TO/FROM CENTRAL PLANT TO REMAIN.
20. EXISTING 8" CHILLED WATER PIPING FROM THIS POINT AND IN TO CRAWL SPACE TO REMAIN.
21. EXISTING DOMESTIC COLD WATER PIPING IN CENTRAL PLANT AND INTO CRAWL SPACE TO REMAIN.
22. EXISTING CRAWL SPACE VENTILATION FAN TO REMAIN IN SERVICE.
23. EXISTING EQUIPMENT TO REMAIN IN SERVICE. NO WORK.
24. EXISTING CHILLED WATER FAN COIL UNIT TO REMAIN IN SERVICE IN OFFICE. REMOVE EXISTING 1" CHILLED WATER SUPPLY AND RETURN PIPING AND ALL INSULATION. PREP FAN COIL UNIT FOR NEW 1" SUPPLY AND RETURN WATER PIPING. UNIT HAS EXISTING 6-WAY PRESSURE INDEPENDENT CONTROL VALVE (BELIMO). RECONNECT NEW CHILLED WATER PIPING TO EXISTING FCU CHILLED WATER SUPPLY AND RETURN NPT BODY SIZES. HOT WATER CONNECTIONS AND FAN COIL UNIT SUPPLY AND RETURN LINES ARE TO REMAIN AS-IS.
25. EXISTING CONDENSER WATER SUPPLY PIPING UNDERGROUND FROM COOLING TOWER SUMP TO CONDENSER WATER PUMP SUMP PIT IN CENTRAL PLANT SHALL REMAIN IN SERVICE.
26. EXISTING BYPASS BUTTERFLY VALVE TO BE REMOVED AND REPLACED WITH NEW CONTROL VALVE IN EXISTING 8" BYPASS WITH BELIMO ACTUATOR.
27. DEMOLISH EXISTING CONCRETE CURBS UNDER CHILLERS WHEN THEY ARE REMOVED. NEW CURBS WILL BE REQUIRED FOR NEW CHILLERS. SEE M2.1.1 PHASE 4.



DEMO HVAC LEGEND:

EXISTING WORK TO REMAIN. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO BE DEMOLISHED. (WORK SHOWN IN DASHED LINES).

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
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TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
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Fax: 727-726-2070

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78745
AISD PROJECT No. 200029-BEDCHK

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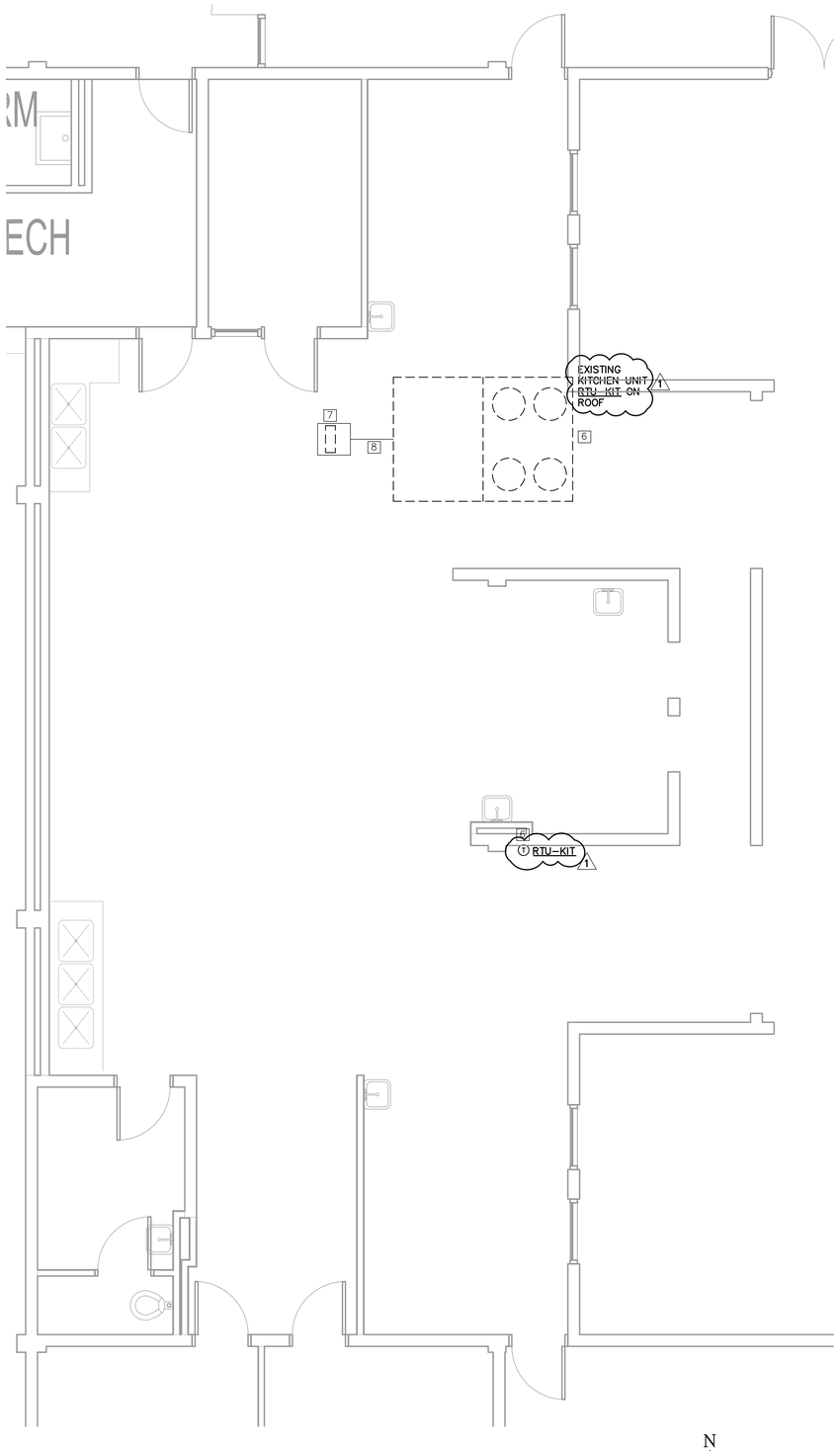
MECHANICAL DEMO PLAN CENTRAL PLANT - PHASE 4

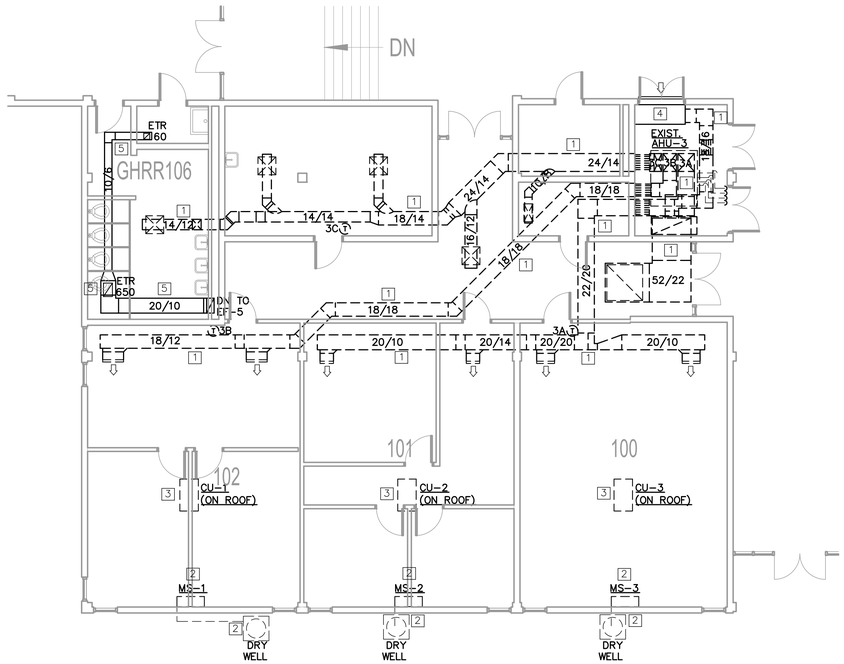
SHEET

M1.1.1 PHASE 4



KEYED MECHANICAL DEMOLITION NOTES:

1. CONTRACTOR TO DEMOLISH EXISTING AHU-3 AND ALL ASSOCIATED SUPPLY AND RETURN DUCTWORK, AIR DEVICES AND CONTROLS. REMOVE PIPING BACK TO 2" CHS/R AND 1-1/4" HWS/R PIPING RISERS DOWN TO CRAWL SPACE AND PREP FOR NEW WORK. RETURN EXISTING DEMOLISHED CONTROLS TO AISD/OWNER.
2. REMOVE EXISTING MINI-SPLIT ON WALL AND ASSOCIATED CONTROL WIRING, CONDENSATE PIPING AND DRY WELL. RETURN EXISTING EQUIPMENT AND CONTROLS TO AISD SERVICE CENTER. SEAL WALL PENETRATIONS FROM CONDENSATE REMOVAL AIR AND WATER-TIGHT. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION.
3. DEMOLISH EXISTING MINI-SPLIT CONDENSING UNIT ON ROOF AND ALL ASSOCIATED REFRIGERANT LINES. RETURN EXISTING EQUIPMENT AND CONTROLS TO AISD SERVICE CENTER. SEAL ROOF PENETRATIONS AIR AND WATER-TIGHT.
4. EXISTING OUTSIDE AIR LOUVER AND PLENUM TO REMAIN. SEE M2.4 FOR NEW OUTSIDE AIR DUCT TO NEW AHU-3.
5. EXISTING EXHAUST DUCTWORK IN GIRL'S RESTROOM AND JANITOR'S CLOSET TO REMAIN IN SERVICE.
6. CONTRACTOR TO DEMOLISH EXISTING KITCHEN RTU-KIT ON ROOF, ROOF CURB AND ASSOCIATED TEMPERATURE CONTROLS. PREP EXISTING ROOF OPENINGS FOR SUPPLY AND RETURN DUCTWORK FOR NEW ROOF CURB AND NEW KITCHEN RTU-KIT. REFER TO M2.3. EXISTING SUPPLY AND RETURN AIR DUCTWORK LOCATED IN KITCHEN CEILING PLENUM IS TO REMAIN AS MUCH AS POSSIBLE. RETURN EXISTING DEMOLISHED CONTROLS TO AISD/OWNER.
7. EXISTING THYCURB ON ROOF IN THIS APPROXIMATE LOCATION. REPLACE EXISTING RTU-KIT DISCONNECT AND PROVIDE NEW DISCONNECT WITH NEW RTU-KIT.
8. EXISTING CONDENSATE DRAIN LINE ROUTING DOWN THROUGH EXISTING TYHCURB SUPPORTING RTU-KIT DISCONNECT TO REMAIN. PREP FOR TIE-IN TO NEW CONDENSATE LINE FROM NEW RTU-KIT.

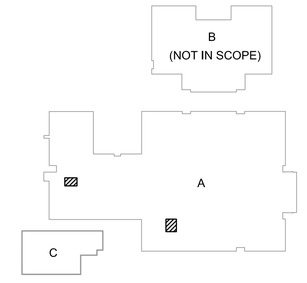


MECHANICAL DEMO PLAN - FIRST FLOOR

SCALE: 1/8" = 1'-0"

MECHANICAL DEMO PLAN - KITCHEN

SCALE: 1/4" = 1'-0"



DEMO HVAC LEGEND:

EXISTING WORK TO REMAIN. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO BE DEMOLISHED. (WORK SHOWN IN DASHED LINES).

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
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Austin, TX 78750
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Consulting Engineers

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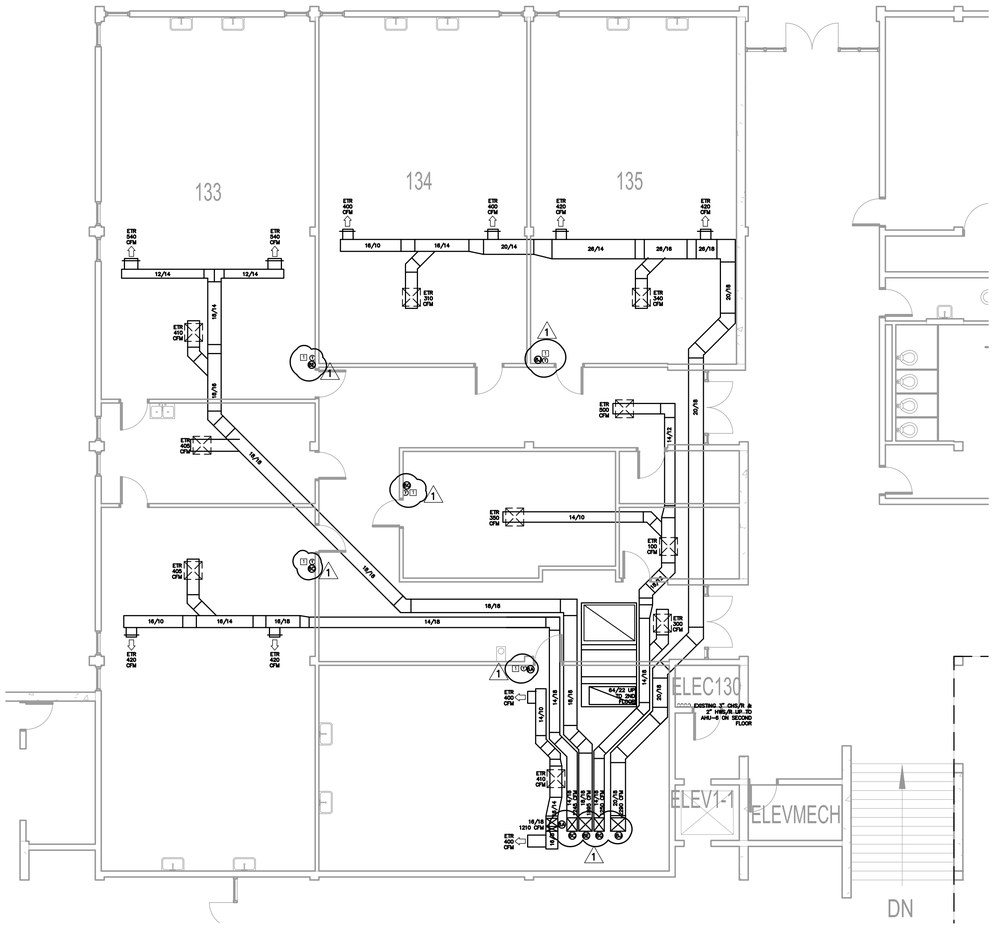
MECHANICAL DEMO PLAN FIRST FLOOR & KITCHEN

SHEET

M1.3

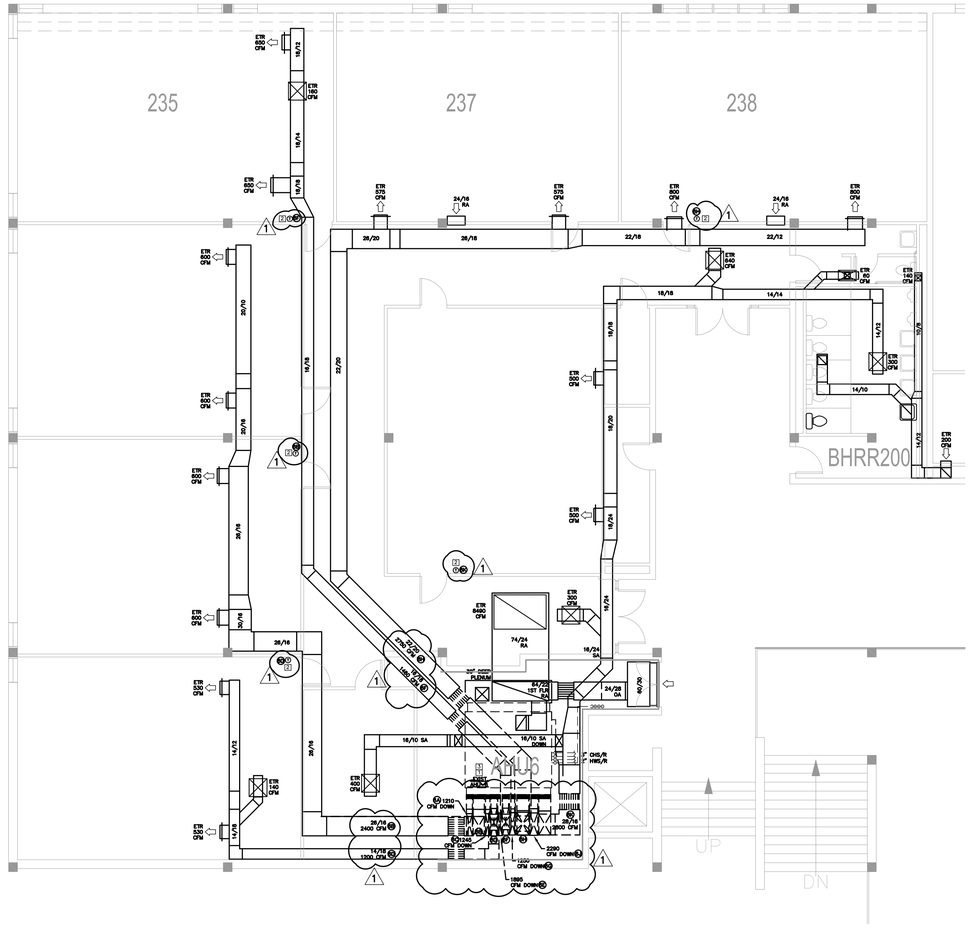


MECHANICAL DEMO PLAN - FIRST FLOOR - AHU-6

SCALE: 1/8" = 1'-0"

KEYED MECHANICAL DEMOLITION NOTES:

1 DEMOLISH EXISTING ZONE THERMOSTAT AND PREPARE EXISTING SURFACE FOR NEW DDC THERMOSTAT.



MECHANICAL DEMO PLAN - SECOND FLOOR - AHU-6

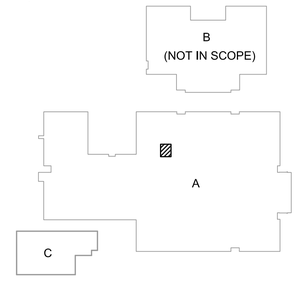
SCALE: 1/8" = 1'-0"

KEYED MECHANICAL DEMOLITION NOTES:

1 CONTRACTOR TO DEMOLISH EXISTING AIR HANDLING UNIT AND REPLACE WITH NEW AIR HANDLING UNIT AS SCHEDULED. CONTRACTOR SHALL REUSE AS MUCH EXISTING OUTSIDE AIR, SUPPLY AIR (ZONES) AND RETURN AIR DUCTWORK AS POSSIBLE AND PROVIDE NEW DUCTWORK AS REQUIRED FOR CONNECTIONS TO NEW AIR HANDLING UNIT ZONES. DEMOLISH EXISTING CHILLED AND HOT WATER PIPING BACK TO THE RISER UP FROM THE FLOOR BELOW AND DEMO ALL EXISTING CONDENSATE PIPING. REFER TO M2.6 AND PROVIDE NEW PIPING, BELIMO VALVES, AND ACTUATORS AS REQUIRED FOR CONNECTIONS TO THE NEW AIR HANDLING UNIT FROM THE EXISTING PIPING RISER.

2 DEMOLISH EXISTING PNEUMATIC ZONE THERMOSTAT AND PREPARE EXISTING SURFACE FOR NEW ZONE DDC THERMOSTAT SERVED BY NEW AHU-6.

3 SEE M2.6 AND M2.6.1 FOR NEW WORK REQUIRED AND SCOPE OF DUCTWORK TO BE DEMOLISHED.



DEMO HVAC LEGEND:

EXISTING WORK TO REMAIN. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO BE DEMOLISHED. (WORK SHOWN IN DASHED LINES).

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

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WILSON & GIRGENTI, LLC
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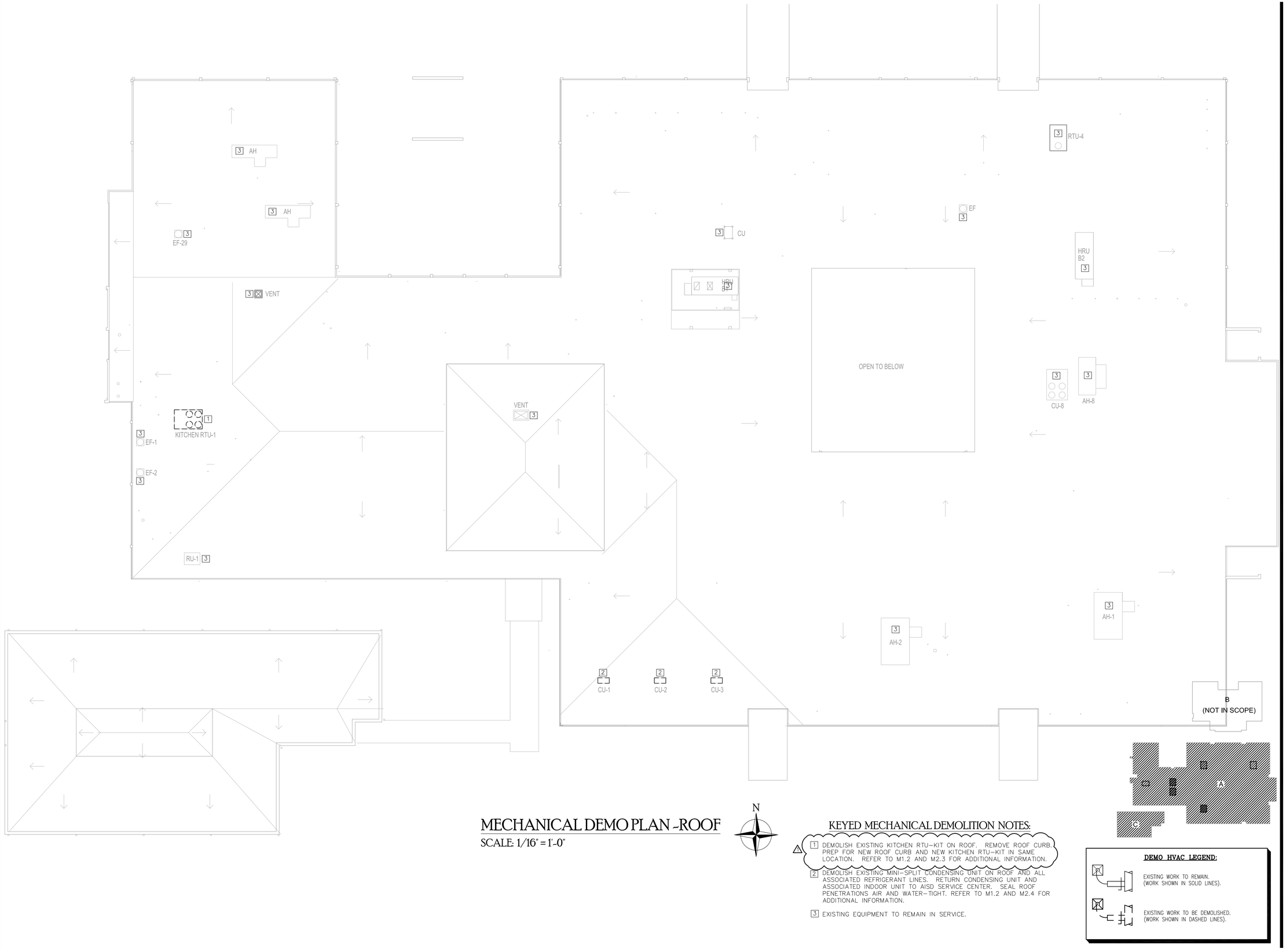
MECHANICAL DEMO PLAN FIRST FLOOR

SHEET

M1.4



MECHANICAL DEMO PLAN -ROOF

SCALE: 1/16" = 1'-0"

N

KEYED MECHANICAL DEMOLITION NOTES:

1. DEMOLISH EXISTING KITCHEN RTU-KIT ON ROOF. REMOVE ROOF CURB. PREP FOR NEW ROOF CURB AND NEW KITCHEN RTU-KIT IN SAME LOCATION. REFER TO M1.2 AND M2.3 FOR ADDITIONAL INFORMATION.
2. DEMOLISH EXISTING MINI-SPLIT CONDENSING UNIT ON ROOF AND ALL ASSOCIATED REFRIGERANT LINES. RETURN CONDENSING UNIT AND ASSOCIATED INDOOR UNIT TO AISD SERVICE CENTER. SEAL ROOF PENETRATIONS AIR AND WATER-TIGHT. REFER TO M1.2 AND M2.4 FOR ADDITIONAL INFORMATION.
3. EXISTING EQUIPMENT TO REMAIN IN SERVICE.

DEMO HVAC LEGEND:

EXISTING WORK TO REMAIN.
(WORK SHOWN IN SOLID LINES).

EXISTING WORK TO BE DEMOLISHED.
(WORK SHOWN IN DASHED LINES).

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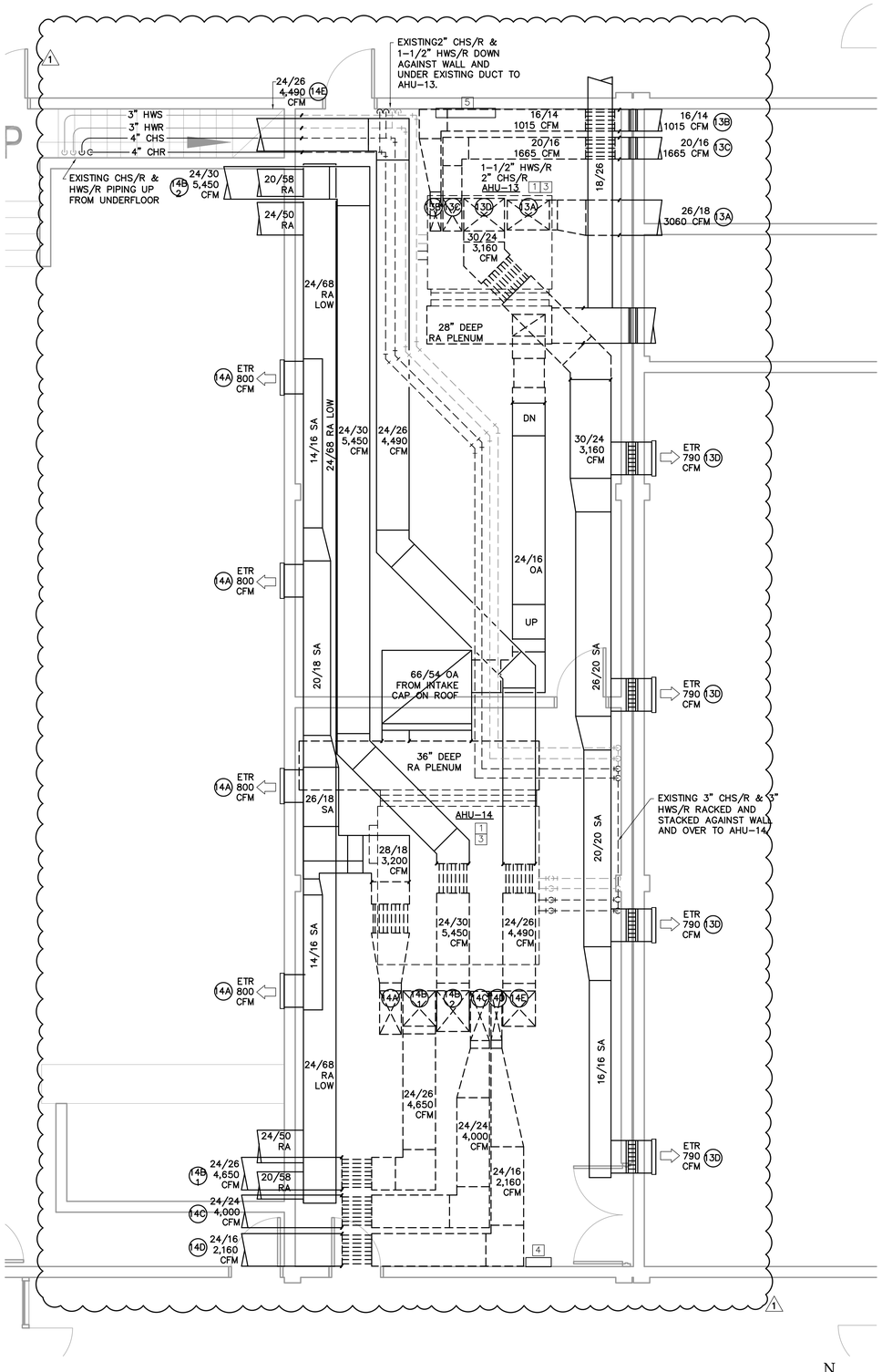
MECHANICAL DEMO PLAN ROOF

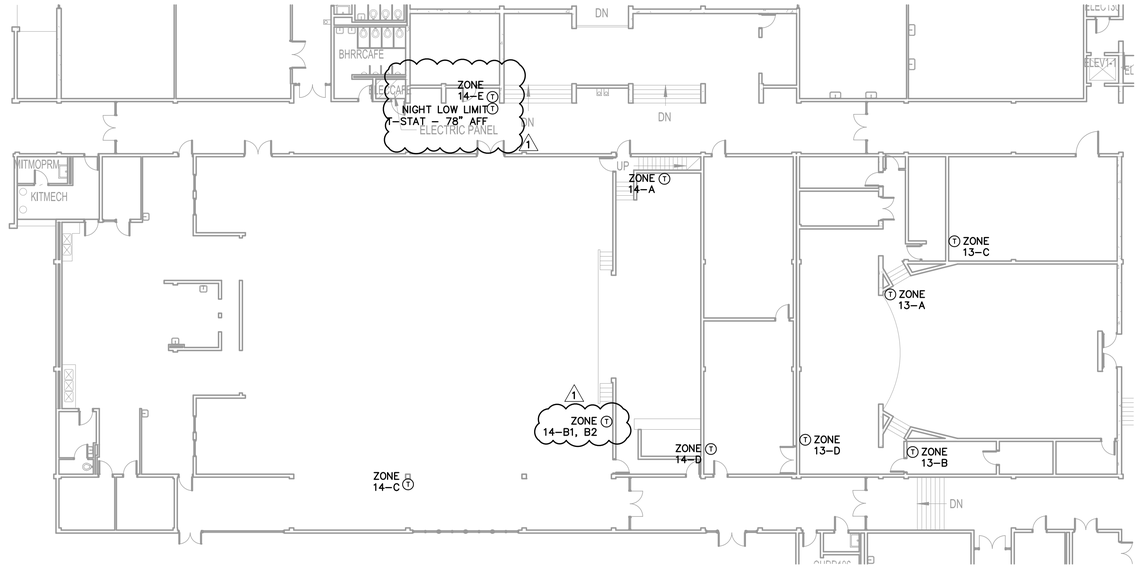
SHEET

M1.6



MECHANICAL DEMO PLAN -PENTHOUSE - AHU-13 & AHU-14 PHASE 5

SCALE: 1/4" = 1'-0"

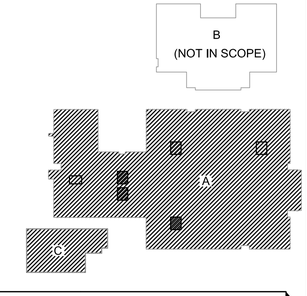


AHU-13 & AHU-14 - EXISTING THERMOSTAT LOCATIONS PHASE 5

SCALE: 1/16 = 1'-0"

KEYED MECHANICAL DEMOLITION NOTES:

1. CONTRACTOR TO DEMOLISH EXISTING AIR HANDLING UNIT AND REPLACE WITH NEW AIR HANDLING UNIT AS SCHEDULED. CONTRACTOR SHALL REUSE AS MUCH EXISTING OUTSIDE AIR, SUPPLY AIR (ZONES) AND RETURN AIR DUCTWORK AS POSSIBLE AND PROVIDE NEW DUCTWORK AS REQUIRED FOR CONNECTIONS TO NEW AIR HANDLING UNIT ZONES. RE-USE EXISTING CHILLED AND HOT WATER PIPING AND CONDENSATE PIPING TO THE GREATEST EXTENT POSSIBLE. PROVIDE NEW PIPING AND BELIMO VALVES AND ACTUATORS AS REQUIRED FOR CONNECTIONS TO THE NEW AIR HANDLING UNIT FROM EXISTING LINES. RETURN EXISTING DEMOLISHED CONTROLS TO AISD/OWNER.
2. DEMOLISH EXISTING ZONE THERMOSTAT, RETURN TO AISD/OWNER, AND PREPARE EXISTING SURFACE FOR NEW DDC THERMOSTAT FOR NEW AIR HANDLING UNIT ZONE. PLEASE NOTE: AHU-13 WILL HAVE 4 ZONE THERMOSTATS TO DEMOLISH AND REPLACE. AHU-14 WILL HAVE 6 ZONE THERMOSTATS TO DEMOLISH AND REPLACE.
3. SEE M2.9 PHASE 5 FOR SCOPE OF NEW WORK AND EXTENT OF EXISTING DUCTWORK TO BE DEMOLISHED.
4. EXISTING CONTROL PANEL LOCATION.
5. EXISTING ELECTRICAL GEAR (DISCONNECTS, ETC...) TO REMAIN IN SERVICE.



DEMO HVAC LEGEND:

EXISTING WORK TO REMAIN. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO BE DEMOLISHED. (WORK SHOWN IN DASHED LINES).

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd, Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

hcg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

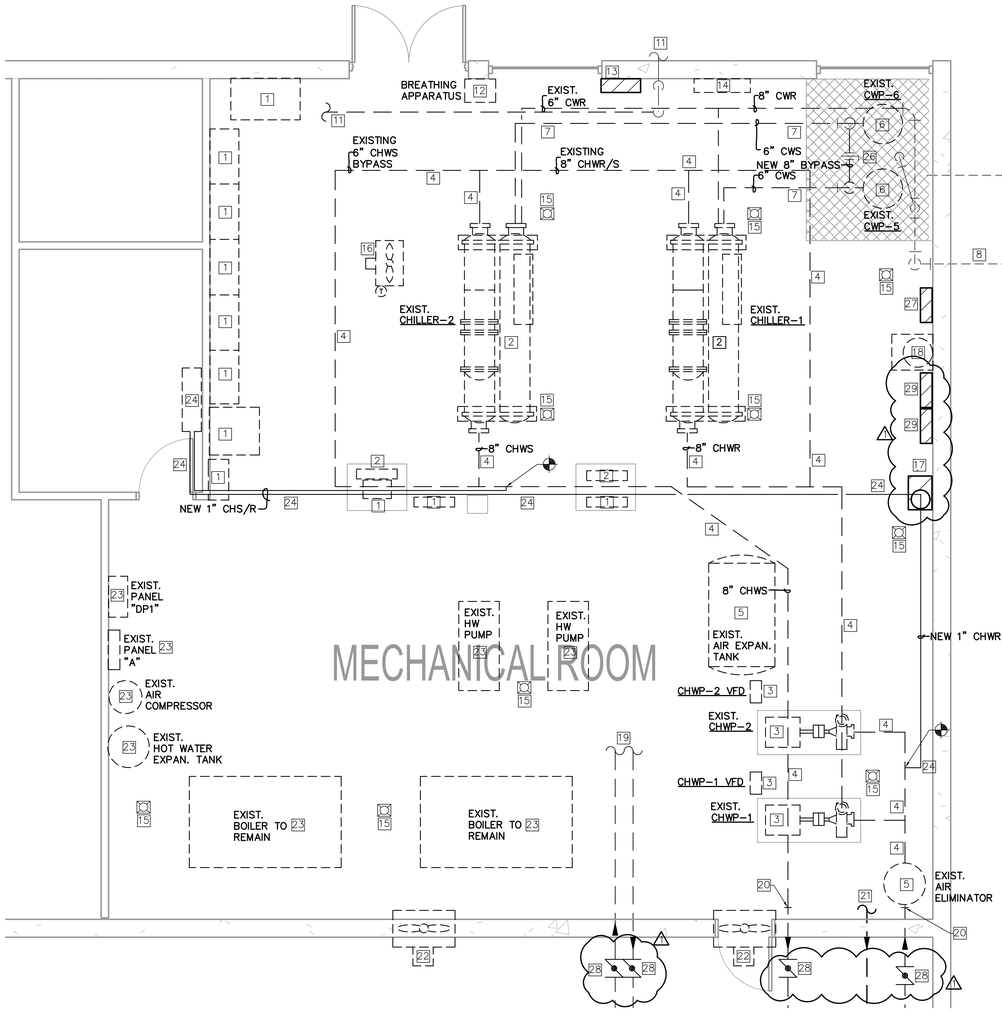
Date	09/04/2020
Job Number	20-0029
Scale	AS NOTED
Drawn	W&G
Checked	W&G
Approved	W&G

TITLE

MECHANICAL DEMO PLAN PENTHOUSE

SHEET

M1.7 PHASE 5



MECHANICAL PLAN -CENTRAL PLANT

SCALE: 1/4" = 1'-0"

KEYED MECHANICAL DEMOLITION NOTES:

1. EXISTING ELECTRICAL EQUIPMENT TO REMAIN IN SERVICE. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL SCOPE OF WORK.
2. EXISTING WATER-COOLED CHILLER AND ASSOCIATED EXISTING PIPING, STARTERS, VALVES, DRAINS, ETC...TO REMAIN IN SERVICE.
3. EXISTING CHILLED WATER PUMP AND ASSOCIATED DISCONNECT AND VFD TO REMAIN IN SERVICE. CONCRETE PUMP BASE TO REMAIN.
4. EXISTING CHILLED WATER PIPING AND PIPE SUPPORTS TO REMAIN IN SERVICE.
5. EXISTING CHILLED WATER AIR EXPANSION TANK AND AIR ELIMINATOR/STRAINER TO REMAIN IN SERVICE.
6. EXISTING CONDENSER WATER PUMP AND ALL ASSOCIATED PIPING AND CONTROLS TO REMAIN IN SERVICE. REFER TO NOTE 26 FOR NEW BYPASS VALVE.
7. EXISTING CONDENSER WATER PIPING FROM CONDENSER WATER PUMP TO EXISTING CHILLER SHALL REMAIN IN SERVICE.
8. EXISTING 8" CONDENSER WATER RETURN PIPING UNDERGROUND FROM CENTRAL PLANT SUMP TO TERMINATION OF PIPING AT COUPLING APPROX. 6 FEET ABOVE GRADE WITHIN THE COOLING TOWER ENCLOSURE SHALL REMAIN. PREP FOR NEW VALVE AND PIPING CONNECTION.
9. PROVIDE AND INSTALL NEW 8" CONDENSER WATER RETURN PIPING FROM COUPLING APPROX. 6 FEET ABOVE GRADE AND UP TO BOTH NEW COOLING TOWER CELLS. SUPPORT PIPE FROM ENCLOSURE WALL AS NEEDED WITH RUST-PROOF WALL BRACKETS. INSTALL 8" BUTTERFLY ISOLATION VALVE AT COUPLING.
10. PROVIDE AND INSTALL NEW COOLING TOWER AND ASSOCIATED FANS, MOTORS, DISCONNECT, PIPING, RAILING, LADDER, ETC...NEW TOWER MUST FIT THE EXISTING BASIN AND TOWER SUPPORTS. SUMP AND METAL GRATE BELOW COOLING TOWER IS TO REMAIN IN SERVICE. A CRANE WILL BE REQUIRED TO LIFT NEW COOLING TOWER OVER EXISTING STRUCTURE.
11. EXISTING NATURAL GAS LINE AND SERVICE TO REMAIN.
12. EXISTING BREATHING APPARATUS TO REMAIN.
13. PROVIDE NEW REFRIGERANT DETECTION SYSTEM MANUFACTURED BY HONEYWELL ANALYTICS. PROVIDE 301EM-20 CONTROLLER, 301IRFS GAS DETECTORS (MINIMUM 6), SENSOR WIRING AND RELAY WIRING. UPON DETECTION, ALERT BEACON SHALL BE INITIATED AND EXISTING SIDEWALL FANS (QUANTITY 2) SHALL ACTIVATE AND DISCHARGE AIR INTO THE CRAWL SPACE. PROVIDE HARDWIRE INTERFACING FOR BAS MONITORING PER CENTRAL PLANT POINTS LIST. (1)
14. EXISTING MAKE-UP WATER ASSEMBLY TO REMAIN. MAINTAIN ALL EXISTING MAKE-UP WATER LINES TO EQUIPMENT.
15. EXISTING FLOOR DRAIN TO REMAIN.
16. EXISTING HOT WATER UNIT HEATER AND ASSOCIATED HOT WATER PIPING AND CONTROLS TO REMAIN.
17. (1) NEW WATER FILTER FEEDER TO BE PROVIDED. PROVIDE " AQUAPHOENIX GTP", FLAT BOTTOM 10 GALLON FEEDER, OR APPROVED EQUAL. PROVIDE ALL NEW INLET, OUTLET AND DRAIN WATER PIPING AND CONNECTIONS TO CHILLED WATER PIPING LOOP.
18. EXISTING CHEMICAL FEEDER/SOLUTION TANK TO REMAIN AND SERVE NEW COOLING TOWER TO BE INSTALLED ON M2.1.
19. EXISTING HOT WATER PIPING TO/FROM CENTRAL PLANT TO REMAIN.
20. EXISTING 8" CHILLED WATER PIPING FROM THIS POINT AND IN TO CRAWL SPACE TO REMAIN.
21. EXISTING DOMESTIC COLD WATER PIPING IN CENTRAL PLANT AND INTO CRAWL SPACE TO REMAIN.
22. EXISTING CRAWL SPACE VENTILATION FAN TO REMAIN IN SERVICE.
23. EXISTING EQUIPMENT TO REMAIN IN SERVICE. NO WORK.
24. EXISTING CHILLED WATER FAN COIL UNIT TO REMAIN IN SERVICE IN OFFICE. REMOVE EXISTING 1" CHILLED WATER SUPPLY AND RETURN PIPING AND ALL INSULATION. PREP FAN COIL UNIT FOR NEW 1" SUPPLY AND RETURN WATER PIPING. UNIT HAS EXISTING 6-WAY PRESSURE INDEPENDENT CONTROL VALVE (BELIMO) TO BE REUSED AND RECONNECTED. RECONNECT NEW CHILLED WATER PIPING TO EXISTING CHILLED WATER SUPPLY AND RETURN NPT BODY SIZES. HOT WATER CONNECTIONS AND FAN COIL UNIT SUPPLY AND RETURN LINES ARE TO REMAIN AS-IS.
25. EXISTING CONDENSER WATER SUPPLY PIPING UNDERGROUND FROM COOLING TOWER SUMP TO CONDENSER WATER PUMP SUMP PIT IN CENTRAL PLANT SHALL REMAIN IN SERVICE.
26. EXISTING BYPASS BUTTERFLY VALVE TO BE REMOVED AND REPLACED WITH NEW CONTROL VALVE IN NEW 8" BYPASS WITH BELIMO ACTUATOR.
27. EXTEND BACNET CAPABILITY TO THE EXISTING CENTRAL PLANT AND EXPAND THE EXISTING TRIDIUM JACE. ADD NEW TOWERS, NEW KITCHEN RTU-1 AND NEW AHU'S 3, 6 & 7 TO EXPANDED BACNET/TRIDIUM JACE BUILDING CONTROLS SYSTEM.
28. (1) PROVIDE NEW BUTTERFLY MANUAL ISOLATION VALVES, FULL SIZE, IN EXISTING CHILLED & HOT WATER SUPPLY AND RETURN PIPING INSIDE CRAWL SPACE ON OPPOSITE SIDE OF CENTRAL PLANT WALL.
29. NEW COOLING TOWER VFD'S.

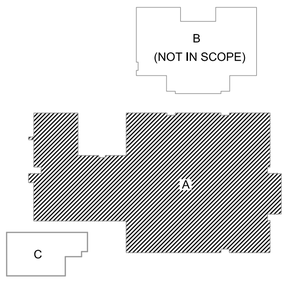
NEW HVAC LEGEND:

NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
10. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.



SCOPE OF WORK:

REPLACE EXISTING COOLING TOWER, CT-1, IN EXISTING ENCLOSURE. NEW TOWER SHALL BE 2-CELL, APPROX. 1800 GPM TOTAL. EXISTING UNDERGROUND PIPING FROM TOWER BASIN TO EXISTING CONDENSER WATER PUMPS, CWP-5 AND CWP-6, IN CENTRAL PLANT TO REMAIN.

(1) EXTEND BACNET CAPABILITY TO THE EXISTING CENTRAL PLAN AND EXPAND THE EXISTING TRIDIUM JACE. ADD NEW TOWERS, NEW KITCHEN RTU-KIT, AND AHU'S 3, 6, & 7 TO BACNET/TRIDIUM JACE. THIS PROJECT WILL NEED TO BE INCORPORATED INTO THE AISD TRIDIUM ENTERPRISE SERVER.

HADDON+COWAN ARCHITECTS
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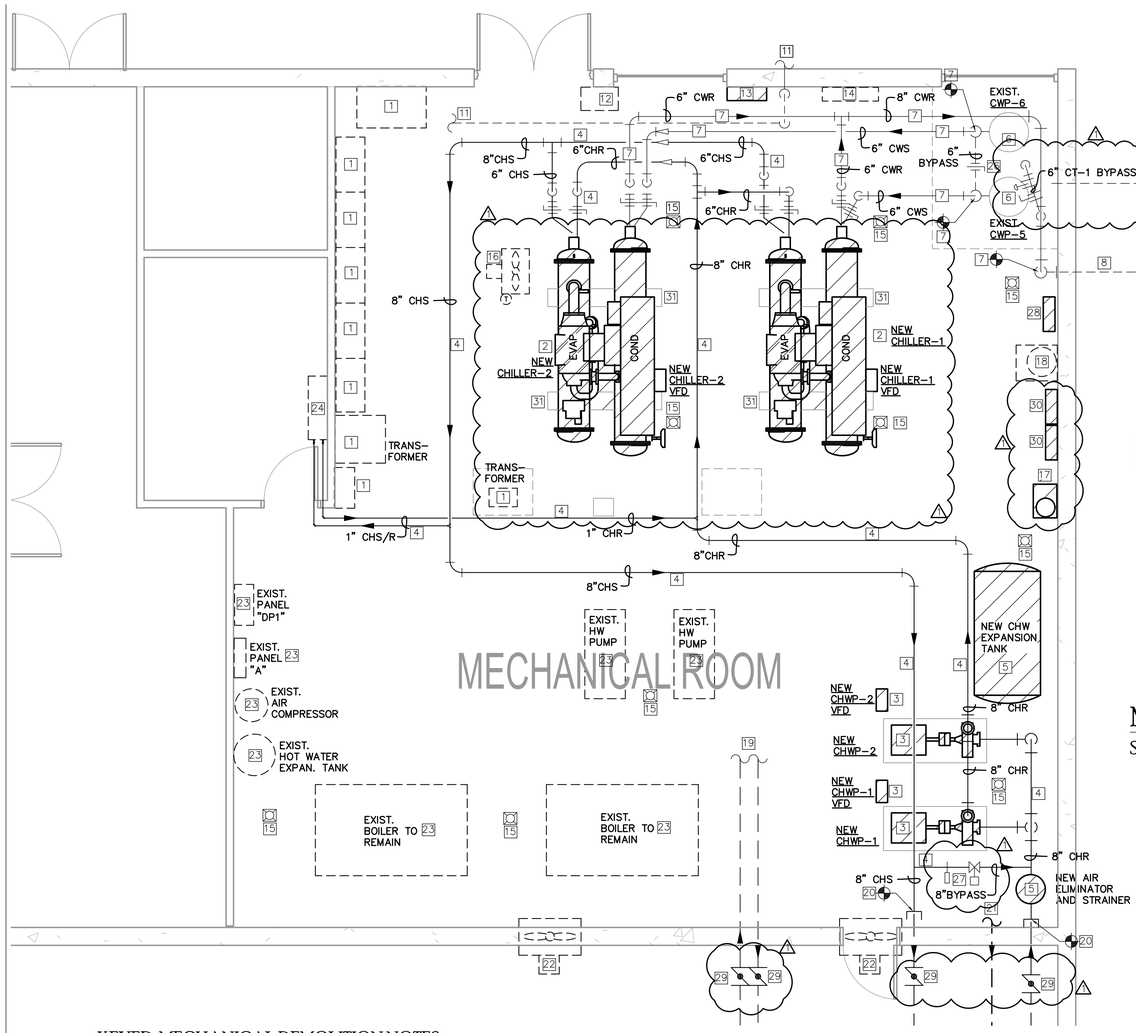
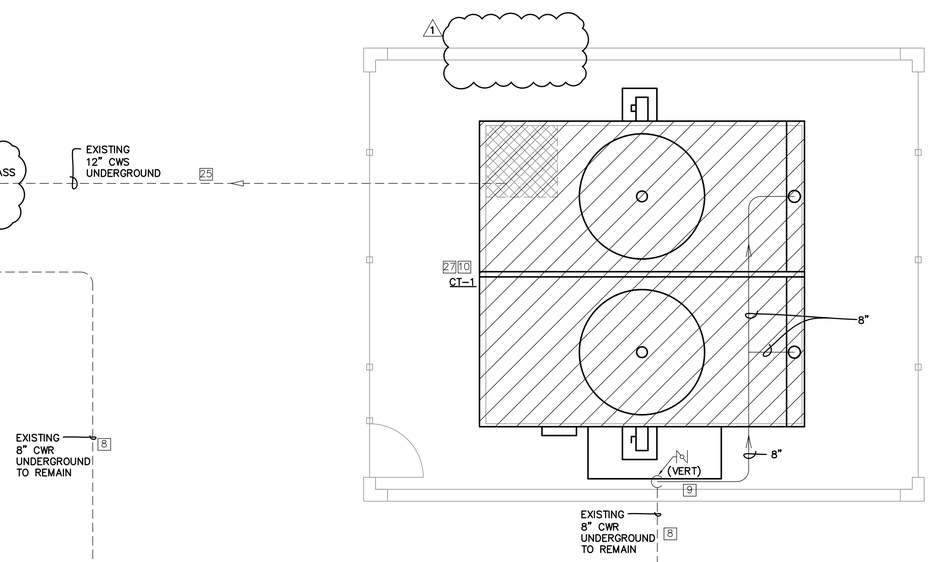
MECHANICAL PLAN CENTRAL PLANT

SHEET

M2.1





MECHANICAL PLAN -CENTRAL PLANT

SCALE: 1/4" = 1'-0"

N

NEW HVAC LEGEND:

NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION, IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
10. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.

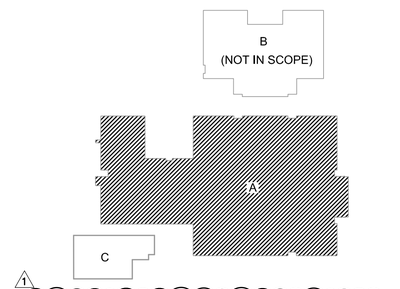
KEYED MECHANICAL DEMOLITION NOTES:

1. EXISTING ELECTRICAL EQUIPMENT TO REMAIN IN SERVICE. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL SCOPE OF WORK.
2. PROVIDE AND INSTALL NEW WATER-COOLED CHILLER. PROVIDE ALL ASSOCIATED STARTERS/VFDS, PIPING, VALVES, DRAINS, ETC...AS REQUIRED FOR FULL AND COMPLETE OPERATION AND INSTALLATION.
3. PROVIDE AND INSTALL NEW CHILLED WATER PUMP AND ASSOCIATED DISCONNECT. PROVIDE AND INSTALL NEW VFD AS SCHEDULED. MOUNT NEW PUMP ON EXISTING CONCRETE PUMP BASE. PROVIDE INERTIA BASE.
4. PROVIDE AND INSTALL NEW CHILLED WATER PIPING AND PIPE SUPPORTS.
5. PROVIDE AND INSTALL NEW CHILLED WATER AIR EXPANSION TANK AND AIR ELIMINATOR/STRAINER. INSTALL EXPANSION TANK AS HIGH AS POSSIBLE. REFER TO DETAIL ON 4/M0.6 FOR NEW TANK SIZE.
6. EXISTING CONDENSER WATER PUMP AND ALL ASSOCIATED PIPING AND CONTROLS TO REMAIN IN SERVICE. REFER TO NOTE 26 FOR NEW BYPASS VALVE.
7. PROVIDE AND INSTALL NEW CONDENSER WATER PIPING FROM TOP OF VERTICAL PIPING FROM EXISTING CONDENSER WATER PUMPS AS SHOWN.
8. EXISTING 8" CONDENSER WATER RETURN PIPING UNDERGROUND FROM CENTRAL PLANT SUMP TO TERMINATION OF PIPING AT COUPLING APPROX. 6 FEET ABOVE GRADE WITHIN THE COOLING TOWER ENCLOSURE SHALL REMAIN. PREP FOR NEW VALVE AND PIPING CONNECTION.
9. PROVIDE AND INSTALL NEW 8" CONDENSER WATER RETURN PIPING FROM COUPLING APPROX. 6 FEET ABOVE GRADE AND UP TO BOTH NEW COOLING TOWER CELLS. SUPPORT PIPE FROM ENCLOSURE WALL AS NEEDED WITH RUST-PROOF WALL BRACKETS. INSTALL 8" BUTTERFLY ISOLATION VALVE AT COUPLING.
10. PROVIDE AND INSTALL NEW COOLING TOWER AND ASSOCIATED FANS, MOTORS, DISCONNECT, PIPING, RAILING, LADDER, ETC...NEW TOWER MUST FIT THE EXISTING BASIN AND TOWER SUPPORTS. SUMP AND METAL GRATE BELOW COOLING TOWER IS TO REMAIN IN SERVICE. A CRANE WILL BE REQUIRED TO LIFT NEW COOLING TOWER OVER EXISTING STRUCTURE.
11. EXISTING NATURAL GAS LINE AND SERVICE TO REMAIN.
12. EXISTING BREATHING APPARATUS TO REMAIN.
13. PROVIDE NEW REFRIGERANT DETECTION SYSTEM MANUFACTURED BY HONEYWELL ANALYTICS. PROVIDE 301EM-20 CONTROLLER, 301IRFS GAS DETECTORS (MINIMUM 6), SENSOR WIRING AND RELAY WIRING. UPON DETECTION, ALERT BEACON SHALL BE INITIATED AND EXISTING SIDEWALL FANS (QUANTITY 2) SHALL ACTIVATE AND DISCHARGE AIR INTO THE CRAWL SPACE.
14. EXISTING MAKE-UP WATER ASSEMBLY TO REMAIN. MAINTAIN ALL EXISTING MAKE-UP WATER LINES TO EQUIPMENT. PROVIDE NEW CONNECTIONS AS REQUIRED TO NEW EQUIPMENT TO BE INSTALLED ON M2.1.
15. EXISTING FLOOR DRAIN TO REMAIN.
16. EXISTING HOT WATER UNIT HEATER AND ASSOCIATED HOT WATER PIPING AND CONTROLS TO REMAIN.
17. NEW WATER FILTER FEEDER TO BE PROVIDED. PROVIDE " AQUAPHOENIX GTP", FLAT BOTTOM 10 GALLON FEEDER, OR APPROVED EQUAL. PROVIDE ALL NEW INLET, OUTLET AND DRAIN WATER PIPING AND CONNECTIONS TO CHILLED WATER PIPING LOOP.
18. EXISTING CHEMICAL FEEDER/SOLUTION TANK TO REMAIN AND SERVE NEW COOLING TOWER.
19. EXISTING HOT WATER PIPING TO/FROM CENTRAL PLANT TO REMAIN.
20. EXISTING 8" CHILLED WATER PIPING FROM THIS POINT AND IN TO CRAWL SPACE TO REMAIN. PROVIDE AND INSTALL NEW 8" CHILLED WATER PIPING FROM THIS POINT INTO THE CENTRAL PLANT AND ROUTE AS SHOWN.
21. EXISTING DOMESTIC COLD WATER PIPING IN CENTRAL PLANT AND INTO CRAWL SPACE TO REMAIN.
22. EXISTING CRAWL SPACE VENTILATION FAN TO REMAIN IN SERVICE.
23. EXISTING EQUIPMENT TO REMAIN IN SERVICE. NO WORK.
24. EXISTING CHILLED WATER FAN COIL UNIT TO REMAIN IN SERVICE IN OFFICE. UNIT HAS EXISTING 6-WAY PRESSURE INDEPENDENT CONTROL VALVE (BELIMO). RECONNECT NEW 1" CHILLED WATER PIPING TO EXISTING CHILLED WATER SUPPLY AND RETURN NPT BODY SIZES. HOT WATER CONNECTIONS AND FAN COIL UNIT HOT WATER SUPPLY AND RETURN LINES ARE TO REMAIN AS-IS.
25. EXISTING 12" CONDENSER WATER SUPPLY PIPING UNDERGROUND FROM COOLING TOWER SUMP TO CONDENSER WATER PUMP SUMP PIT IN CENTRAL PLANT SHALL REMAIN IN SERVICE.
26. REPLACE EXISTING COOLING TOWER BYPASS VALVE (BUTTERFLY VALVE) WITH NEW 2-WAY CONTROL VALVE WITH BELIMO ACTUATOR, 120V.
27. PROVIDE 8" CHILLED WATER BYPASS WITH NEW THERMOSTATIC CONTROL VALVE WITH BELIMO ACTUATOR. 120V. PROVIDE TEMP SENSOR IN BYPASS.
28. EXTEND BACNET CAPABILITY TO THE EXISTING CENTRAL PLANT AND EXPAND THE EXISTING TRIDIUM JACE. ADD NEW TOWERS, NEW KITCHEN RTU-1 AND NEW AHU'S 3, 6 & 7 TO EXPANDED BACNET/TRIDIUM JACE BUILDING CONTROLS SYSTEM.
29. PROVIDE NEW BUTTERFLY MANUAL ISOLATION VALVES, FULL SIZE, IN EXISTING CHILLED & HOT WATER SUPPLY AND RETURN PIPING INSIDE CRAWL SPACE ON OPPOSITE SIDE OF CENTRAL PLANT WALL.
30. NEW COOLING TOWER VFD'S.
31. PROVIDE NEW CONCRETE PAD UNDER NEW CHILLER. REFER TO CHILLER INSTALLATION INSTRUCTIONS FOR EXACT PAD LOCATIONS TO SUPPORT CHILLER. PAD MINIMUM 6" IN HEIGHT.

IMPORTANT NOTE:

NOT ALL VALVES AND SPECIALTIES HAVE BEEN SHOWN ON THE DRAWING. PLEASE REFER TO THE CONDENSER AND CHILLED WATER PIPING SCHEMATIC AND THE CENTRAL PLANT CONTROLS SCHEMATIC FOR ADDITIONAL REQUIREMENTS. PROVIDE ALL VALVES, ACTUATORS, CONTROLS, WIRING, ETC... FOR A COMPLETE AND OPERATIONAL SYSTEM AS REQUIRED BY CODE AND BY AISD.

ALL NEW MECHANICAL EQUIPMENT INSTALLED UNDER PHASE 4 SCOPE OF WORK SHALL BE CONNECTED TO THE SCHOOL'S EXISTING TRIDIUM JACE/BACNET SYSTEM CURRENTLY HOUSED IN THE MDF ROOM ON THE SECOND FLOOR OF THE SCHOOL. ALL CABLES/WIRING SHALL BE RUN THRU THE CRAWL SPACE TO CONNECT THE NEW EQUIPMENT WITH THE BACNET. THE FIRMWARE WILL REQUIRE AN UPGRADE, HOWEVER, THE EXISTING JACE/BACNET SHOULD HAVE AVAILABLE SPACES FOR THE NEW EQUIPMENT. EXPAND EXISTING SYSTEM AS NEEDED.



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SCOPE OF WORK (INCLUDES PHASES 4 & 5):

(BASE SCOPE OF WORK): REPLACE EXISTING COOLING TOWER, CT-1, IN EXISTING ENCLOSURE. NEW TOWER SHALL BE 2-CELL, APPROX. 1200 GPM TOTAL. EXISTING UNDERGROUND PIPING FROM TOWER BASIN TO EXISTING CONDENSER WATER PUMPS, CWP-5 AND CWP-6, IN CENTRAL PLANT TO REMAIN.

(PHASE 4): REPLACE EXISTING CHILLERS 1 & 2 AND EXISTING CHILLED WATER PUMPS. PROVIDE ALL NEW PIPING WITHIN THE CENTRAL PLANT FROM CONDENSER WATER PUMPS TO WALL SEPARATING CENTRAL PLANT FROM CRAWL SPACE TO CREATE PARALLEL PIPING LOOP.

(PHASE 4 & 5): EXTEND BACNET CAPABILITY TO THE EXISTING CENTRAL PLAN AND EXPAND THE EXISTING TRIDIUM JACE. ADD NEW TOWERS, NEW CHILLERS, NEW CHILLED WATER PUMPS, NEW RTU-KIT, AND AHU'S 3, 6, 7, 13 & 14 TO NEWLY EXPANDED BACNET/TRIDIUM JACE BUILDING CONTROLS SYSTEM. PROVIDE FIRMWARE UPDATE.

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2301 E. Riverside Drive, Bldg A, Suite 80
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P.O. Box 1377
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Office: 813-855-3330
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09/30/2020

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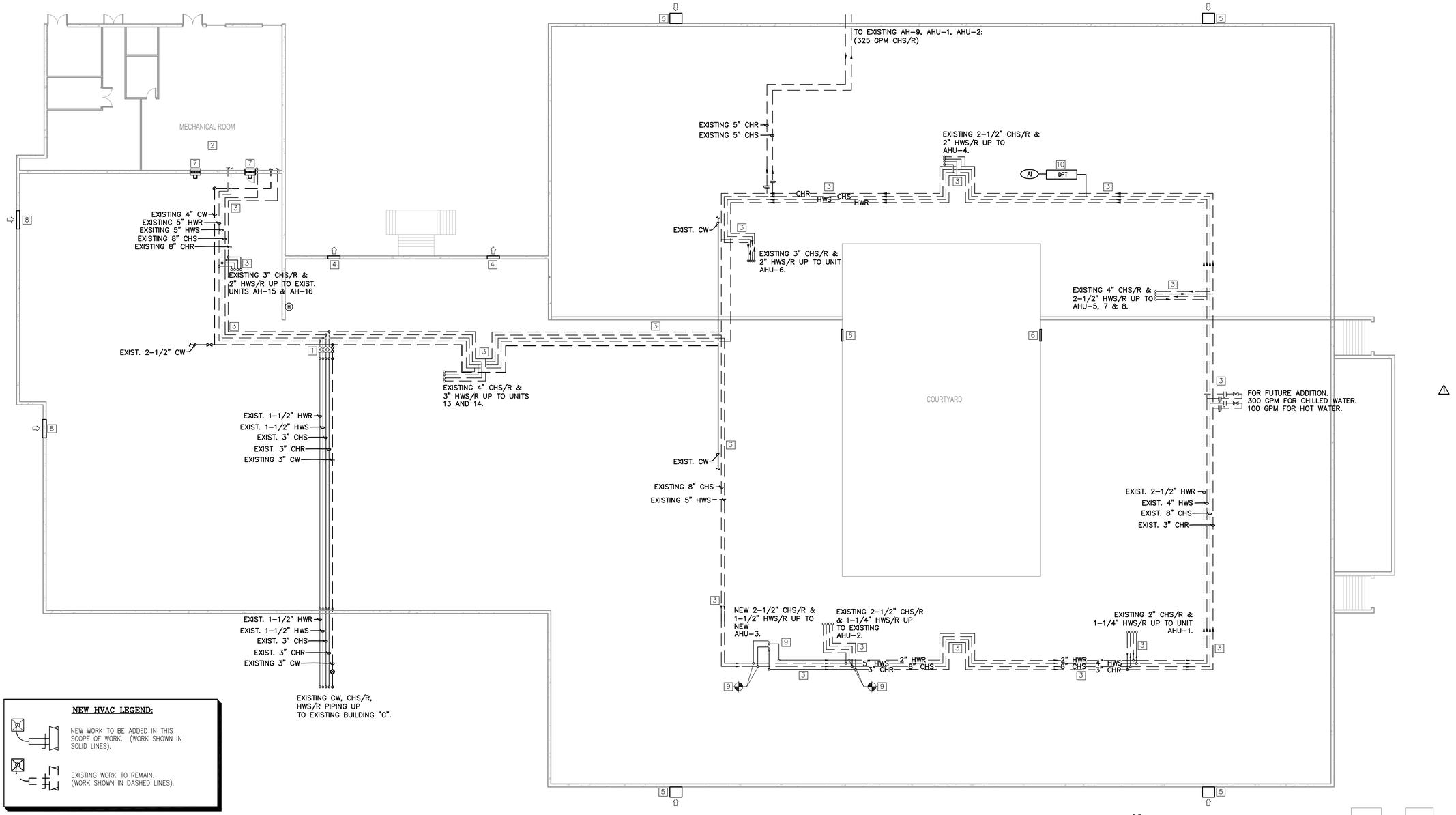
TITLE

MECHANICAL PLAN CENTRAL PLANT - PHASE 4

SHEET

M2.1.1 PHASE 4



NEW HVAC LEGEND:

NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

KEYED MECHANICAL NOTES - BASE BID:

1. EXISTING CHILLED AND HOT WATER SUPPLY AND RETURN LINES CURRENTLY SERVING BUILDING "C" ARE TO REMAIN, HOWEVER, EXISTING INSULATION AND JACKETING ON PIPING SHALL BE DEMOLISHED.. PREP EXISTING PIPING FOR NEW INSULATION AND ALUMINUM JACKETING.
2. REFER TO M2.1 FOR NEW WORK IN MAIN MECHANICAL ROOM/CENTRAL PLANT.
3. EXISTING CHILLED AND HOT WATER SUPPLY AND RETURN LINES CURRENTLY LOCATED IN THE CRAWL SPACE ARE TO REMAIN, HOWEVER, EXISTING INSULATION AND JACKETING ON PIPING SHALL BE DEMOLISHED.. PREP EXISTING PIPING FOR NEW INSULATION AND ALUMINUM JACKETING.
4. APPROXIMATE LOCATION OF EXISTING SIDEWALL VENTILATION OPENING IN CRAWL SPACE TO REMAIN. APPROXIMATELY 48" WIDE X 24" HIGH WITH BOTTOM OF OPENING APPROXIMATELY 60" ABOVE CRAWL SPACE DIRT FLOOR.
5. APPROXIMATE LOCATION OF EXISTING VENTILATION AREAWAY TO REMAIN. APPROXIMATELY 48" WIDE X 40" LENGTH AND 3 FEET DEEP WITH APPROXIMATELY 12" CLEAR UNDER STRUCTURAL GRADE BEAM. MECHANICAL CONTRACTOR SHALL CLEAR ANY DEBRIS FROM IN, ON AND AROUND EXISTING VENTILATION AREAWAY.
6. APPROXIMATE LOCATION OF CRAWL SPACE METAL ACCESS DOOR. DOOR IS APPROXIMATELY 46" WIDE X 62" TALL. DOOR TO REMAIN.
7. EXISTING VENTILATION FAN IN EXISTING WALL SEPARATING MAIN MECHANICAL ROOM FROM THE CRAWL SPACE. FAN SHALL REMAIN IN SERVICE.
8. APPROXIMATE LOCATION OF EXISTING SIDEWALL VENTILATION OPENING IN CRAWL SPACE TO REMAIN. APPROXIMATELY 72" WIDE X 18" HIGH WITH BOTTOM OF OPENING APPROXIMATELY 60" ABOVE CRAWL SPACE DIRT FLOOR. MECHANICAL CONTRACTOR SHALL CLEAR ANY DEBRIS FROM IN, ON AND AROUND EXISTING VENTILATION AREAWAY.
9. INSTALL NEW 2-1/2" CHS/R AND 1-1/2" HWS/R UP FROM MAIN CHILLED AND HOT WATER PIPING LOOP UP TO MECHANICAL ROOM TO NEW AHU-3. EXISTING PIPING SHALL BE UPSIZED TO CONNECTION POINTS AT EXISTING PIPING AS INDICATED.
10. PROVIDE NEW DIFFERENTIAL PRESSURE SENSOR IN THE CHILLED WATER LOOP IN THIS APPROXIMATE LOCATION. REFER TO M0.8 FOR ADDITIONAL INFORMATION. SIGNAL SHALL BE HARDWIRED BACK TO THE CONTROL PANEL SERVING EXISTING AHU-4.

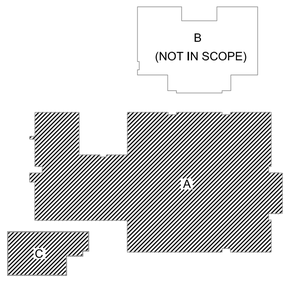
MECHANICAL PLAN - CRAWL SPACE

SCALE: 1/16" = 1'-0"

NOTE: CHILLED WATER AND HOT WATER SUPPLY AND RETURN PIPING AND CONDENSATE AND DOMESTIC COLD WATER PIPING ROUTING IN CRAWL SPACE IS AN ASSUMPTION BASED ON EXISTING AVAILABLE CONSTRUCTION DRAWINGS AND FIELD VISIT BY THE ENGINEER OF RECORD. THE EXACT EXISTING ROUTING OF THE PIPING HAS NOT BEEN CONFIRMED AND THE MECHANICAL CONTRACTOR WILL NEED TO BASE THEIR ESTIMATE OF LABOR AND MATERIALS ON THESE DRAWINGS AND ADJUST THEIR COST, IF NECESSARY, AFTER ABATEMENT HAS BEEN COMPLETED AND AFTER VISITING THE CRAWL SPACE TO DETERMINE EXACT SIZES AND LENGTHS OF PIPING.

GENERAL NOTES TO CONTRACTOR:

1. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
2. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
3. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.



HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

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WILSON & GIRGENTI, LLC
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Fax: 727-726-2070

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DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL
RENOVATIONS
6800 Bill Hughes Rd. Austin, TX
78745
AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

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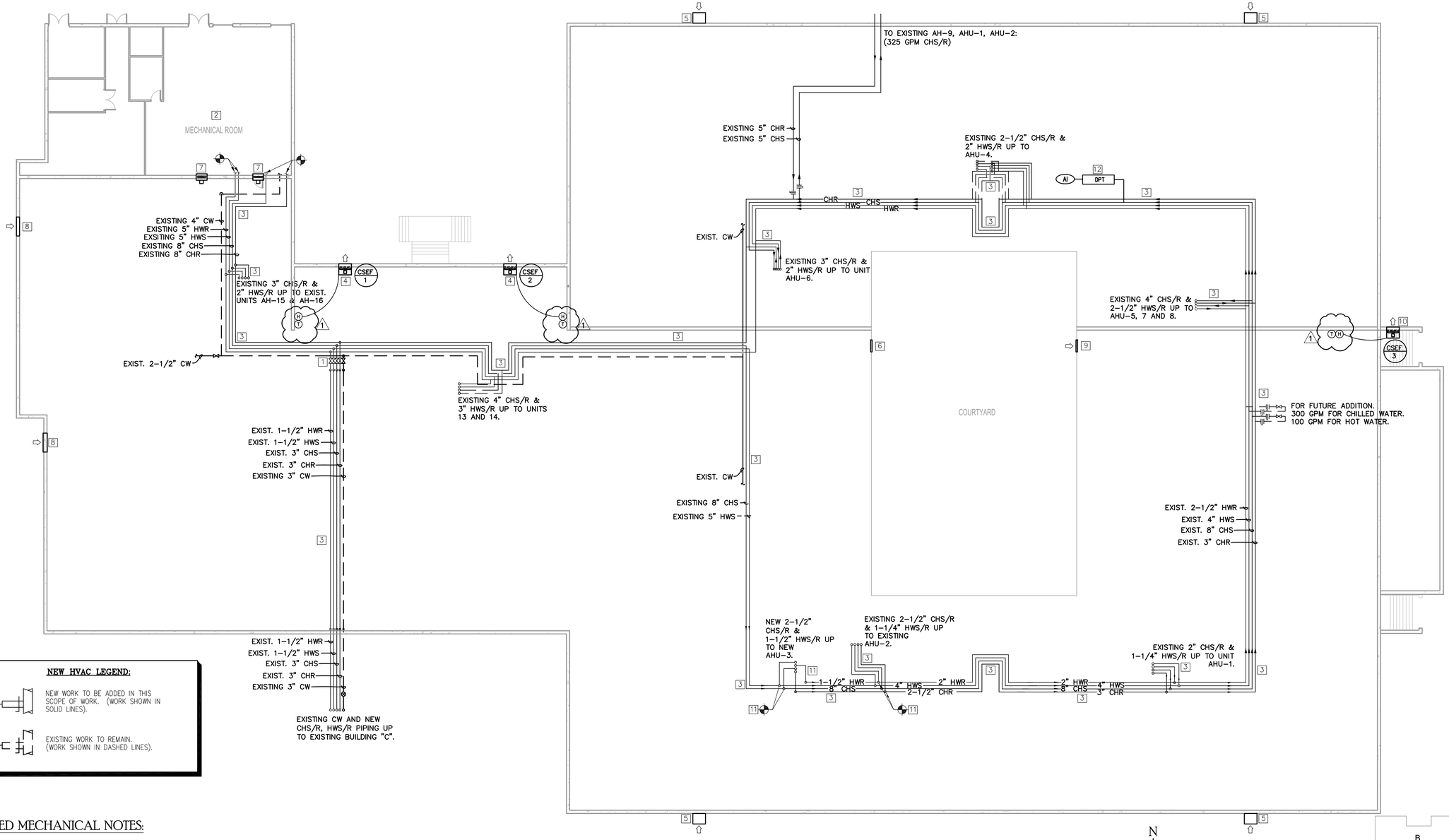
MECHANICAL PLAN CRAWL SPACE

SHEET

M2.2



KEYED MECHANICAL NOTES:

1. PHASE 1: MECHANICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW CHILLED AND HOT WATER PIPING INSULATION AND ALUMINUM JACKETING ON EXISTING, FRESHLY ABATED, PIPING FROM CRAWL SPACE TO EXISTING BUILDING "C" PER SPECIFICATION SECTION 230719.
2. REFER TO M2.1 FOR NEW WORK IN MAIN MECHANICAL ROOM/CENTRAL PLANT.
3. PHASE 1: MECHANICAL CONTRACTOR SHALL PROVIDE AND INSTALL NEW CHILLED AND HOT WATER PIPING INSULATION AND ALUMINUM JACKETING ON EXISTING, FRESHY ABATED, PIPING IN CRAWL SPACE, STARTING AT THE WALL TO THE CENTRAL PLANT AND THROUGHOUT THE CRAWL SPACE. INSULATE ALL NEW BRANCH PIPING FOR EXISTING AND NEW AHU'S TO ELBOW UP FROM CRAWL SPACE TO LEVEL ABOVE UNLESS NOTED OTHERWISE (EXAMPLE: AHU-3).
4. PHASE 2: APPROXIMATE LOCATION OF EXISTING SIDEWALL VENTILATION OPENING IN CRAWL SPACE. APPROXIMATELY 48" WIDE X 24" HIGH WITH BOTTOM OF OPENING APPROXIMATELY 60" ABOVE CRAWL SPACE DIRT FLOOR. INSTALL NEW CRAWL SPACE SIDEWALL EXHAUST FAN AS SCHEDULED IN EXISTING OPENING. PROVIDE NEW METAL GRATE IN OPENING NOT FILLED BY NEW EXHAUST FAN. (FAN NOT DRAWN TO SCALE).
5. APPROXIMATE LOCATION OF EXISTING VENTILATION AREAWAY. APPROXIMATELY 48" WIDE X 40" LENGTH AND 3 FEET DEEP WITH APPROXIMATELY 12" CLEAR UNDER STRUCTURAL GRADE BEAM. MECHANICAL CONTRACTOR SHALL CLEAR ANY DEBRIS FROM IN, ON AND AROUND EXISTING VENTILATION AREAWAY.
6. APPROXIMATE LOCATION OF CRAWL SPACE METAL ACCESS DOOR. DOOR IS APPROXIMATELY 46" WIDE X 62" TALL. DOOR TO REMAIN.
7. EXISTING VENTILATION FAN IN EXISTING WALL SEPARATING MAIN MECHANICAL ROOM FROM THE CRAWL SPACE. FAN SHALL REMAIN IN SERVICE.
8. APPROXIMATE LOCATION OF EXISTING SIDEWALL VENTILATION OPENING IN CRAWL SPACE. APPROXIMATELY 72" WIDE X 18" HIGH WITH BOTTOM OF OPENING APPROXIMATELY 60" ABOVE CRAWL SPACE DIRT FLOOR. MECHANICAL CONTRACTOR SHALL CLEAR ANY DEBRIS FROM IN, ON AND AROUND EXISTING VENTILATION AREAWAY.
9. NEW VANDAL-PROOF METAL BAR GRATE TO FIT THE EXISTING OPENING (APPROX. 46" WIDE X 62" TALL). BAR HEIGHT TO BE 1-1/2", MESH SIZE TO BE 1-1/2" X 1-1/2". INSTALL BAR GRATE TO VERTICAL HINGES TO ALLOW GRATE TO SWING OUT FOR ACCESS TO THE CRAWL SPACE. PROVIDE TWO DOOR SECURITY PLATES/DOOR LATCH IN EXTERIOR WALL AND KEY LOCKS TO RESTRICT ENTRANCE TO CRAWL SPACE.
10. PHASE 2: APPROXIMATE LOCATION OF NEW CRAWL SPACE EXHAUST FAN UNDER EXISTING STAIRWELL. INSTALL NEW CRAWL SPACE SIDEWALL EXHAUST FAN AS SCHEDULED IN NEW OPENING. (FAN NOT DRAWN TO SCALE).
11. INSTALL NEW 2-1/2" CHS/R AND 1-1/2" HWS/R UP FROM MAIN CHILLED AND HOT WATER PIPING LOOP UP TO MECHANICAL ROOM WITH NEW AHU-3. ROUTE NEW PIPING TO NEW AHU-3. EXISTING PIPING SHALL BE UPSIZED TO CONNECTION POINTS AT EXISTING PIPING AS INDICATED.
12. PROVIDE NEW DIFFERENTIAL PRESSURE SENSOR IN THE CHILLED WATER LOOP IN THIS APPROXIMATE LOCATION. REFER TO M0.8 FOR ADDITIONAL INFORMATION. SIGNAL SHALL BE HARDWIRED BACK TO THE CONTROL PANEL SERVING EXISTING AHU-4.

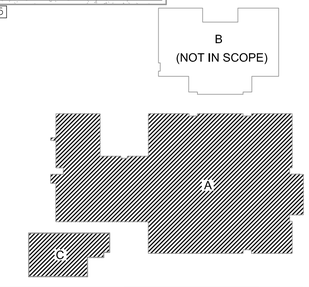
MECHANICAL PLAN -CRAWL SPACE

SCALE: 1/16" = 1'-0"

NOTE: CHILLED WATER AND HOT WATER SUPPLY AND RETURN PIPING AND CONDENSATE AND DOMESTIC COLD WATER PIPING ROUTING IN CRAWL SPACE IS AN ASSUMPTION BASED ON EXISTING AVAILABLE CONSTRUCTION DRAWINGS AND FIELD VISIT BY THE ENGINEER OF RECORD. THE EXACT EXISTING ROUTING OF THE PIPING HAS NOT BEEN CONFIRMED AND THE MECHANICAL CONTRACTOR WILL NEED TO BASE THEIR ESTIMATE OF LABOR AND MATERIALS ON THESE DRAWINGS AND ADJUST THEIR COST, IF NECESSARY, AFTER ABATEMENT HAS BEEN COMPLETED AND AFTER VISITING THE CRAWL SPACE TO DETERMINE EXACT SIZES AND LENGTHS OF PIPING.

GENERAL NOTES TO CONTRACTOR:

1. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
2. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
3. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.



SCOPE OF WORK, PHASE 1 & 2:

AFTER ABATEMENT, ALL EXISTING PIPING LOCATED IN CRAWL SPACE SHALL BE RE-INSULATED WITH NEW INSULATION AND PROTECTED WITH NEW ALUMINUM JACKETING.

EXISTING CHS/CHR AND HWS/HWR PIPING IN CRAWL SPACE AND UNDERGROUND TO BUILDING "C" SHALL BE RE-INSULATED AND PROTECTED WITH NEW ALUMINUM JACKETING.

PROVIDE AND INSTALL NEW CRAWL SPACE EXHAUST FANS CSEF-1, CSEF-2 AND CSEF-3.

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com
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DEPARTMENT OF CONSTRUCTION MANAGEMENT

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AISD PROJECT No. 200029-BEDCHK

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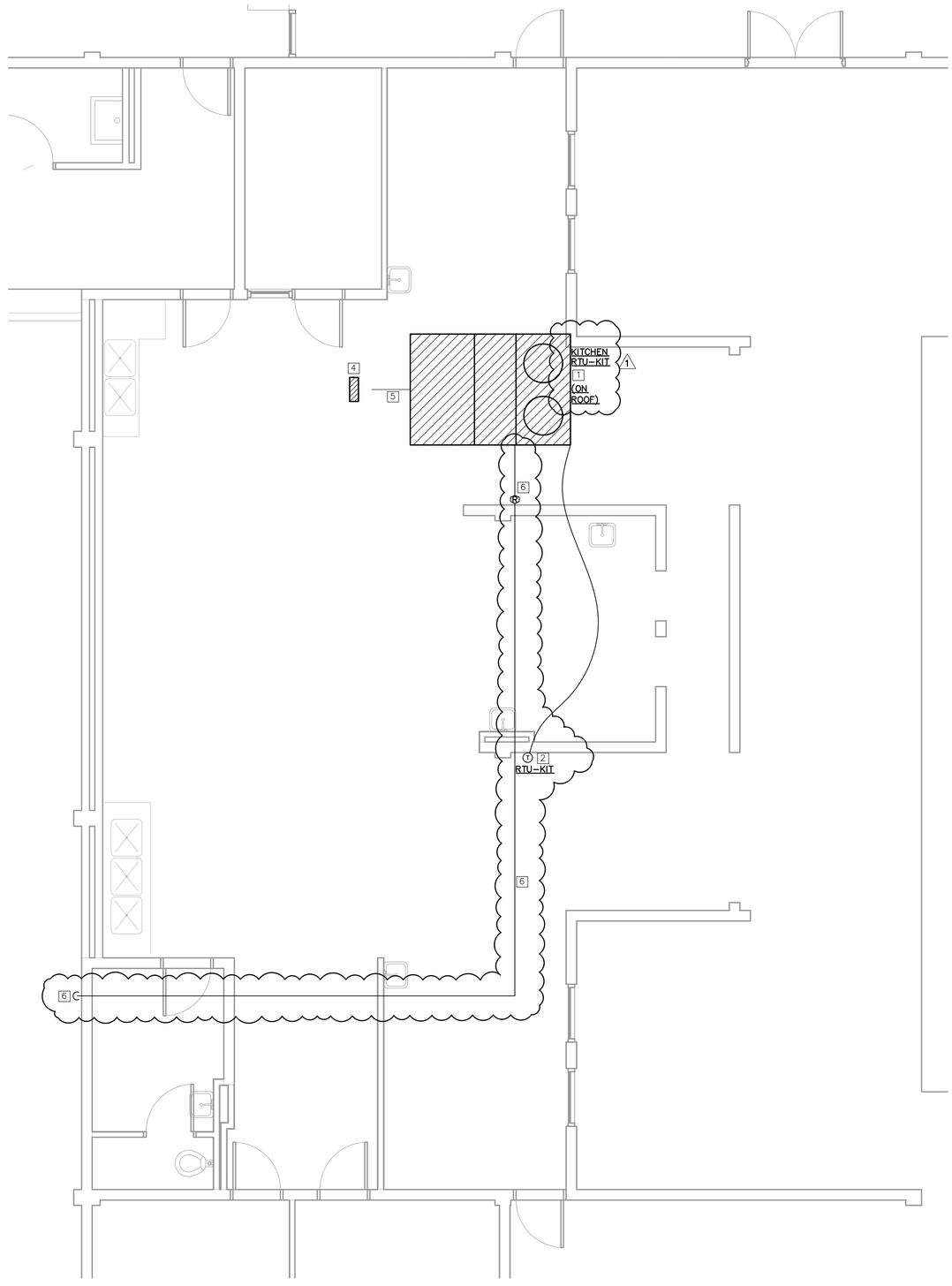
MECHANICAL PLAN CRAWL SPACE - PHASE 1 & 2

SHEET

M2.2.1 PHASE 1 & 2



MECHANICAL PLAN -FIRST FLOOR

SCALE: 1/4" = 1'-0"

N

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. PROVIDE UNIT-SIZE LINED SUPPLY & RETURN DROPS FOR ALL EXISTING AND NEW RTU'S, AHU'S, AND FAN COIL UNITS.
10. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
11. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.

NEW HVAC LEGEND:

NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

KEYED MECHANICAL NOTES:

1

1 CONTRACTOR TO PROVIDE AND INSTALL NEW DX PACKAGED ROOFTOP UNIT TO SERVE THE KITCHEN. INSTALL NEW UNIT WHERE PREVIOUS UNIT WAS LOCATED. PROVIDE NEW ROOF CURB. PROVIDE NEW SUPPLY AND RETURN DUCTWORK AS NEEDED TO CONNECT NEW UNIT TO EXISTING SUPPLY AND RETURN DUCTWORK SERVING THE KITCHEN IN THE CEILING PLENUM.

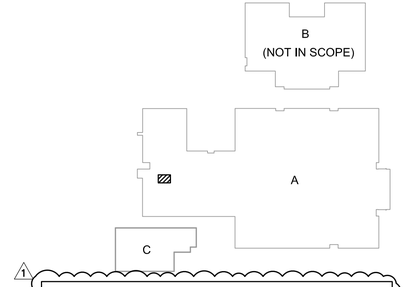
2 PROVIDE NEW DDC THERMOSTAT AND ALL ASSOCIATED CONTROL WIRING TO LOCATION SHOWN FOR NEW KITCHEN RTU-KIT.

3 PROVIDE NEW DUCT SMOKE DETECTOR IN SUPPLY AIR DISCHARGE OFF OF NEW KITCHEN RTU-KIT. UPON ACTIVATION, SMOKE DETECTOR SHALL SHUT-DOWN UNIT AND GIVE GENERAL AUDIBLE/VISIBLE ALARM AND REPORT TO SILENT KNIGHT FIRE ALARM PANEL.

4 EXISTING THYCURB ON ROOF IN THIS APPROXIMATE LOCATION. REPLACE EXISTING RTU-KIT DISCONNECT AND PROVIDE NEW RTU-KIT DISCONNECT WITH NEW RTU-KIT.

5 CONNECT EXISTING CONDENSATE DRAIN LINE ROUTING DOWN THROUGH EXISTING TYHCURB SUPPORTING RTU-KIT DISCONNECT TO NEW RTU-KIT. PROVIDE ADDITIONAL PVC PIPING AS REQUIRED FOR CONNECTION TO NEW RTU-KIT. EXISTING CONDENSATE DRAIN LINE DOWN FROM EXISTING KITCHEN RTU-KIT TO REMAIN AND BE REUSED FOR NEW KITCHEN RTU-KIT.

6 CONNECT NEW GAS LINE SIZED FOR BTUH REQUIREMENT ON DX ROOFTOP SCHEDULE FOR NEW RTU-KIT TO EXISTING METER PROVIDING GAS TO KITCHEN EQUIPMENT. INSTALL GAS PIPING ON ROOF ON PORTABLE PIPE HANGERS EVERY 10 FT. TO ELIMINATE ROOF PENETRATIONS. PROVIDE PRESSURE REGULATOR.



1

SCOPE OF WORK:

REPLACE EXISTING KITCHEN RTU-KIT ON ROOF. INSTALL NEW KITCHEN RTU-KIT UNIT ON THE ROOF WHERE EXISTING UNIT IS CURRENTLY LOCATED. PROVIDE NEW ROOF CURB AND REUSE EXISTING ROOF PENETRATIONS. MECHANICAL CONTRACTOR SHALL PROVIDE NEW SUPPLY AND RETURN DISCHARGE DUCTWORK FROM NEW RTU-KIT AND CONNECT TO EXISTING DUCTWORK LOCATED IN KITCHEN CEILING PLENUM. EXISTING DUCTWORK IN KITCHEN CEILING PLENUM SHALL REMAIN AS-IS. NEW UNIT SHALL BE PACKAGED DX WITH GAS HEAT.

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
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TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
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DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

REVISIONS

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MECHANICAL PLAN FIRST FLOOR

SHEET

M2.3

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
10. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.

NEW HVAC LEGEND:

NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

KEYED MECHANICAL NOTES:

[1] CONTRACTOR TO PROVIDE AND INSTALL NEW 4-PIPE AIR HANDLING UNIT AHU-3. AFTER DEMOLITION OF EXISTING AHU-3 AND ASSOCIATED SUPPLY AND RETURN DUCTWORK. ALL NEW SUPPLY AND RETURN DUCTWORK AND CHILLED AND HOT WATER SUPPLY AND RETURN PIPING SHALL BE PROVIDED AS SHOWN.

[2] PROVIDE NEW 18/14 OUTSIDE AIR DUCT (1,500 CFM) FROM EXISTING OUTSIDE AIR INTAKE LOUVER AND PLENUM LOCATED OVER DOUBLE DOORS TO MECHANICAL ROOM. INSTALL MOTORIZED AND MANUAL DAMPERS IN OUTSIDE AIR DUCT. ROUTE OUTSIDE AIR DUCT TO RETURN AIR PLENUM AT BACK OF NEW AHU-3. DO NOT ROUTE DUCTWORK OVER EXISTING ELECTRICAL PANELS AND EQUIPMENT. MOTORIZED OUTSIDE AIR DAMPER SHALL BE INTERLOCKED WITH AHU-3 AND SHALL CLOSE WHEN AHU-3 IS DE-ENERGIZED, AND DAMPER SHALL OPEN WHEN AHU-3 IS ENERGIZED. T&B CONTRACTOR SHALL USE MANUAL BALANCING DAMPER TO BALANCE OUTSIDE AIR TO 1,500 CFM.

[3] ROUTE NEW 2-1/2" CHS/CHR AND 1-1/2" HWS/HWR PIPING TO NEW AHU-3 FROM CRAWL SPACE BELOW. PROVIDE PIPE SIZES AS INDICATED AND PROVIDE ALL BELIMO VALVES, ACTUATORS, STRAINERS, THERMOSTATS, PETE'S PLUGS, ETC...AS SHOWN IN COIL PIPING DETAIL TO NEW AHU-3.

[4] TRANSITION AND OFFSET DUCTWORK AS REQUIRED IN THIS AREA TO ACCOMMODATE DUCT CROSSINGS WITH CEILING AND EXISTING STRUCTURE.

[5] PROVIDE NEW DDC ZONE THERMOSTAT AND CO2 SENSOR AND ALL ASSOCIATED CONTROL WIRING TO NEW ZONE DAMPER AT CORRESPONDING ZONE AT NEW AHU-3.

[6] PROVIDE NEW DUCT SMOKE DETECTOR IN SUPPLY AIR DISCHARGE OFF OF NEW AHU-3 PRIOR TO ZONE DUCTWORK. UPON ACTIVATION, SMOKE DETECTOR SHALL SHUT-DOWN UNIT AND GIVE GENERAL AUDIBLE/VISIBLE ALARM AND REPORT TO SILENT KNIGHT FIRE ALARM PANEL.

[7] CEILING PLENUM SHALL NOT HAVE ANY "ABANDONED" DUCTWORK, EQUIPMENT, WIRING, ETC...PER THE CITY OF AUSTIN. GENERAL CONTRACTOR SHALL REMOVE EXISTING WALLS (GHOST WALLS) ABOVE CEILING, INCLUDING ANY RETURN AIR TRANSFERS AND ASSOCIATED FIRE DAMPERS IF APPLICABLE. MECHANICAL CONTRACTOR SHALL CONFIRM GENERAL CONTRACTOR'S WORK.

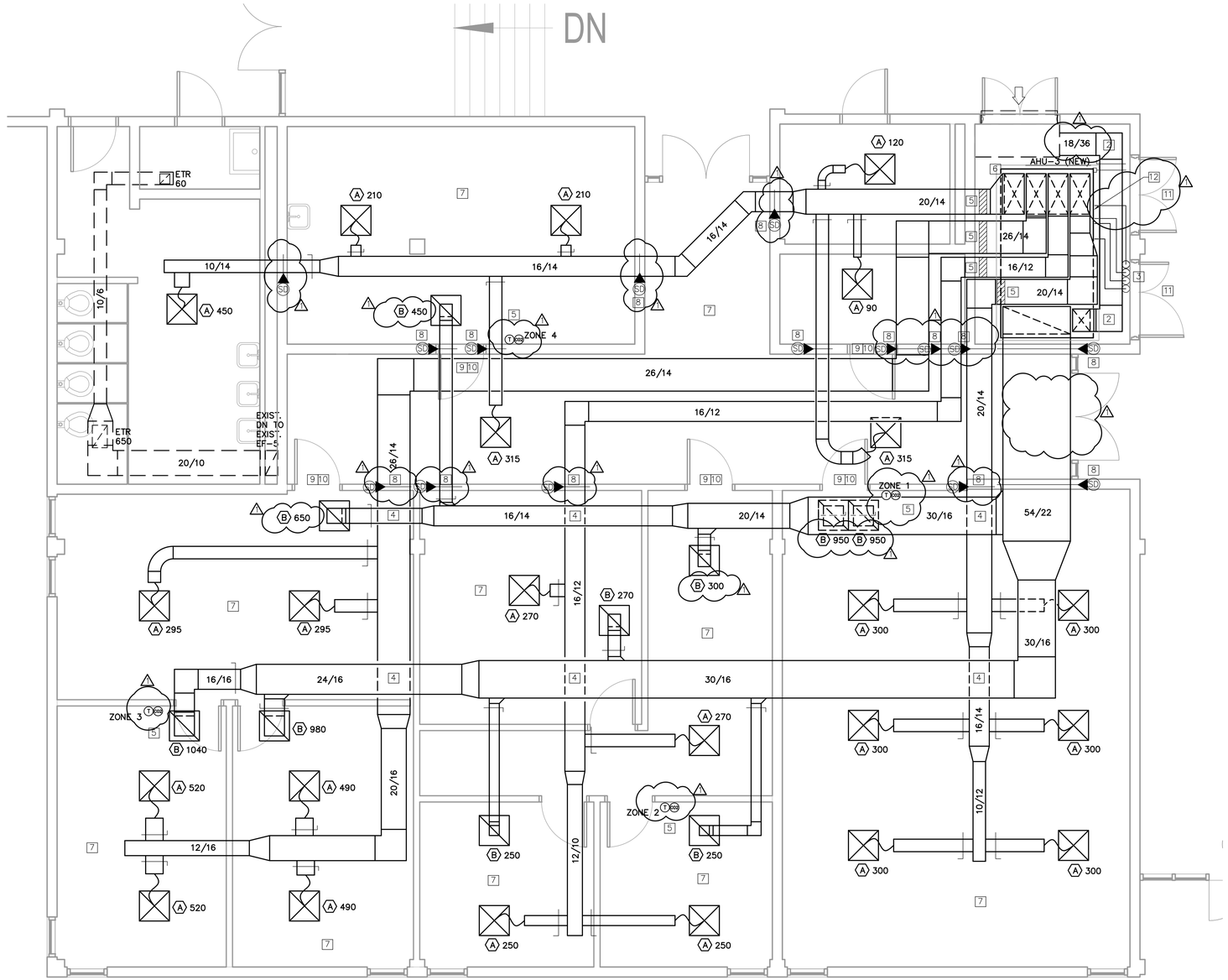
[8] PROVIDE NEW FIRE/SMOKE DAMPER IN RATED CORRIDOR WALL PENETRATION. COORDINATE WITH ELECTRICIAN FOR POWER.

[9] REFER TO DEMOLITION SHEET M1.2. EXISTING RETURN AIR LOUVER ABOVE EXISTING CLASSROOM DOOR SHALL BE REMOVED AND EXISTING WALL SHALL BE FILLED IN TO CREATE 2-HOUR RATED CORRIDOR WALL.

[10] REFER TO DEMOLITION SHEET M1.2. EXISTING CLASSROOM DOOR WITH LOUVER SHALL BE REMOVED AND REPLACED WITH NEW 2-HOUR RATED DOOR WITH VIEWING WINDOW. REFER TO ARCHITECTURAL DRAWINGS FOR DOOR SPECIFICATIONS.

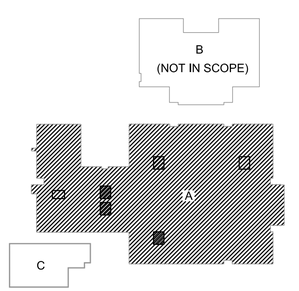
[11] NEW DOUBLE DOORS TO BE INSTALLED IN EXISTING MECHANICAL ROOM WALL TO ALLOW FOR MAINTENANCE ACCESS TO NEW AHU-3. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION.

[12] PROVIDE ACCESS PANEL/DOOR TO ACCESS THE TOP SIDE OF THE HOT WATER COIL FOR CLEANING.



MECHANICAL PLAN - FIRST FLOOR

SCALE: 1/4" = 1'-0"



SCOPE OF WORK:

REPLACE EXISTING AHU-3 AND DEMOLISH ALL ASSOCIATED EXISTING SUPPLY AND RETURN DUCTWORK. INSTALL NEW AHU-3, ALL NEW AIR DEVICES, OUTSIDE AIR, SUPPLY AND RETURN DUCTWORK, THERMOSTATS, DAMPERS, ETC...AS SHOWN. TIE IN TO EXISTING CHS/CHR AND HWS/HWR PIPING UP FROM CRAWL SPACE TO NEW AHU-3.

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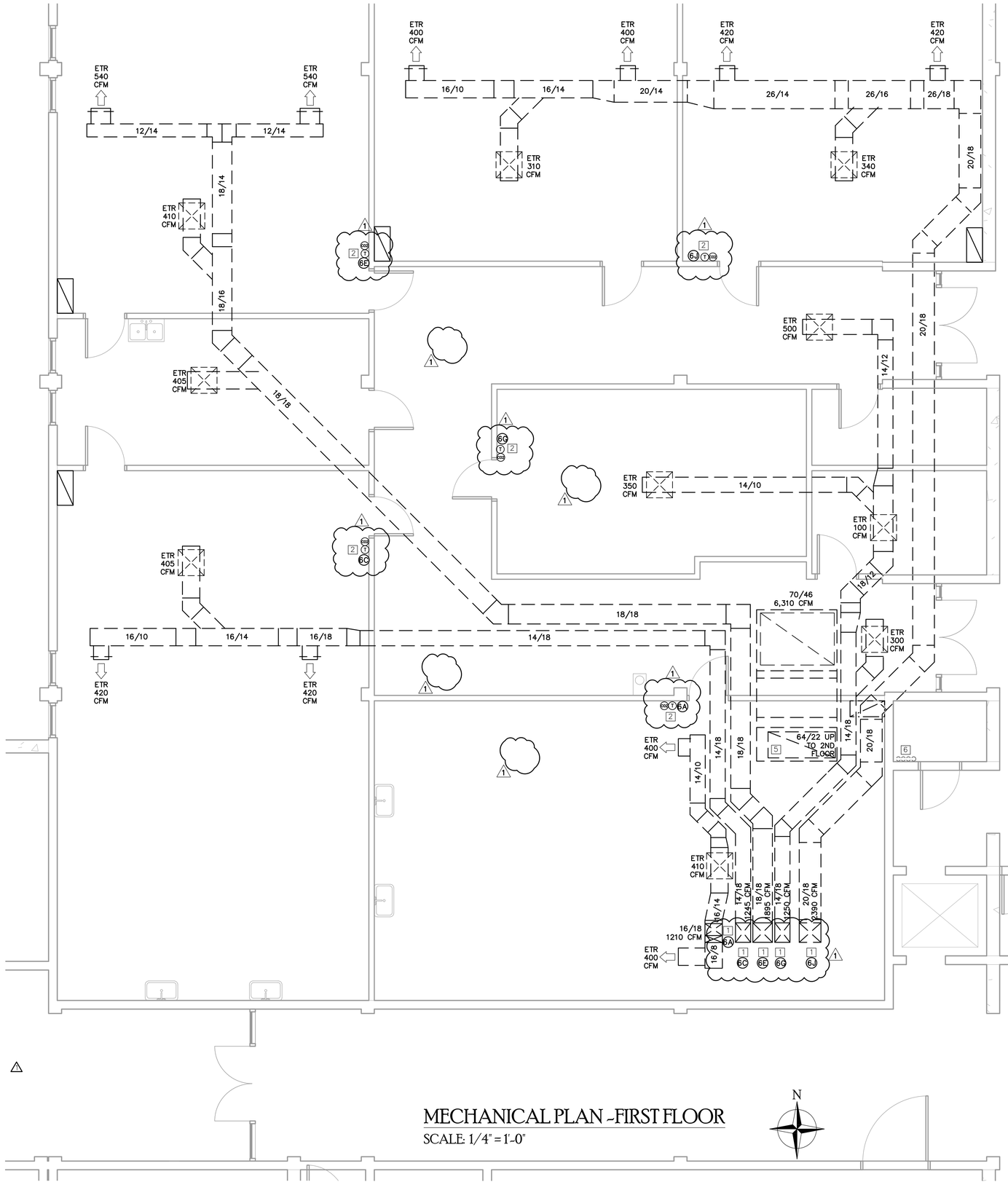
MECHANICAL PLAN FIRST FLOOR

SHEET

M2.4



MECHANICAL PLAN - FIRST FLOOR

SCALE: 1/4" = 1'-0"

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
10. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.

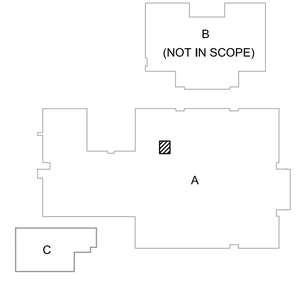
NEW HVAC LEGEND:

NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

KEYED MECHANICAL NOTES:

1. EXISTING ZONE SUPPLY DUCTWORK DOWN FROM SECOND FLOOR MECHANICAL ROOM AND AHU-6 TO REMAIN. CONNECT EXISTING DUCT TO NEW DUCTWORK IN MECHANICAL ROOM ON SECOND FLOOR. REFER TO M2.6.
2. PROVIDE NEW DDC ZONE THERMOSTAT AND CO2 SENSOR AND ALL ASSOCIATED CONTROL WIRING TO NEW ZONE DAMPER AT CORRESPONDING ZONE AT NEW AHU-6.
3. NOT USED.
4. EXTEND NEW CHILLED WATER AND HOT WATER (SIZES INDICATED) TO NEW COIL CONNECTIONS AT NEW AHU-6. TRANSITION AS REQUIRED TO WATER INLET SIZES. PROVIDE ALL REQUIRED VALVES WITH BELIMO ACTUATORS AS SHOWN ON THE DETAILS SHEETS. PROVIDE WATER BALANCE TO GPMS INDICATED IN AHU EQUIPMENT SCHEDULE.
5. EXISTING RETURN AIR DUCT FROM FIRST FLOOR AND EXISTING RETURN AIR PLENUM UP TO SECOND FLOOR TO REMAIN.
6. EXISTING 3" CHS/R AND 2" HWS/R UP FROM CRAWL SPACE TO CONTINUE UP TO SECOND FLOOR.



SCOPE OF WORK:

REPLACE EXISTING AHU-6. INSTALL NEW UNIT IN THE EXISTING MECHANICAL ROOM IT IS CURRENTLY HOUSED IN. NEW UNIT SHALL BE MULTIZONE, 4-PIPE UNIT WITH SAME NUMBER OF ZONES AS CURRENTLY EXISTING. EXISTING OUTSIDE AIR DUCT SHALL BE EXTENDED AND CONNECTED TO NEW RETURN AIR PLENUM AT BACK OF NEW AHU-6.

NEW AHU-6 SHALL BE 18,600 CFM.

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/

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MECHANICAL - ELECTRICAL - PLUMBING
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DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

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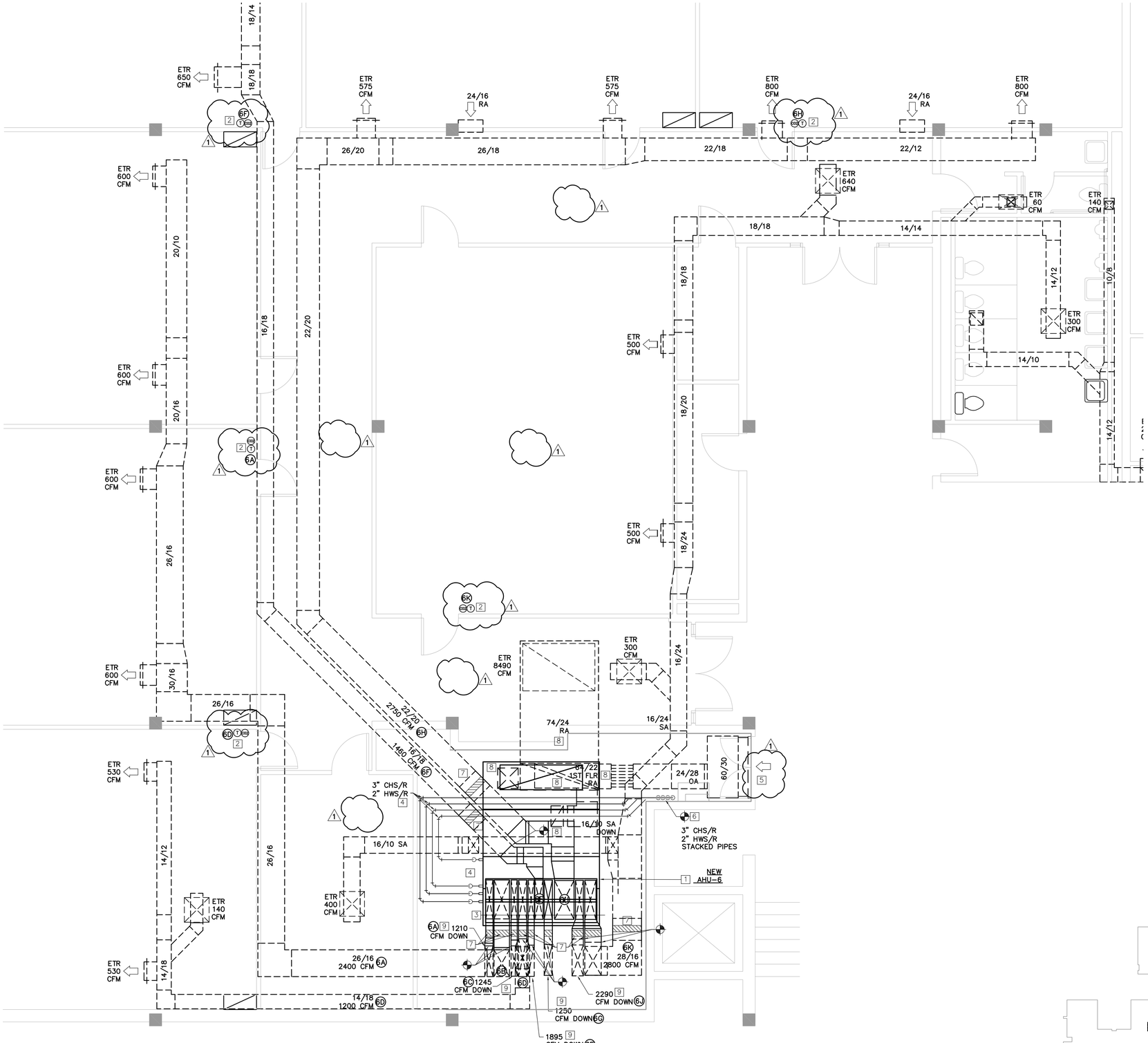
MECHANICAL PLAN FIRST FLOOR

SHEET

M2.5



MECHANICAL PLAN - SECOND FLOOR

SCALE: 1/4" = 1'-0"

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
10. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.

NEW HVAC LEGEND:

NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

KEYED MECHANICAL NOTES:

1. CONTRACTOR TO PROVIDE AND INSTALL NEW 4-PIPE AIR HANDLING UNIT AHU-6. AFTER DEMOLITION OF EXISTING AHU-6, RECONNECT EXISTING SUPPLY ZONE DUCTWORK, RETURN AND OUTSIDE AIR DUCTWORK, AND HOT AND CHILLED WATER AND CONDENSATE DRAIN LINES. PROVIDE NEW BELIMO VALVES AND ACTUATORS AS REQUIRED FOR CONNECTIONS TO THE NEW AIR HANDLING UNIT FROM EXISTING LINES. IT IS THE ENGINEER'S INTENT TO MAINTAIN AS MUCH OF THE EXISTING ZONE DUCTWORK TO CLASSROOMS AS POSSIBLE AND ONLY MODIFY DUCTWORK IN THE MECHANICAL ROOM, IF POSSIBLE. PROVIDE NEW HOUSEKEEPING PAD UNDER NEW AHU-6. MIN. 6" TALL.
2. PROVIDE NEW DDC ZONE THERMOSTAT AND CO2 SENSOR AND ALL ASSOCIATED CONTROL WIRING TO NEW ZONE DAMPER AT CORRESPONDING ZONE AT NEW AHU-6.
3. PROVIDE NEW DUCT SMOKE DETECTOR IN SUPPLY AIR DISCHARGE OFF OF NEW AHU-6 PRIOR TO ZONE DUCTWORK. UPON ACTIVATION, SMOKE DETECTOR SHALL SHUT-DOWN UNIT AND GIVE GENERAL AUDIBLE/VISIBLE ALARM AND REPORT TO SILENT KNIGHT FIRE ALARM PANEL.
4. EXTEND NEW CHILLED WATER AND HOT WATER (SIZES INDICATED) TO NEW COIL CONNECTIONS AT NEW AHU-6. TRANSITION AS REQUIRED TO WATER INLET SIZES. PROVIDE ALL REQUIRED VALVES WITH BELIMO ACTUATORS AS SHOWN ON THE DETAILS SHEETS. PROVIDE WATER BALANCE TO GPMS INDICATED IN AHU EQUIPMENT SCHEDULE.
5. EXISTING OUTSIDE AIR LOUVER AND ASSOCIATE OUTSIDE AIR DUCTWORK TO REMAIN.
6. CONNECT NEW 3" CHS/R AND 2" HWS/R FROM EXISTING PIPING RISERS IN THIS LOCATION. NEW PIPING IS TO BE ROUTED AS HIGH AS POSSIBLE OVER TO NEW AHU-6.
7. NEW DDC ACTUATOR/AIR BALANCING VALVE TO BE INSTALLED IN ZONE SUPPLY DUCT TO PROVIDE EASY MAINTENANCE ACCESS.
8. EXTEND RETURN AIR DUCT UP FROM FIRST FLOOR TO BOTTOM OF NEW MIXING BOX PLENUM. EXTEND RETURN AIR DUCT FROM SECOND FLOOR CORRIDOR CEILING SPACE DOWN TO MIXING BOX PLENUM. EXTEND EXISTING OUTSIDE AIR DUCT FROM EXISTING HRU B1 ON ROOF DOWN TO MIXING BOX PLENUM.
9. EXISTING ZONE SUPPLY DUCTS DOWN TO FIRST FLOOR TO REMAIN IN SERVICE.

SCOPE OF WORK:

REPLACE EXISTING AHU-6. INSTALL NEW UNIT IN THE EXISTING MECHANICAL ROOM IT IS CURRENTLY HOUSED IN. NEW UNIT SHALL BE MULTIZONE, 4-PIPE UNIT WITH SAME NUMBER OF ZONES AS CURRENTLY EXISTING. EXISTING OUTSIDE AIR DUCT SHALL BE EXTENDED AND CONNECTED TO NEW RETURN AIR PLENUM AT BACK OF NEW AHU-6.

1 NEW AHU-6 SHALL BE 18,600 CFM.

ALL EXISTING CLASSROOMS SHALL REMAIN UNTOUCHED.

NEW AHU-6 SHALL ENTER THROUGH CORRIDOR DOUBLE DOORS. EXISTING WALL WILL BE KNOCKED OUT TO ALLOW FOR NEW AHU-6 INSTALLATION IN NEWLY ENLARGED MECHANICAL ROOM.

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

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KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
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MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd, Suite 125
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P.O. Box 1377
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DEPARTMENT OF CONSTRUCTION MANAGEMENT

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6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
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MECHANICAL PLAN SECOND FLOOR

SHEET

M2.6

SCOPE OF WORK:

REPLACE EXISTING AHU-7. INSTALL NEW UNIT IN THE MECHANICAL ROOM IT IS CURRENTLY HOUSED IN. NEW UNIT SHALL BE MULTIZONE, 4-PIPE UNIT WITH SIX ZONES. NEW ZONE DISCHARGE DUCTWORK SHALL CONNECT TO EXISTING ZONE SUPPLY DUCTWORK TO CLASSROOMS WHERE INDICATED. PROVIDE NEW DUCTWORK, ZONE BALANCING VALVES, CONTROLS, AND INSULATION AS REQUIRED FOR A COMPLETE AND FUNCTIONAL SYSTEM.

NEW AHU-7 SHALL BE 10,560 CFM.

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
10. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.

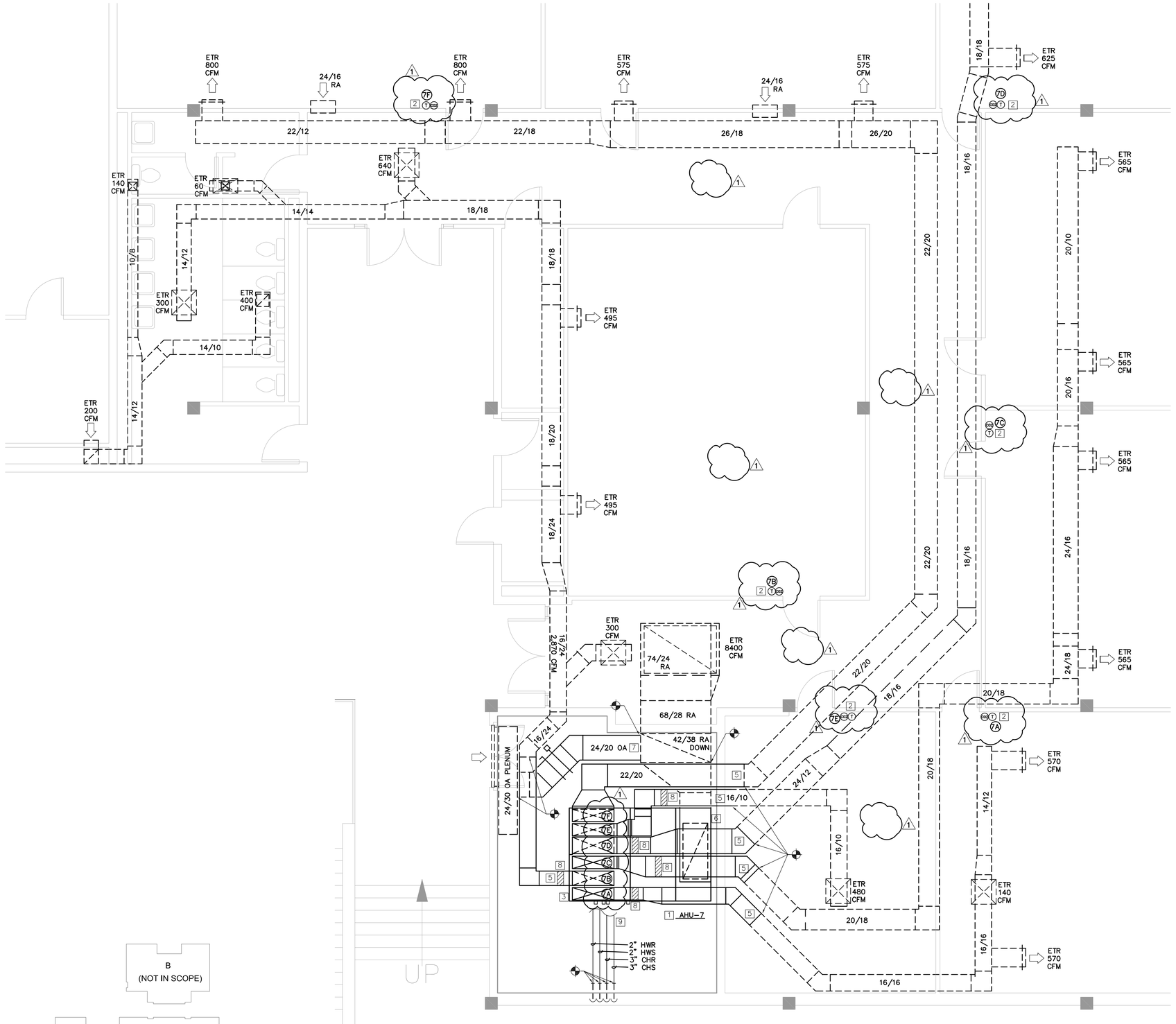
NEW HVAC LEGEND:

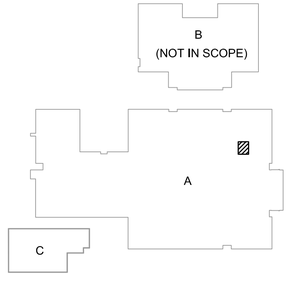
NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

KEYED MECHANICAL NOTES:

1. CONTRACTOR TO PROVIDE AND INSTALL NEW 4-PIPE AIR HANDLING UNIT AHU-7 AFTER DEMOLITION OF EXISTING AHU-7. RECONNECT EXISTING SUPPLY ZONE DUCTWORK, RETURN AND OUTSIDE AIR DUCTWORK, AND HOT AND CHILLED WATER AND CONDENSATE LINES AS SHOWN. PROVIDE NEW PIPING AND BELIMO VALVES AND ACTUATORS AS REQUIRED FOR CONNECTING TO THE NEW AIR HANDLING UNIT FROM EXISTING LINES. PROVIDE NEW HOUSEKEEPING PAD UNDER NEW AHU-7. MIN. 6" TALL.
2. PROVIDE NEW DDC ZONE THERMOSTAT AND CO2 SENSOR AND ALL ASSOCIATED CONTROL WIRING TO NEW ZONE DAMPER AT CORRESPONDING ZONE AT NEW AHU-7.
3. PROVIDE NEW DUCT SMOKE DETECTOR IN SUPPLY AIR DISCHARGE OFF OF NEW AHU-7 PRIOR TO ZONE DUCTWORK. UPON ACTIVATION, SMOKE DETECTOR SHALL SHUT-DOWN UNIT AND GIVE GENERAL AUDIBLE/VISIBLE ALARM AND REPORT TO SILENT KNIGHT FIRE ALARM PANEL.
4. NOT USED.
5. EXISTING RETURN AIR DUCT FROM FIRST FLOOR AND EXISTING RETURN AIR PLENUM TO REMAIN.
6. EXTEND EXISTING RETURN AIR DUCT TO BACK OF NEW AHU-7 IN MECHANICAL ROOM AS SHOWN.
7. EXTEND EXISTING OUTSIDE AIR DUCT TO EXISTING RETURN AIR DUCT TO BACK OF NEW AHU-7 IN MECHANICAL ROOM AS SHOWN.
8. NEW DDC ACTUATORS/AIR BALANCING VALVE TO BE CONTROLLED BY NEW THERMOSTAT IN CORRESPONDING ZONE.
9. EXTEND NEW CHILLED WATER AND HOT WATER (SIZES INDICATED) TO NEW COIL CONNECTIONS AT NEW AHU. TRANSITION AS REQUIRED TO WATER INLET SIZES. PROVIDE ALL REQUIRED VALVES AS SHOWN ON THE DETAILS SHEETS. PROVIDE WATER BALANCE TO GPMS INDICATED IN AHU EQUIPMENT SCHEDULE.
10. NEW DDC ACTUATOR/AIR BALANCING VALVE TO BE INSTALLED IN VERTICAL ZONE SUPPLY DUCT TO PROVIDE EASY MAINTENANCE ACCESS.





MECHANICAL PLAN - SECOND FLOOR

SCALE: 1/4" = 1'-0"

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
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In Association w/

KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd, Suite 125
Austin, TX 78750
P.O.Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

htg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX

78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
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PROFESSIONAL ENGINEER
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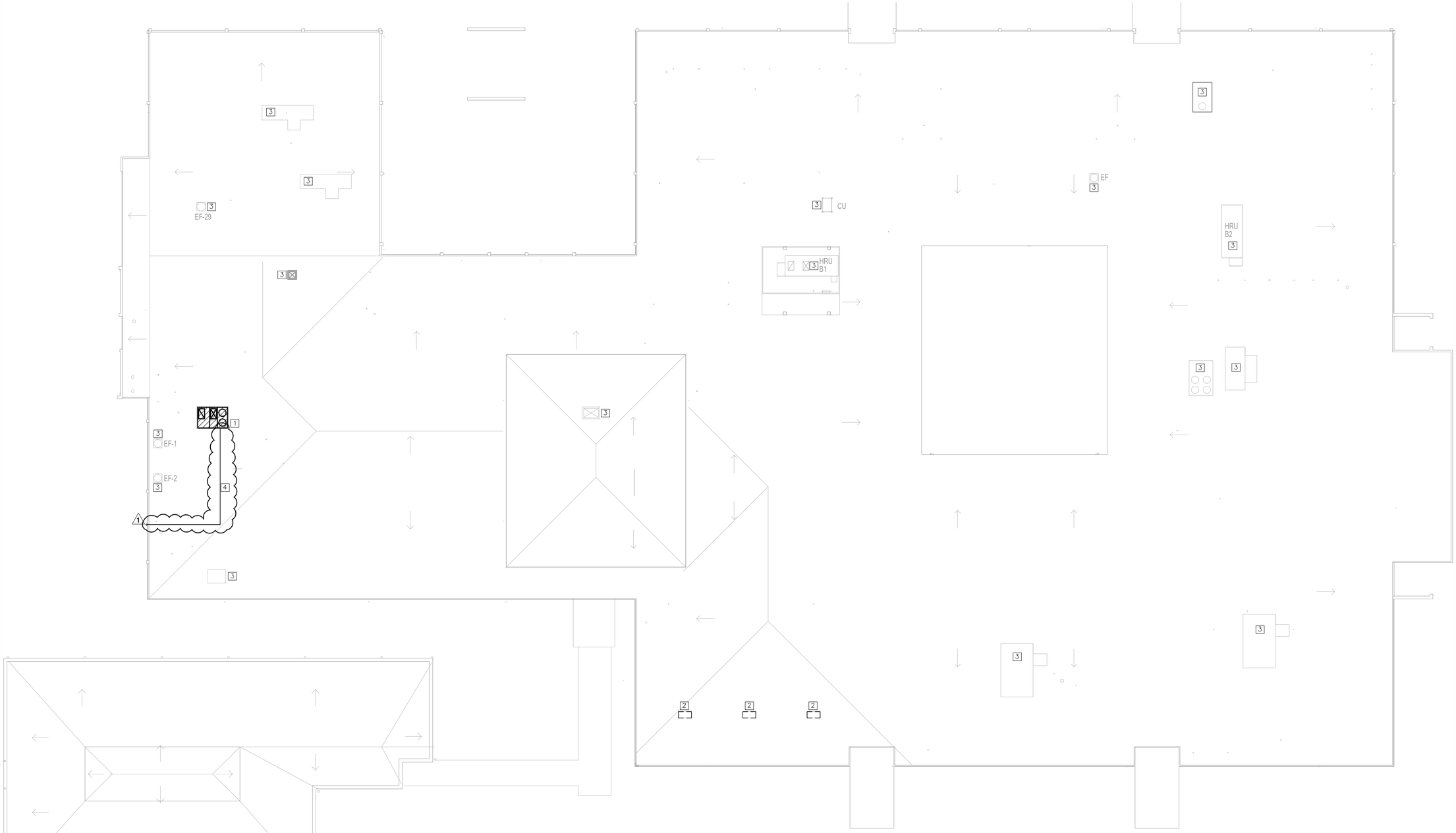
MECHANICAL PLAN SECOND FLOOR

SHEET

M2.7



MECHANICAL ROOF PLAN

SCALE: 1/16" = 1'-0"

SCOPE OF WORK:

REPLACE EXISTING KITCHEN RTU-KIT WITH NEW PACKAGED DX RTU WITH GAS HEAT. REUSE EXISTING ROOF OPENINGS AND PROVIDE NEW ROOF CURB. CONNECT TO EXTENDED BACNET/TRIDIUM JACE SYSTEM.

KEYED MECHANICAL NOTES:

1. PROVIDE AND INSTALL NEW KITCHEN RTU-KIT IN SAME LOCATION AS PREVIOUS KITCHEN RTU-KIT. PROVIDE NEW ROOF CURB AND ADJUST EXISTING ROOF OPENINGS AS REQUIRED. PROVIDE NEW SUPPLY AND RETURN DUCTWORK AND ANY REQUIRED TRANSITIONS FROM NEW KITCHEN RTU-KIT TO CONNECT TO EXISTING SUPPLY AND RETURN DUCTWORK IN KITCHEN CEILING PLENUM BELOW. CONNECT NEW KITCHEN RTU-KIT TO EXTENDED BACNET/TRIDIUM JACE SYSTEM TO BE PROVIDED UNDER THIS SCOPE OF WORK.
2. EXISTING ROOF SUPPORT CURB FROM MINI-SPLIT CONDENSING UNIT ON ROOF TO REMAIN AFTER DEMOLITION OF CONDENSING UNITS. SEAL ANY OPEN ROOF PENETRATIONS AIR AND WATER-TIGHT.
3. EXISTING EQUIPMENT TO REMAIN IN SERVICE.
4. GAS TO NEW RTU-KIT. REFER TO M2.3 FOR ADDITIONAL INFORMATION.

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
10. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.

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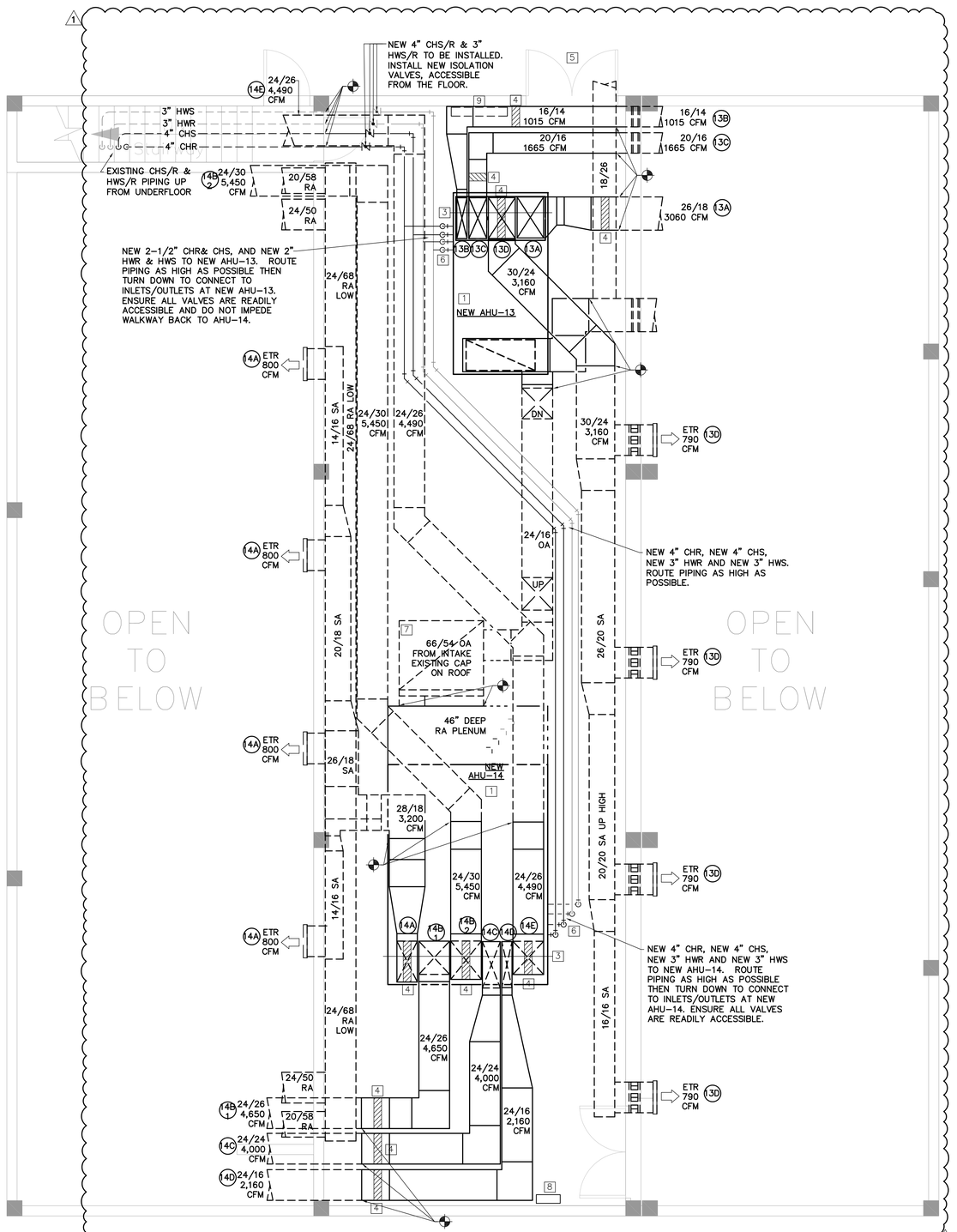
MECHANICAL ROOF PLAN

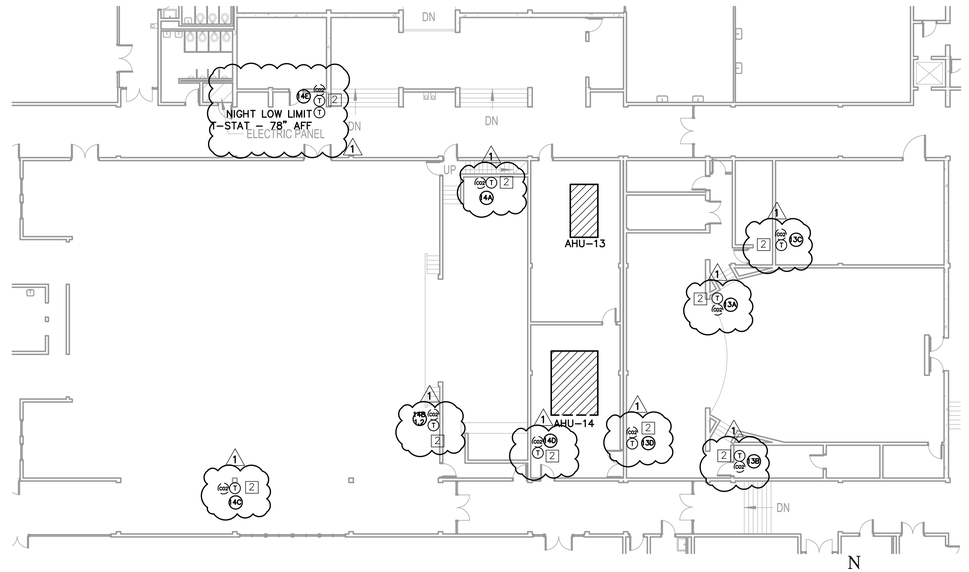
SHEET

M2.8



MECHANICAL PLAN - PENTHOUSE

SCALE: 1/4" = 1'-0"



A HU-13&14 NEW DDC THERMOSTAT LOCATIONS

SCALE: 1/16" = 1'-0"

NEW HVAC LEGEND:

NEW WORK TO BE ADDED IN THIS SCOPE OF WORK. (WORK SHOWN IN SOLID LINES).

EXISTING WORK TO REMAIN. (WORK SHOWN IN DASHED LINES).

KEYED MECHANICAL NOTES:

1. CONTRACTOR TO PROVIDE AND INSTALL NEW 4-PIPE AIR HANDLING UNIT AFTER DEMOLITION OF EXISTING AHU. RECONNECT EXISTING SUPPLY ZONE DUCTWORK, RETURN AND OUTSIDE AIR DUCTWORK, AND HOT AND CHILLED WATER AND CONDENSATE DRAIN LINES. PROVIDE NEW BELIMO VALVES AND ACTUATORS AS REQUIRED FOR CONNECTIONS TO THE NEW AIR HANDLING UNIT FROM EXISTING LINES. IT IS THE ENGINEER'S INTENT TO MAINTAIN AS MUCH OF THE EXISTING ZONE DUCTWORK TO CLASSROOMS AS POSSIBLE AND ONLY MODIFY DUCTWORK IN THE MECHANICAL ROOM, IF POSSIBLE. PROVIDE NEW HOUSEKEEPING PAD UNDER NEW AHU. MIN. 6" TALL.
2. PROVIDE NEW DDC ZONE THERMOSTAT AND CO2 SENSOR AND ALL ASSOCIATED CONTROL WIRING TO NEW ZONE DAMPER AT CORRESPONDING ZONE AT NEW AHU-6.
3. PROVIDE NEW DUCT SMOKE DETECTOR IN SUPPLY AIR DISCHARGE OFF OF NEW AHU PRIOR TO ZONE DUCTWORK. UPON ACTIVATION, SMOKE DETECTOR SHALL SHUT-DOWN UNIT AND GIVE GENERAL AUDIBLE/VISIBLE ALARM AND REPORT TO SILENT KNIGHT FIRE ALARM PANEL.
4. NEW DDC ACTUATORS/AIR BALANCING VALVE TO BE CONTROLLED BY NEW THERMOSTAT IN CORRESPONDING ZONE. INSTALL IN AN EASILY ACCESSIBLE SPACE.
5. NEW DOUBLE DOORS TO BE INSTALLED BY CONTRACTOR. EXISTING AHU-13 AND AHU-14 SHALL BE DISASSEMBLED AND REMOVED THROUGH THESE DOORS. NEW AHU-13 AND AHU-14 SHALL BE BROUGHT IN THROUGH THESE DOORS AND ASSEMBLED IN PLACE DUE TO LIMITED CLEARANCES IN EXISTING PENTHOUSE.
6. EXTEND NEW CHILLED WATER AND HOT WATER (SIZES INDICATED) TO NEW COIL CONNECTIONS AT NEW AHU. TRANSITION AS REQUIRED TO WATER INLET SIZES. PROVIDE ALL REQUIRED VALVES WITH BELIMO ACTUATORS AS SHOWN ON THE DETAILS SHEETS. PROVIDE WATER BALANCE TO GPMS INDICATED IN AHU EQUIPMENT SCHEDULE.
7. EXISTING OUTSIDE AIR INTAKE HOOD ON ROOF AND ASSOCIATED OUTSIDE AIR DUCTWORK TO REMAIN.
8. EXISTING CONTROL PANEL LOCATION.
9. EXISTING ELECTRICAL GEAR (DISCONNECTS, ETC...) TO REMAIN IN SERVICE.

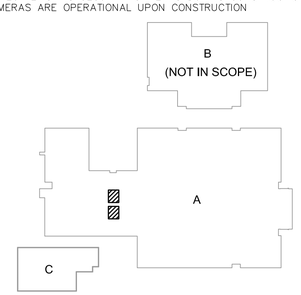
SCOPE OF WORK - PHASE 5:

REPLACE EXISTING AHU-13 AND AHU-14. INSTALL NEW UNITS IN SAME LOCATION AS CURRENTLY EXISTING. NEW UNITS SHALL BE MULTIZONE, 4-PIPE UNIT WITH SAME NUMBER OF ZONES AS CURRENTLY EXISTING. NEW DISCHARGE DUCTWORK SHALL CONNECT TO EXISTING ZONE DUCTWORK IN MECHANICAL ROOM. EXISTING HOUSEKEEPING PAD SHALL BE ENLARGED TO ACCOMMODATE THE NEW AHU FOOT PRINT. ALL NEW CHILLED WATER AND HOT WATER SUPPLY AND RETURN PIPING SHALL BE REPLACED AS IT ENTERS THE PENTHOUSE. INSTALL NEW ISOLATION VALVES PER PIPE SIZE LISTED AND PROVIDE NEW PIPING TO NEW AHU-13 AND AHU-14. EXISTING ZONE DUCTWORK MAY NEED TO BE TEMPORARILY REMOVED TO INSTALL NEW AHU'S. NEW AHU'S SHALL BE BROUGHT IN TO THE PENTHOUSE VIA A NEW WALL OPENING AT ROOF LEVEL WITH DOUBLE DOORS.

NEW AHU-13 SHALL BE 8900 CFM.
NEW AHU-14 SHALL BE 23,950 CFM.

GENERAL NOTES TO CONTRACTOR:

1. CONTRACTOR TO COORDINATE NEW EQUIPMENT LOCATIONS WITH EXISTING EQUIPMENT OR ANY OTHER EXISTING ELEMENTS.
2. ALL ROOFTOP EQUIPMENT LOCATIONS TO MAINTAIN A MINIMUM OF 10'-0" FROM ROOF EDGE.
3. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS IN FIELD.
4. MAINTAIN A MINIMUM OF 10'-0" BETWEEN EXHAUST VENTS AND OUTSIDE AIR INTAKES.
5. COORDINATE ALL DIFFUSERS WITH LIGHT FIXTURES, OCCUPANCY SENSORS, FIRE ALARM DEVICES, ETC...INSTALLED ON/IN CEILING TILES.
6. ALL NEW EQUIPMENT TO BE INSTALLED ACCORDING TO MANUFACTURER'S GUIDELINES. MAINTAIN MINIMUM CLEARANCE FOR SERVICE & ACCESSIBILITY.
7. EXISTING MECHANICAL INDICATED IS TAKEN FROM FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT EXISTING OR UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
8. OUTSIDE AIR QUANTITIES FOR NEW EQUIPMENT IS TO BE PROVIDED PER THE OUTSIDE AIR CALCULATIONS SHOWN ON M0.1 AND AS INDICATED IN EQUIPMENT SCHEDULES. T&B CONTRACTOR TO PROVIDE T&B REPORT FOR ENGINEER'S REVIEW PRIOR TO SUBSTANTIAL COMPLETION.
9. SMOKE DETECTORS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
10. CONTRACTOR SHALL PROTECT EXISTING SECURITY CAMERAS DURING CONSTRUCTION AND SHALL CONFIRM CAMERAS ARE OPERATIONAL UPON CONSTRUCTION COMPLETION.



HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd, Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

hcg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
07/31/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

Date	09/04/2020
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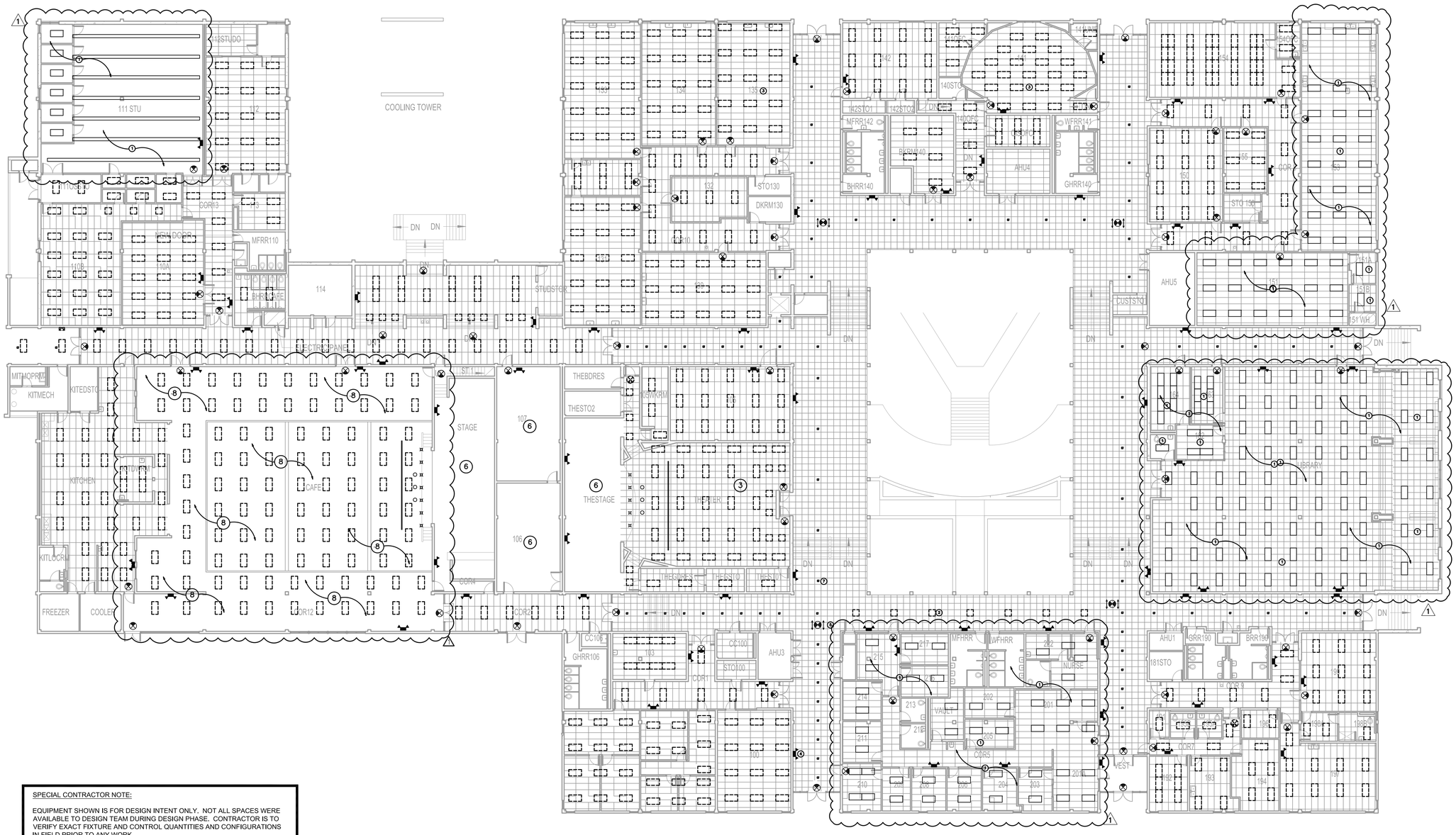
TITLE

MECHANICAL PLAN PENTHOUSE - PHASE 5

SHEET

M2.9 PHASE 5



SPECIAL CONTRACTOR NOTE:

EQUIPMENT SHOWN IS FOR DESIGN INTENT ONLY. NOT ALL SPACES WERE AVAILABLE TO DESIGN TEAM DURING DESIGN PHASE. CONTRACTOR IS TO VERIFY EXACT FIXTURE AND CONTROL QUANTITIES AND CONFIGURATIONS IN FIELD PRIOR TO ANY WORK.

LIGHTING CONTROL NOTE:

EXISTING LIGHTING CONTROLS TO REMAIN IN SAME LOCATION AND BE MODIFIED AS NECESSARY TO ACCOMMODATE NEW LED LIGHT FIXTURES. REPLACE ONE TOGGLE SWITCH IN EACH CLASSROOM WITH NEW DIMMING SWITCH. CEILING MOUNT OCCUPANCY SENSORS TO REMAIN AND BE CONNECTED TO NEW FIXTURES. RE-CONFIGURE WIRING AS NECESSARY.

LIGHTING DEMO PLAN -FIRST FLOOR

SCALE: 1/16" = 1'-0"

N

LIGHTING DEMO PLAN KEYED NOTES

1. EXISTING LIGHT FIXTURES AND CONTROLS IN THIS ROOM TO REMAIN AS IS. VERIFY THAT ALL FIXTURES REMAIN IN GOOD WORKING ORDER.
2. EXISTING 2X2 LIGHT FIXTURES TO BE REPLACED WITH NEW 2X2 LED FIXTURES. PROVIDE NEW CEILING TILES AS NECESSARY. TYPICAL FOR ALL 2X2 FIXTURES.
3. FOR EACH CLASSROOM, THEATER, OFFICES AND SPECIAL PURPOSE ROOMS, ALL EXISTING 2X4 FIXTURES TO BE REPLACED WITH NEW 2X4 LED FIXTURES. ALL CEILING TILES TO BE REPLACED AND LIGHTING CONTROLS TO BE MODIFIED. TYPICAL FOR ALL 2X4 FIXTURES.
4. VERIFY THAT ALL EMERGENCY FIXTURES ARE IN GOOD WORKING ORDER. REPLACE ANY THAT ARE NOT OPERATING PROPERLY. TYPICAL FOR ALL EMERGENCY FIXTURES IN SCHOOL.
5. REPLACE ALL EXIT SIGNS WITH NEW BUILDING STANDARD EXIT. TYPICAL FOR EXITS IN SCHOOL.
6. EXISTING THEATRICAL AND STAGE LIGHTING TO REMAIN AS IS. CONTROLS ARE TO REMAIN AS IS.
7. EXISTING 1X1 FIXTURES TO BE REPLACED WITH NEW 2X2 LED FIXTURES. PROVIDE NEW CEILING TILES AS NECESSARY. TYPICAL FOR ALL 1X1 FIXTURES.
8. PHASE 3: PROVIDE SEPARATE PRICING TO REPLACE ALL EXISTING LIGHTING IN THE CAFETERIA AND AT THE STAGE (HATCHED AREA INDICATED FOR CLARITY). DO NOT INCLUDE REPLACEMENT OF THE CAFETERIA AND STAGE LIGHTING IN PHASE 1 PRICING.

HADDON+COWAN ARCHITECTS
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6800 Bill Hughes Rd. Austin, TX

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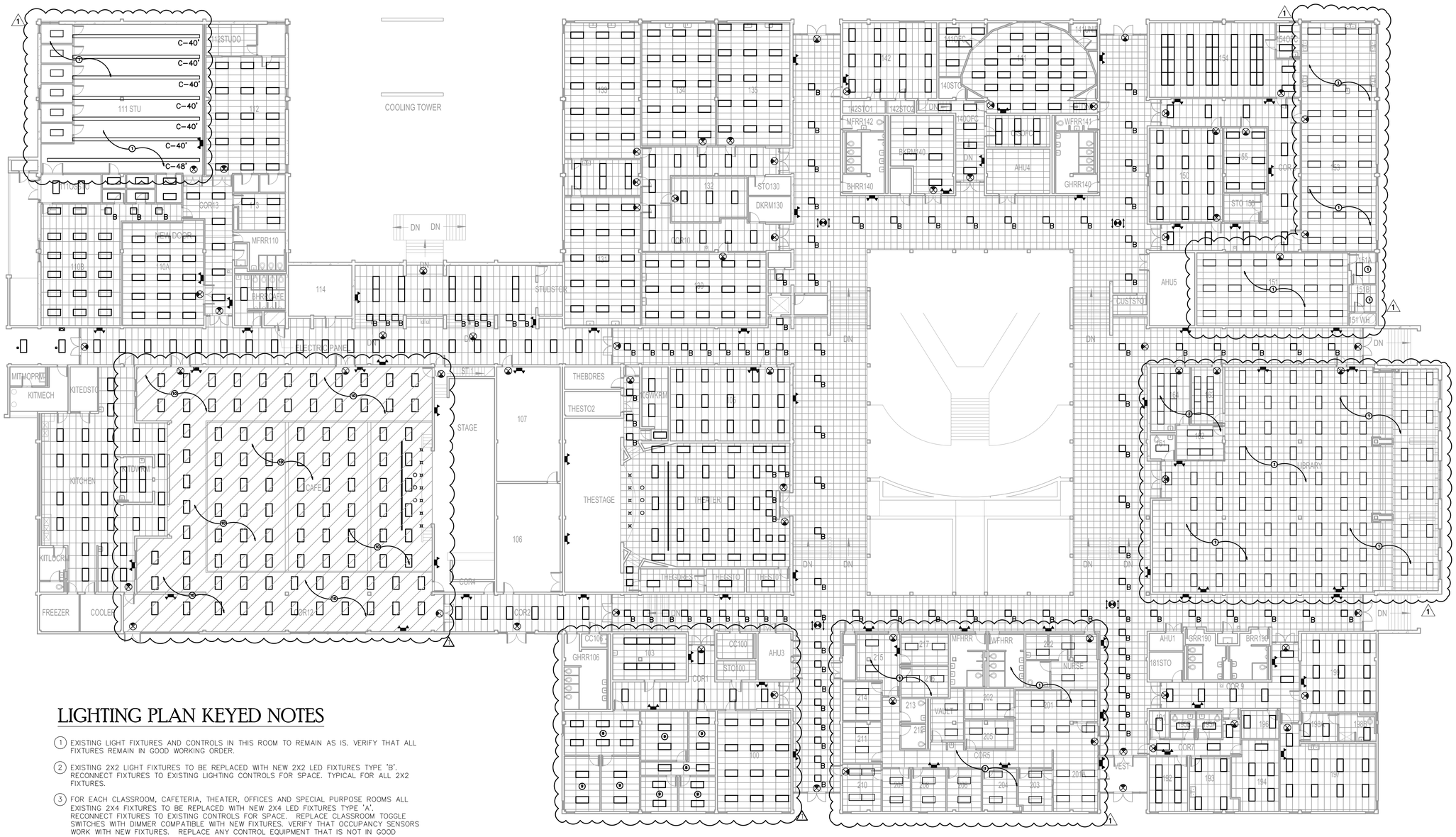
LIGHTING DEMO PLAN FIRST FLOOR PHASE 1 & PHASE 3

SHEET

E1.1



LIGHTING PLAN KEYED NOTES

1. EXISTING LIGHT FIXTURES AND CONTROLS IN THIS ROOM TO REMAIN AS IS. VERIFY THAT ALL FIXTURES REMAIN IN GOOD WORKING ORDER.
2. EXISTING 2X2 LIGHT FIXTURES TO BE REPLACED WITH NEW 2X2 LED FIXTURES TYPE 'B'. RECONNECT FIXTURES TO EXISTING LIGHTING CONTROLS FOR SPACE. TYPICAL FOR ALL 2X2 FIXTURES.
3. FOR EACH CLASSROOM, CAFETERIA, THEATER, OFFICES AND SPECIAL PURPOSE ROOMS ALL EXISTING 2X4 FIXTURES TO BE REPLACED WITH NEW 2X4 LED FIXTURES TYPE 'A'. RECONNECT FIXTURES TO EXISTING CONTROLS FOR SPACE. REPLACE CLASSROOM TOGGLE SWITCHES WITH DIMMER COMPATIBLE WITH NEW FIXTURES. VERIFY THAT OCCUPANCY SENSORS WORK WITH NEW FIXTURES. REPLACE ANY CONTROL EQUIPMENT THAT IS NOT IN GOOD WORKING ORDER. TYPICAL FOR ALL 2X4 FIXTURES.
4. VERIFY THAT ALL EMERGENCY FIXTURES ARE IN GOOD WORKING ORDER. REPLACE ANY THAT ARE NOT OPERATING PROPERLY. TYPICAL FOR ALL EMERGENCY FIXTURES IN SCHOOL.
5. REPLACE ALL EXIT SIGNS WITH NEW BUILDING STANDARD EXIT TYPE 'X'. TYPICAL FOR ALL EXITS IN SCHOOL. VERIFY THAT EACH CLASSROOM HAS AN EXIT SIGN. PROVIDE NEW EXITS AS NEEDED. CONNECT TO NEAREST UN-SWITCHED EMERGENCY CIRCUIT WITH 2#12 & 1#12 IN 1/2" CONDUIT.
6. EXISTING THEATRICAL AND STAGE LIGHTING TO REMAIN AS IS. CONTROLS ARE TO REMAIN AS IS.
7. EXISTING 1X1 FIXTURES TO BE REPLACED WITH NEW 2X2 LED FIXTURES TYPE 'B'. PROVIDE NEW CEILING TILES AS NECESSARY. RECONNECT FIXTURES TO EXISTING CONTROLS FOR SPACE. TYPICAL FOR ALL 1X1 FIXTURES.
8. EXISTING FLUORESCENT INDUSTRIAL FIXTURES TO BE REPLACED WITH NEW LED INDUSTRIAL FIXTURES TYPE 'C'. RECONNECT FIXTURES TO EXISTING LIGHTING CONTROLS.
9. COORDINATE WITH GENERAL CONTRACTOR FOR RELOCATION OF FIXTURES IN THIS ROOM. EXISTING TEMPORARY WALLS TO BE MADE PERMANENT AND NEW CEILING GRID TO BE PROVIDED.
10. PHASE 3: PROVIDE SEPARATE PRICING TO REPLACE ALL EXISTING LIGHTING IN THE CAFETERIA AND AT THE STAGE (HATCHED AREA INDICATED FOR CLARITY). DO NOT INCLUDE REPLACEMENT OF THE CAFETERIA AND STAGE LIGHTING IN PHASE 1 PRICING.

LIGHTING PLAN -FIRST FLOOR

SCALE: 1/16" = 1'-0"

N

ALL 2X4 FIXTURES ARE TYPE 'A'.
TYPICAL FOR ALL 2X4 FIXTURES

SEE E2.2 FOR LIGHT FIXTURE SCHEDULE

LIGHTING CONTROL NOTE:

EXISTING LIGHTING CONTROLS TO REMAIN IN SAME LOCATION AND BE MODIFIED AS NECESSARY TO ACCOMMODATE NEW LED LIGHT FIXTURES. REPLACE ONE TOGGLE SWITCH IN EACH CLASSROOM WITH NEW DIMMING SWITCH. CEILING MOUNT OCCUPANCY SENSORS TO REMAIN AND BE CONNECTED TO NEW FIXTURES. RE-CONFIGURE WIRING AS NECESSARY.

SPECIAL CONTRACTOR NOTE:

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AISD PROJECT No. 200029-BEDCHK

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PROFESSIONAL ENGINEER
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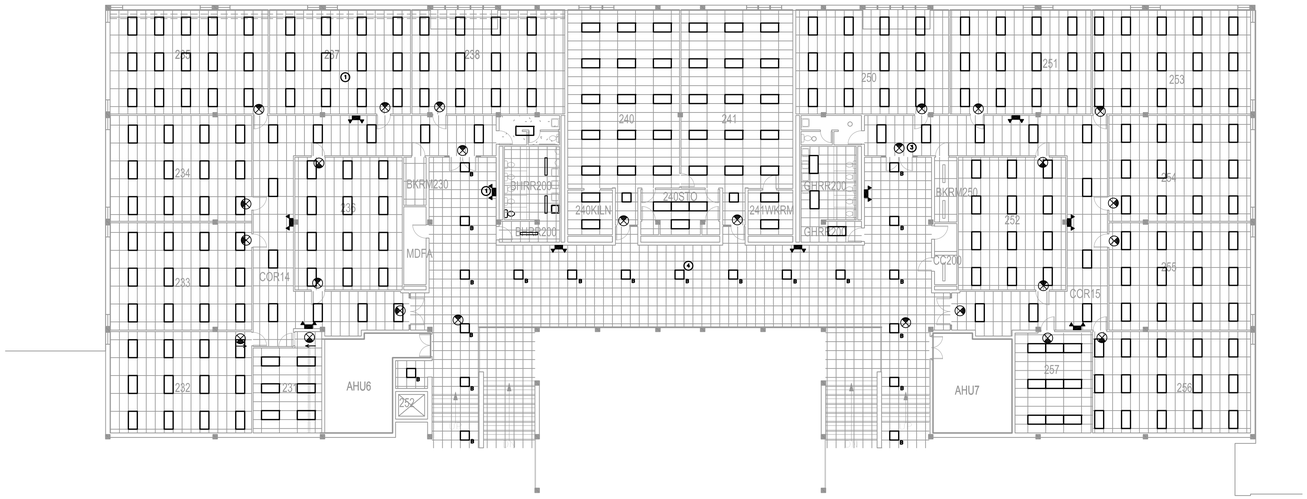
LIGHTING PLAN FIRST FLOOR - PHASE 1 & PHASE 3

SHEET

E2.1



LIGHTING PLAN -SECOND FLOOR

SCALE: 1/16" = 1'-0"

N

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	CATALOG NO.	MOUNTING	VOLT	LAMP	REMARKS	NOTES
A	COLUMBIA	CCL24-5035	RECESSED	UNV	44W LED	2X4 VOLUMETRIC FIXTURE WITH FROSTED CURVED LENS, 4900 LUMEN OUTPUT & 35K LEDS	1,2,3
B	COLUMBIA	CCL22-3335	RECESSED	UNV	29W LED	2X2 VOLUMETRIC FIXTURE WITH FROSTED CURVED LENS, 3223 LUMEN OUTPUT & 35K LEDS	1,2,3
C	COLUMBIA	MPS48-35ML-CWEU-CM48SCF3-KIT/CM48NF-KIT-MPSCRK-C	SUSPENDED	UNV	14W/FT LED	STRIP LED FIXTURE WITH CURVED ACRYLIC LENS, ACC SUSPENSION, FIXED OUTPUT BALLAST AND CONTINUOUS ROW MOUNTING KIT	1,2,3
EM	LITHONIA	ELM6L	SURFACE	UNV	LED	EMERGENCY FIXTURE WITH LED, 12V, 1100 LUMEN OUTPUT	1,2,4
X2	DUAL LITE	EVEURW	SURFACE	UNV	LED	THERMOPLASTIC EXIT WITH RED LED LETTERS AND BACK-UP BATTERY.	1,2,3

NOTE:
1. PROVIDE ALL NECESSARY MOUNTING HARDWARE AND ACCESSORIES AS REQUIRED.
2. ~~FIELD VERIFY MOUNTING REQUIREMENTS PRIOR TO ORDER.~~
3. ALTERNATE FIXTURES ONLY AS APPROVED BY AISD PROJECT DEVELOPMENT MANUAL.
4. REPLACEMENT FIXTURES TO MATCH EXISTING ONLY.

1

LIGHTING CONTROL NOTE:

EXISTING LIGHTING CONTROLS TO REMAIN IN SAME LOCATION AND BE MODIFIED AS NECESSARY TO ACCOMMODATE NEW LED LIGHT FIXTURES. REPLACE ONE TOGGLE SWITCH IN EACH CLASSROOM WITH NEW DIMMING SWITCH. CEILING MOUNT OCCUPANCY SENSORS TO REMAIN AND BE CONNECTED TO NEW FIXTURES. RE-CONFIGURE WIRING AS NECESSARY.

SPECIAL CONTRACTOR NOTE:

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ALL 2X4 FIXTURES ARE TYPE 'A'.
TYPICAL FOR ALL 2X4 FIXTURES

LIGHTING PLAN KEYED NOTES

1. FOR EACH CLASSROOM, OFFICES AND SPECIAL PURPOSE ROOMS ALL EXISTING 2X4 FIXTURES TO BE REPLACED WITH NEW 2X4 LED FIXTURES TYPE 'A'. RECONNECT FIXTURES TO EXISTING CONTROLS FOR SPACE. REPLACE CLASSROOM TOGGLE SWITCHES WITH DIMMER COMPATIBLE WITH NEW FIXTURES. VERIFY THAT OCCUPANCY SENSORS WORK WITH NEW FIXTURES. REPLACE ANY CONTROL EQUIPMENT THAT IS NOT IN GOOD WORKING ORDER. TYPICAL FOR ALL 2X4 FIXTURES.
2. VERIFY THAT ALL EMERGENCY FIXTURES ARE IN GOOD WORKING ORDER. REPLACE ANY THAT ARE NOT OPERATING PROPERLY WITH NEW TYPE 'EM'. TYPICAL FOR ALL EMERGENCY FIXTURES IN SCHOOL.
3. REPLACE ALL EXIT SIGNS WITH NEW BUILDING STANDARD EXIT TYPE 'X'. TYPICAL FOR ALL EXITS IN SCHOOL. VERIFY THAT EACH CLASSROOM HAS AN EXIT SIGN. PROVIDE NEW EXITS AS NEEDED. CONNECT TO NEAREST UN-SWITCHED EMERGENCY CIRCUIT WITH 2#13 & 1#12 IN 1/2" CONDUIT.
4. EXISTING 1X1 FIXTURES TO BE REPLACED WITH NEW 2X2 LED FIXTURES TYPE 'B'. RECONNECT FIXTURES TO EXISTING CONTROLS FOR SPACE. TYPICAL FOR ALL 1X1 FIXTURES.

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AISD PROJECT No. 200029-BEDCHK

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LIGHTING PLAN SECOND FLOOR - PHASE 1

SHEET

E2.2

RATED THRU WALL PIPE PENETRATION

NTS

SYSTEM NO. WL1001

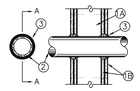
(Formerly System No. 147)

F Ratings– 1, 2, 3 and 4 Hr (See items 2 and 3)

T Ratings– 0,1, 2, 3, and 4 Hr (See item 3)

L Rating At Ambient– less than 1 CFM/sq ft

L Rating At 400 F– less than 1 CFM/sq ft



SECTION A–A

1. WALL ASSEMBLY– 1, 2, 3, OR 4 HR FIRE–RATED GYPSUM WALLBOARD/STUD WALL ASSEMBLY SHALL BE CONSTRUCTED OF THE MATERIALS AND IN THE MANNER DESCRIBED IN THE INDIVIDUAL U300 OR U400 SERIES WALL OR PARTITION DESIGNS IN THE UL FIRE RESISTANCE DIRECTORY AND SHALL INCLUDE THE FOLLOWING CONSTRUCTION FEATURES:

A. STUDS– WALL FRAMING MAY CONSIST OF EITHER WOOD STUDS (MAX 2 H FIRE RATED ASSEMBLIES) OR STEEL CHANNEL STUDS. WOOD STUDS TO CONSIST OF NOM 2 BY 4 IN. LUMBER SPACED 16 IN. OC WITH NOM 2 BY 4 IN. LUMBER END PLATES AND CROSS BRACES. STEL STUDS TO BE MIN 3–5/8 IN. WIDE BY 1–3/8 IN. DEEP CHANNELS SPACED MAX 24 IN. OC.

B. WALLBOARD, GYPSUM*– NOM 1/2 OR 5/8 IN. THICK 4 FT. WDE WITH SQUARE OR TAPERED EDGES. THE GYPSUM WALLBOARD TYPE, THICKNESS, NUMBER OF LAYERS, FASTENER TYPE AND SHEET ORIENTATION SHALL BE AS SPECIFIED IN THE INDIVIDUAL U300 OR U400 SERIES DESIGN IN THE UL FIRE RESISTANCE DIRECTORY. MAX DIAM. OF OPENING IS 13–1/2IN.

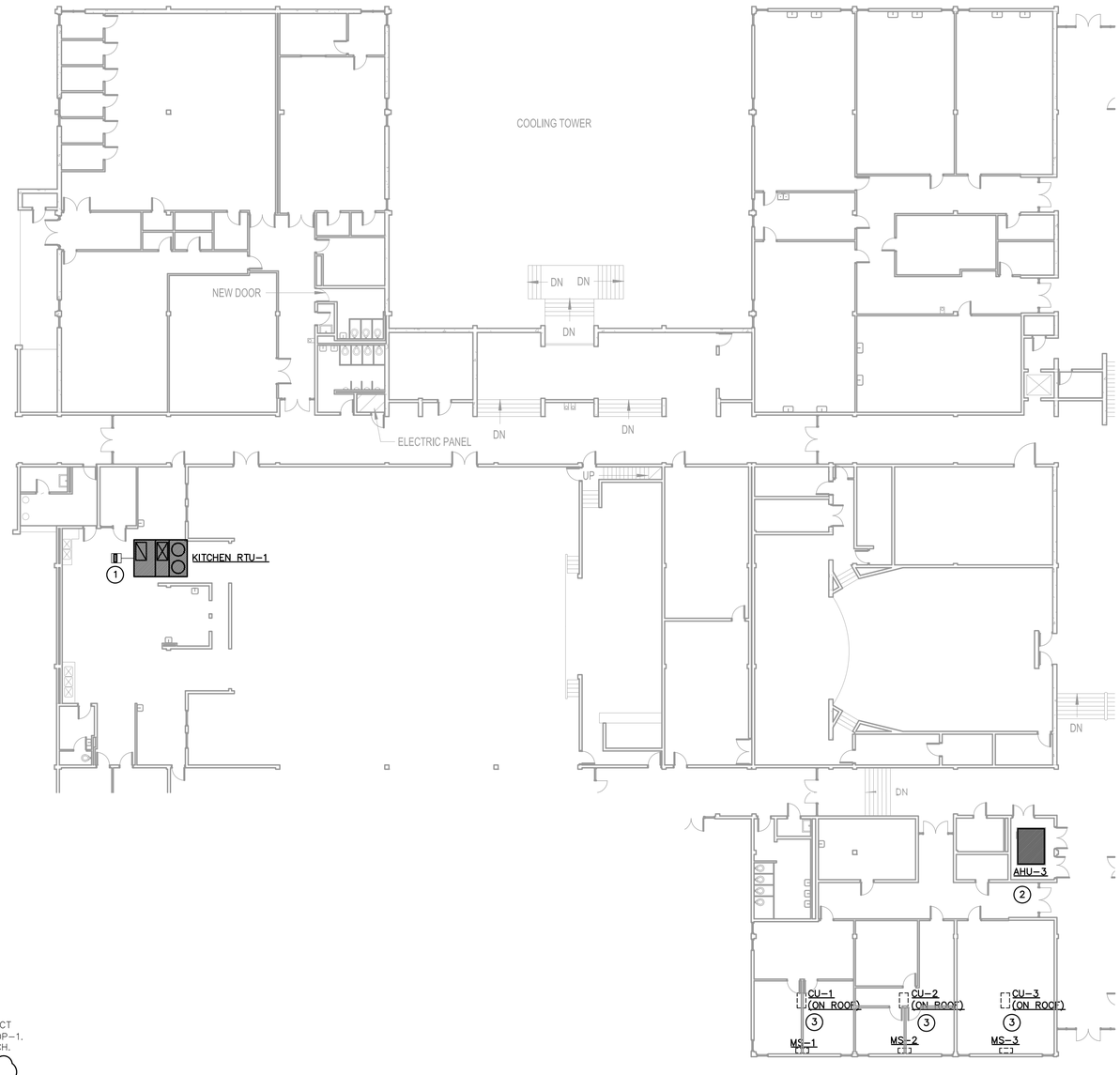
2. PIPE OR CONDUIT– NOM 12 IN. DIAM (OR SMALLER) SCHEDULE 10 (OR HEAVIER) STEEL PIPE, NOM 12 IN. DIAM (OR SMALLER) SERVICE WEIGHT (OR HEAVIER) CAST IRON SOIL PIPE, NOM 12 IN. DIAM. (OR SMALLER) CLASS 50 (OR HEAVIER) DUCTILE IRON PRESSURE PIPE, NOM 6 IN. DIAM. (OR SMALLER) STEEL CONDUIT, NOM 4 IN. DIAM. (OR SMALLER) STEEL ELECTRICAL METALLIC TUBING, NOM 6 IN. DIAM (OR SMALLER) TYPE L OR (OR HEAVIER) COPPER TUBING OR NOM 1 IN. DIAM (OR SMALLER) FLEXIBLE STEEL CONDUIT. WHEN COPPER PIPE IS USED, MAX F RATING OF FIRESTOP SYSTEM (ITEM 3) IS 2 H. STEEL PIPES OR CONDUITS LARGER THAN NOM 4 IN. DIAM MAY ONLY BE USED IN WALLS CONSTRUCTED USING STEEL CHANNEL STUDS. A MAX OF ONE PIPE OR CONDUIT IS PERMITTED IN THE FIRESTOP SYSTEM. PIPE OR CONDUIT TO BE INSTALLED NEAR CENTER OF STUD CAVITY WIDTH AND TO BE RIGIDLY SUPPORTED ON BOTH SIDES OF WALL ASSEMBLY.

3. FILL, VOID OR CAVITY MATERIAL*–CAULK– CAULK FILL MATERIAL INSTALLED TO COMPLETELY FILL ANNULAR SPACE BETWEEN PIPE OR CONDUIT AND GYPSUM WALLBOARD AND WITH A MIN 1/4 IN. DIAM BEAD OF CAULK APPLIED TO PERIMETER OF PIPE OR CONDUIT AT ITS EGRESS FROM THE WALL. CAULK INSTALLED SYMMETRICALLY ON BOTH SIDES OF WALL ASSEMBLY. THE HOURLY F RATING OF THE FIRESTOP SYSTEM IS DEPENDENT UPON THE HOURLY FIRE RATING OF THE WALL ASSEMBLY IN WHICH IT IS INSTALLED, AS SHOWN IN THE FOLLOWING TABLE. THE HOURLY T RATING OF THE FIRESTOP SYSTEM IS DEPENDENT UPON THE TYPE OR SIZE OF THE PIPE OR CONDUIT AND THE HOURLY FIRE RATING OF THE WALL ASSEMBLY IN WHICH IT IS INSTALLED, AS TABULATED BELOW:

MAX PIPE OR CONDUIT DIAM, IN	ANNULAR SPACE IN	F RATING HR	T RATING HR
1	0 to 3/16	1 OR 2	0+, 1 OR 2
1	1/4 to 1/2	3 OR 4	3 OR 4
4	0 to 1/4	1 OR 2	0
4	0 to 1–1/2#	1 OR 2	0
6	1/4 to 1/2	3 OR 4	0
12	3/16 to 3/8	1 OR 2	0

+ WHEN COPPER PIPE IS USED, T RATING IS 0 H.
# 0 TO 1 1/2 IN. ANNULAR SPACE APPLIES ONLY WHEN TYPE CP–25 WB+ CAULK IS USED AND ONLY WHEN THE MIN. THICKNESS OF THE GYPSUM WALLBOARD IS 5/8 IN. FOR 1 HR FIRE RATED WALLS AND 1–1/4 IN. FOR 2 HR RATED WALLS.

* BEARING THE UL CLASSIFICATION MARKING.



POWER PLAN KEYED NOTES

1. NEW RTU–1 IN EXISTING LOCATION. PROVIDE NEW 60A/3P/NF/N3R/HD/600V DISCONNECT IN EXISTING LOCATION. PROVIDE NEW 3#3 & 1#8 GND. IN 1 1/4" CONDUIT BACK TO MDP–1. RECONNECT TO EXISTING SWITCH IN MDP–1. PROVIDE NEW 50A FUSES IN EXISTING SWITCH.
2. NEW AHU–3 WITH NEW VFD/DISCONNECT IN EXISTING LOCATION AND RECONNECT TO EXISTING PANEL WITH 3#10 & 1#10 GND. IN 3/4" CONDUIT. VERIFY THAT EXISTING ELECTRICAL EQUIPMENT IS IN GOOD WORKING ORDER. REPLACE IF NECESSARY ANY EQUIPMENT DAMAGED DURING DEMOLITION OR IS NOT IN GOOD WORKING ORDER. VERIFY EXACT ELECTRICAL REQUIREMENTS WITH ACTUAL MECHANICAL EQUIPMENT PROVIDED PRIOR TO ANY WORK.
3. EXISTING CU–1, CU–2, CU–3, MS–1, MS–2 & MS–3 TO BE REMOVED. REMOVE ALL ASSOCIATED DISCONNECTS, RECEPTACLES, WIRE AND CONDUIT BACK TO SOURCE. CIRCUIT BREAKERS TO REMAIN IN PANEL AND BECOME SPARES.

POWER PLAN –FIRST FLOOR

SCALE: 1/16" = 1'-0"

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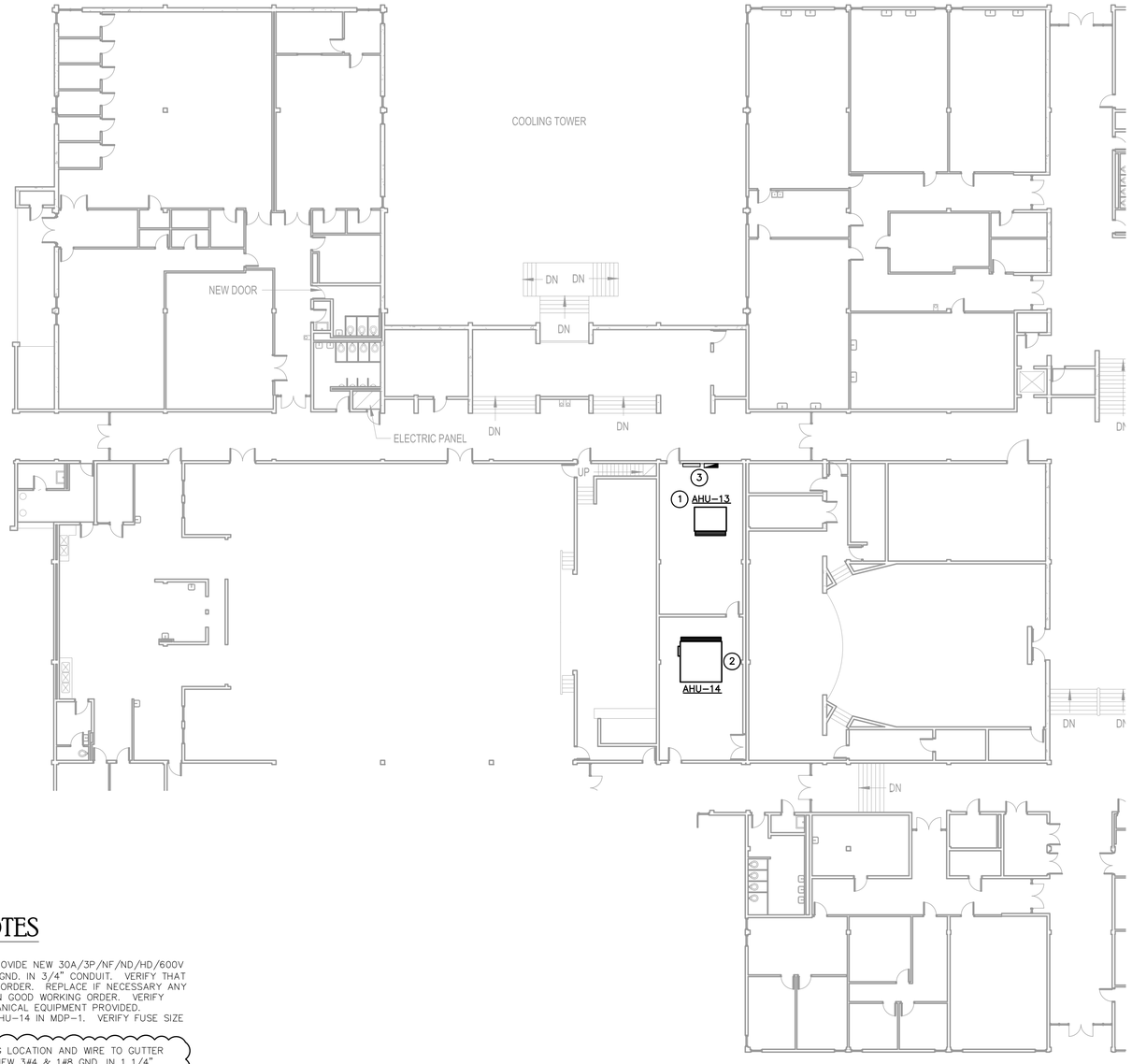
POWER PLAN FIRST FLOOR

SHEET

E3.1



POWER PLAN KEYED NOTES

1. NEW AHU-13 WITH NEW VFD IN EXISTING LOCATION. PROVIDE NEW 30A/3P/NF/ND/HD/600V DISCONNECT AND WIRE TO GUTTER WITH 3#10 & 1#10 GND. IN 3/4" CONDUIT. VERIFY THAT EXISTING ELECTRICAL EQUIPMENT IS IN GOOD WORKING ORDER. REPLACE IF NECESSARY ANY EQUIPMENT DAMAGED DURING DEMOLITION OR IS NOT IN GOOD WORKING ORDER. VERIFY EXACT ELECTRICAL REQUIREMENTS WITH ACTUAL MECHANICAL EQUIPMENT PROVIDED. RECONNECT TO EXISTING 100A SWITCH SHARED WITH AHU-14 IN MDP-1. VERIFY FUSE SIZE AND PROVIDE NEW 70A FUSES AS NECESSARY.
2. NEW AHU-14 WITH NEW VFD'S/DISCONNECT IN EXISTING LOCATION AND WIRE TO GUTTER WITH 3#10 & 1#10 GND. IN 3/4" CONDUIT. PROVIDE NEW 3#4 & 1#8 GND. IN 1 1/4" CONDUIT FROM GUTTER BACK TO MDP-1 AND SWITCH SHARED WITH AHU-13. VERIFY EXISTING FEEDERS TO BOTH AHU-13 & AHU-14. VERIFY EXACT ELECTRICAL REQUIREMENTS WITH ACTUAL MECHANICAL EQUIPMENT PROVIDED.
3. EXISTING ELECTRICAL EQUIPMENT LOCATED IN MECHANICAL PENTHOUSE. VERIFY THAT EQUIPMENT REMAINS IN GOOD WORKING ORDER THROUGHOUT CONSTRUCTION. RELOCATE OR REPLACE ANY EQUIPMENT AS NECESSARY DUE TO WALL OR AHU DEMOLITION.

POWER PLAN -FIRST FLOOR

SCALE: 1/16" = 1'-0"

N

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
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P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
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DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX
78745
AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

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POWER PLAN FIRST FLOOR - PHASE 5

SHEET

E3.1.2

GENERAL ELECTRICAL NOTES

1. CONTRACTOR SHALL VERIFY EXISTING JOB SITE CONDITIONS DURING THE BIDDING PERIOD TO OBTAIN THE SCOPE OF ELECTRICAL WORK INVOLVED AS A RESULT OF ARCHITECTURAL MODIFICATIONS TO THE EXISTING STRUCTURE. THE SCOPE OF WORK SHALL INCLUDE MATERIALS AND OUTLETS CONSISTING OF FIXTURES, DEVICES, EQUIPMENT OR APPARATUS WHICH MUST BE ROUTED, RELOCATED, OR REMOVED EITHER TEMPORARILY OR PERMANENTLY, OR WHICH MUST BE PROVIDED SO THAT THE INDICATED REMODELING MAY BE ACCOMPLISHED.

2. REFER TO ARCHITECTURAL/INTERIOR DRAWINGS FOR EXACT LOCATIONS OF LIGHTING FIXTURES AND OUTLETS. ALL WALL POWER AND TELEPHONE OUTLETS SHALL BE MOUNTED AT 18" A.F.F. TO CENTER AND ALL LIGHT AND DIMMER SWITCHES SHALL BE MOUNTED AT 48" A.F.F TO CENTER. EXCEPT WHERE SPECIFICALLY INDICATED OTHERWISE ON THE PLANS. DIMENSIONS NOTED ON ARCHITECTURAL/INTERIOR DESIGNER'S DRAWINGS SHALL PREVAIL.

3. CONTRACTOR MAY COMBINE WIRES IN ONE CONDUIT FOR CONVENIENCE OF INSTALLATION, PROVIDED ALL THE REQUIREMENTS OF THE N.E.C. ARE OBSERVED.

4. ALL ELECTRICAL EQUIPMENT IS SHOWN DIAGRAMMATICALLY. EXACT LOCATIONS ARE TO BE DETERMINED IN THE FIELD AVOIDING INTERFERENCES.

5. THE INSTALLATION SHALL COMPLY WITH SPECIFICATIONS AND ALL REQUIREMENTS OF THE LATEST EDITION OF THE N.E.C., OSHA, STATE AND LOCAL CODES.

- INTERNATIONAL BUILDING CODE (2015 EDITION)
- INTERNATIONAL ENERGY CONSERVATION CODE (2015 EDITION)
- INTERNATIONAL FIRE CODE (2015 EDITION)
- NFPA 70 NATIONAL ELECTRIC CODE (NEC 2017 EDITION)
- NFPA 72 NATIONAL FIRE CODE (2016 EDITION)
- NFPA 101 LIFE SAFETY CODE (2018 EDITION)

5. ALL WIRE SHALL BE COPPER. ALL WIRE, CONDUIT AND BREAKERS SHALL BE #12 COPPER WIRE (THHN OR THWN), 1/2" CONDUIT AND 20 AMP SINGLE POLE BREAKERS UNLESS OTHERWISE NOTED. (TYPICAL)

7. WHEN BRANCH CIRCUIT LENGTH EXCEEDS 75 FEET FROM PANEL, WIRING SHALL BE INCREASED TO #10 AWG AND #10 AWG GROUND. WHEN BRANCH CIRCUIT LENGTH EXCEEDS 150 FEET FROM PANEL, BRANCH WIRING SHALL BE INCREASED TO #8 AWG WITH #8 AWG GROUND.

8. PROVIDE GROUND CONDUCTOR IN ALL RACEWAYS.

9. NEW OUTLETS ON OPPOSITE SIDE OF WALL SHALL BE STAGGERED BY A MINIMUM OF ONE STUD FOR SOUND ATTENUATION.

10. CONTRACTOR SHALL UPDATE PANEL DIRECTORY AS PER WIRING IN FIELD.

11. CONTRACTOR SHALL USE EXISTING SPARE BREAKERS/BLANKS IN PANEL(S) AND CIRCUITS MADE AVAILABLE THROUGH DEMOLITION PRIOR TO ADDING NEW PANEL(S). VERIFY IN FIELD.

12. BREAKERS FOR ALL MULTIPLE CIRCUIT HOMERUNS WHICH SHARE A COMMON NEUTRAL SHALL BE CONNECTED WITH BREAKER TIES.

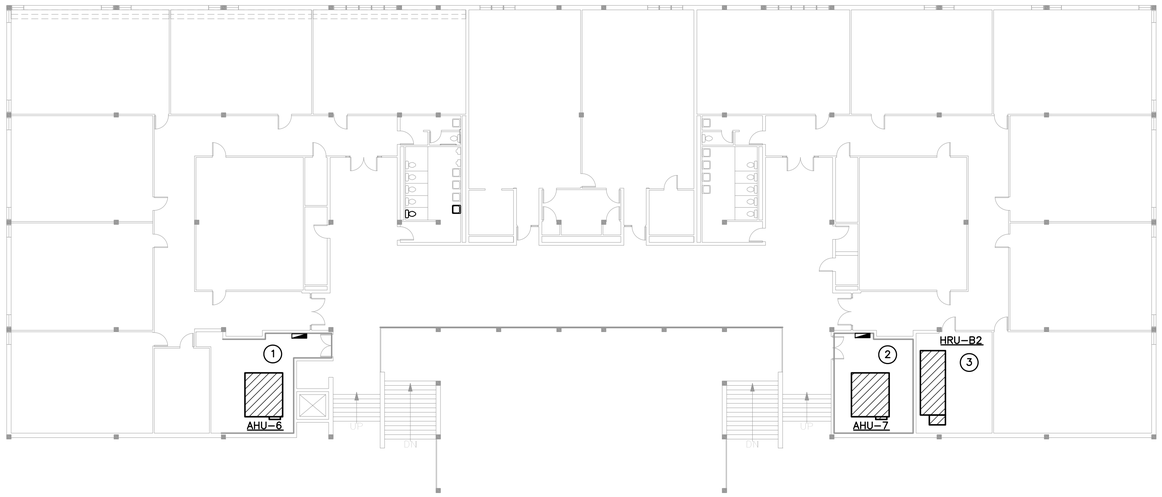
13. ALL CIRCUIT BREAKERS FOR MECHANICAL EQUIPMENT SHALL BE HACR RATED.

14. ALL NEW BREAKERS ADDED TO EXISTING PANELS SHALL HAVE SAME A.I.C. RATING AS EXISTING BREAKERS UNLESS NOTED OTHERWISE.

15. VOLTAGE DROP HAS BEEN CALCULATED IN COMPLIANCE WITH NEC 210.19(A)(1)FPN#4. VOLTAGE DROP IN FEEDER CONDUCTORS TO BE MAXIMUM OF 2% AT DESIGN LOAD. VOLTAGE DROP IN BRACH CIRCUITS TO BE MAXIMUM OF 3% AT DESIGN LOAD.

16. TO THE BEST OF THE ENGINEER'S KNOWLEDGE, THE PLANS AND SPECIFICATIONS COMPLY WITH THE APPLICABLE MINIMUM BUILDING CODES AND THE APPLICABLE FIRE SAFETY STANDARDS AS DETERMINED BY THE LOCAL AUTHORITY HAVING JURISDICTION.

17. ALL ELECTRICAL CONDUIT RUN IN SLAB IS TO BE RUN IN A 2" PVC PIPE. COORDINATE WITH OWNER FOR FINAL LOCATIONS.



ELECTRICAL PLAN -SECOND FLOOR

SCALE: 1/16" = 1'-0"

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ELECTRICAL SYMBOLS LEGEND

SYMBOLS	LEGEND	SYMBOLS	LEGEND
	LIGHTING FIXTURE	T	TRANSFORMER – AS NOTED
	WALLWASHER LIGHT FIXTURE		WALL COMMUNICATION OUTLET. PROVIDE MIN. 1" CONDUIT WITH PULL WIRES TO ABOVE CEILING.(TELE/DATA/CABLE TV)
	FLUORESCENT LIGHTING FIXTURE		FLOOR TELE/DATA BOX
	FLUORESCENT STRIP LIGHTING FIXTURE		FIREMANS PHONE JACK
	EXIT SIGN FIXTURE – ARROWS AS INDICATED		CARD READER
	FIXTURES ON EMERGENCY CIRCUIT OR FURNISHED W/ BATTERY PACK		PLUGMOLD
	REMOTE EMERGENCY LIGHT W/BATTERY PACK		MAGNETIC DOOR HOLDER (REF. HARDWARE SPEC'S)
	S.P.S.T. TOGGLE SWITCH		FIRE ALARM SMOKE DETECTOR – CEILING/WALL MOUNTED
	THREE-WAY TOGGLE SWITCH / FOUR-WAY TOGGLE SWITCH		FIRE ALARM HEAT DETECTOR
	SWITCH WITH PILOT LIGHT		FIRE ALARM SIGNAL LIGHT, MTD. 82"A.F.F.
	DIMMER SWITCH		FIRE ALARM SPRINKLER FLOW SWITCH
	DUPLEX RECEPTACLE OUTLET		FIRE ALARM SPRINKLER VALVE TAMPER SWITCH
	DUPLEX RECEPTACLE OUTLET – MTD. ABOVE COUNTER		FIRE ALARM SMOKE DETECTOR – DUCT MOUNTED
	QUADRAPLEX RECEPTACLE OUTLET		FIRE ALARM SPEAKER, CLG. MTD.
	SINGLE RECEPTACLE OUTLET MTD. AS NOTED	(OR S)	FIRE ALARM COMBINATION AUDIO/VISUAL DEVICE WALL MTD. 82"A.F.F. "F" INDICATES HORN, "S" INDICATES SPEAKER
	FLOOR OUTLET WITH RECEPTACLE		MANUAL STATION 48"A.F.F.
D	DEDICATED DUPLEX OUTLET		RELAY
	SPECIAL PURPOSE OUTLET – AS NOTED		"DO NOT USE ELEVATOR" WARNING LIGHT(F.B. F.A. CONTRACTOR)
	JUNCTION BOX – CEILING MOUNTED		MOTORIZED DAMPER
	JUNCTION BOX – WALL MOUNTED		SMOKE DAMPER
	FLOOR JUNCTION BOX	A	ABANDONED
	FURNITURE SYSTEM POWER POLE	AFF	ABOVE FINISHED FLOOR OR GRADE
	FURNITURE SYSTEM WALL POWER FEED	CLG	CEILING
	FURNITURE SYSTEM WALL TELE/DATA	E	EXISTING
	DISCONNECT SWITCH – 30A/3/NF U.O.N.	EDF	ELECTRIC DRINKING FOUNTAIN
	FUSED DISCONNECT SWITCH	GFI	GROUND FAULT INTERRUPTING
	ENCLOSED CIRCUIT BREAKER	IG	ISOLATED GROUND
	277/480 VOLT PANELBOARD	LTG	LIGHTING
	120/208 VOLT PANELBOARD	NF	NON-FUSED
	MOTOR	OC	ON CENTER
	CONDUIT CONCEALED IN WALL OR OVERHEAD	R	RELOCATED
	CONDUIT CONCEALED IN FLOOR OR UNDERGROUND	REC	RECEPTACLE
	CONDUIT RUN EXPOSED	SPR	SPARE
	CONDUIT WHIP UNDER RAISED FLOOR	UON	UNLESS OTHERWISE NOTED
	TICK MARKS INDICATE #12 CONDUCTORS OR AS NOTED	WP	INDICATES WEATHERPROOF DEVICE OR PLATE
	GROUND CONNECTION AS NOTED	FACP	FIRE ALARM CONTROL PANEL
	CONDUIT STUB-UP LOCATION	FARA	FIRE ALARM ANNUNCIATOR PANEL
	CONDUIT STUB-DOWN LOCATION	SLC	SIGNALING LINE CIRCUIT
	SPECIAL PURPOSE CONDUIT SEE PLANS FOR NOTES	NAC	NOTIFICATION APPLIANCE CIRCUIT
	MOTOR STARTER – MANUAL	(K)	FIRE ALARM KNOX BOX
	MOTOR STARTER – MAGNETIC		

NOTE: NOT ALL SYMBOLS ARE USED.

POWER PLAN KEYED NOTES

1. REPLACEMENT AHU-6 IN SAME LOCATION. PROVIDE NEW 60A/3P/NF/N1/HD/600V DISCONNECT. CONNECT TO NEW VFD SUPPLIED WITH UNIT. RECONNECT TO EXISTING PANELBOARD WITH 3#6 & 1#10 GND. IN 1" CONDUIT. REPLACE EXISTING CIRCUIT BREAKER WITH NEW 60A/3P CIRCUIT BREAKER AS NECESSARY. VERIFY THAT EXISTING ELECTRICAL EQUIPMENT IS IN GOOD WORKING ORDER. REPLACE ANY EQUIPMENT DAMAGED DURING DEMOLITION OR IS NOT IN GOOD WORKING ORDER.
2. REPLACEMENT AHU-7 IN SAME LOCATION. PROVIDE NEW 30A/3P/NF/N1/HD/600V WIRING TO NEW VFD(S)/DISCONNECT SUPPLIED BY CONTRACTOR. RECONNECT TO EXISTING PANEL WITH 3#8 & 1#10 GND IN 1" CONDUIT. VERIFY THAT ELECTRICAL EQUIPMENT IS IN GOOD WORKING ORDER. REPLACE ANY EQUIPMENT DAMAGED DURING DEMOLITION OR IS NOT IN GOOD WORKING ORDER.
3. EXISTING HRU-B2 LOCATED ON ROOF ABOVE AHU-7. REMOVE EXISTING CONDUIT AND WIRE BACK TO SWITCH IN MDP-1. PROVIDE NEW 3#1/0 & 1#6 GND. IN 2" CONDUIT FROM SOURCE TO UNIT. REPLACE ANY ELECTRICAL EQUIPMENT THAT HAS BEEN DAMAGED FROM MALFUNCTION OF UNIT. THIS INCLUDES BUT IS NOT LIMITED TO NEW FUSES, DISCONNECT, VFD, ETC. FIELD VERIFY EXACT ELECTRICAL REQUIREMENTS PRIOR TO ANY WORK. COORDINATE WITH AISD SCHOOL ELECTRICIAN PRIOR TO ANY WORK FOR EXACT MALFUNCTION ISSUES. UNIT IS TO BE RECONNECTED AND BE IN GOOD WORKING ORDER.

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

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Austin, TX 78750
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DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
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PROFESSIONAL ENGINEER
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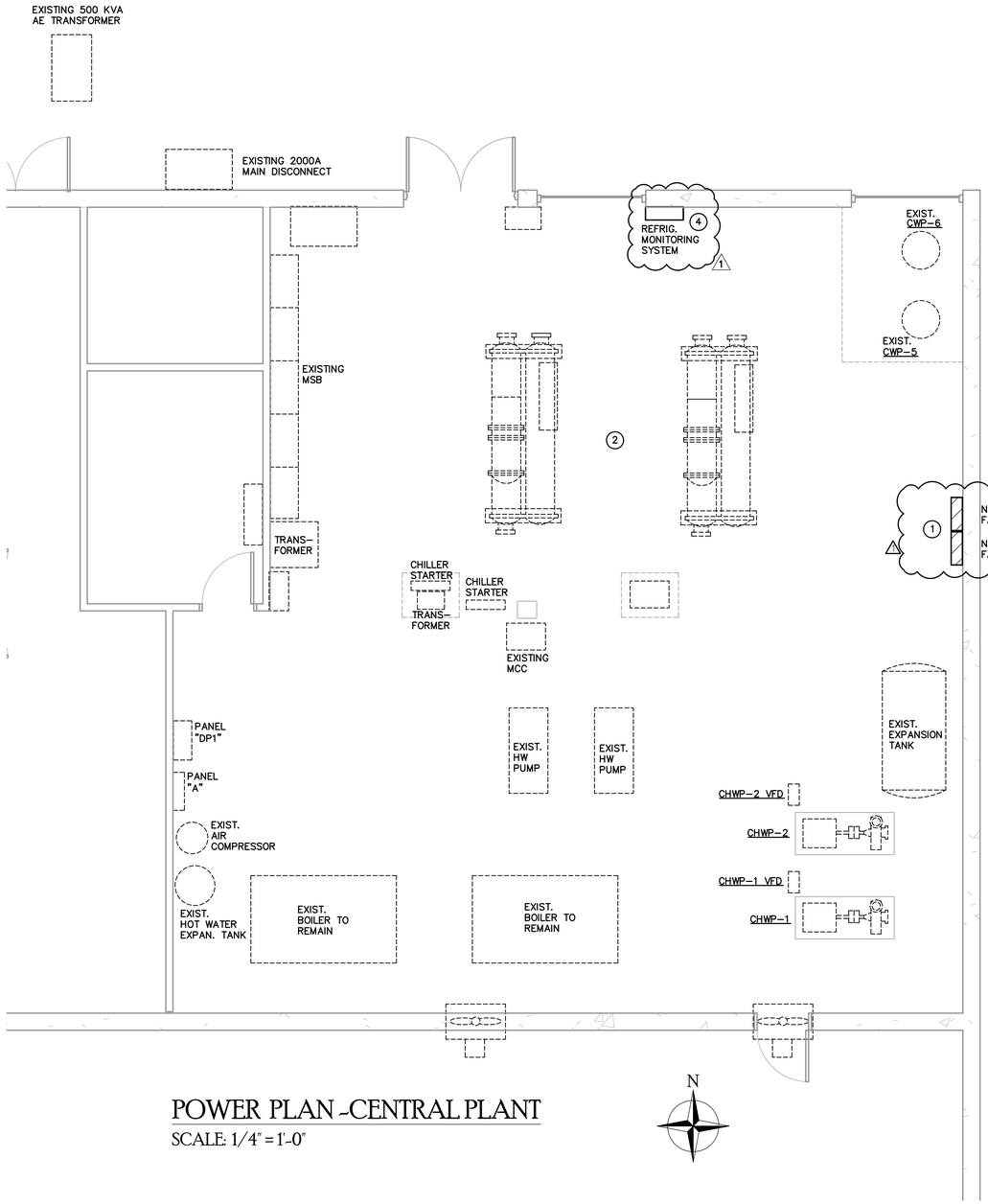
POWER PLAN SECOND FLOOR

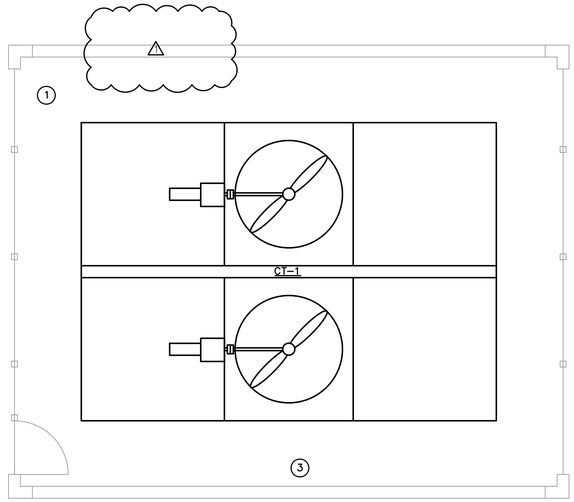
SHEET

E3.2



POWER PLAN -CENTRAL PLANT

SCALE: 1/4" = 1'-0"



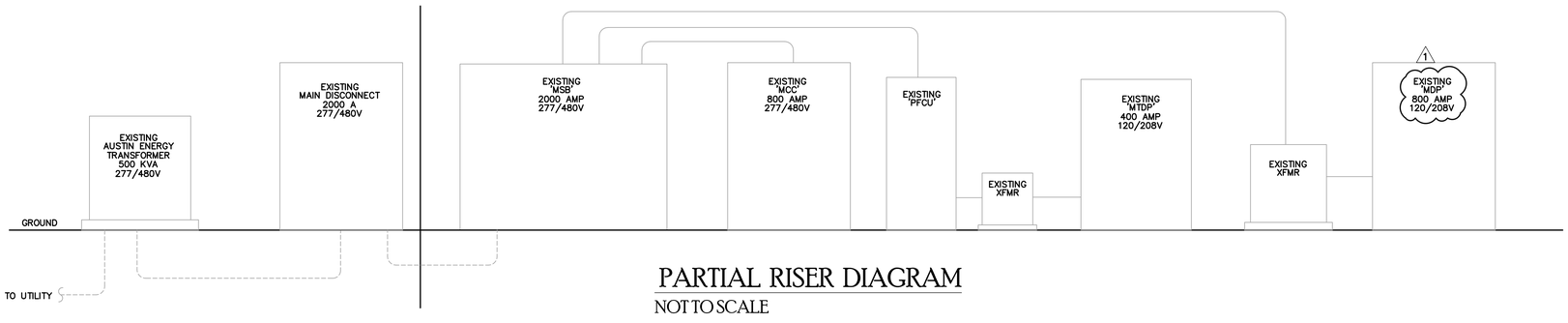
POWER PLAN KEYED NOTES

1
1. NEW COOLING TOWER IN EXISTING LOCATION. CONNECT TO NEW VFDS IN CENTRAL PLANT. VERIFY EXISTING FEEDERS AND PROVIDE NEW 3#6 & 1#10 GND. IN 1" CONDUIT AS NECESSARY. RECONNECT TO EXISTING BUCKETS IN EXISTING MCC-1. VERIFY THAT ALL ELECTRICAL EQUIPMENT REMAINS IN GOOD WORKING ORDER. REPLACE ANY DAMAGED OR MALFUNCTIONING EQUIPMENT.

2. ALL MECHANICAL AND ELECTRICAL EQUIPMENT IN TO REMAIN. COORDINATE WITH MECHANICAL CONTRACTOR FOR ANY EQUIPMENT AFFECTED BY PIPING REPLACEMENT. TYPICAL FOR ENTIRE CENTRAL PLANT.

1
3. ELECTRICAL CONTRACTOR TO COORDINATE WITH CONTROLS CONTRACTOR FOR POWER TO ALL NEW VALVES.

4. NEW REFRIGERANT MONITORING SYSTEM TO BE INSTALLED PER MECHANICAL DRAWINGS. REUSE EXISTING POWER AS REQUIRED.



PARTIAL RISER DIAGRAM

NOT TO SCALE

ALL ELECTRICAL GEAR IS EXISTING AND IS TO REMAIN. EXISTING SERVICE HAS SUFFICIENT CAPACITY FOR ALL NEW WORK.

HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

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MECHANICAL - ELECTRICAL - PLUMBING
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78745
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STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
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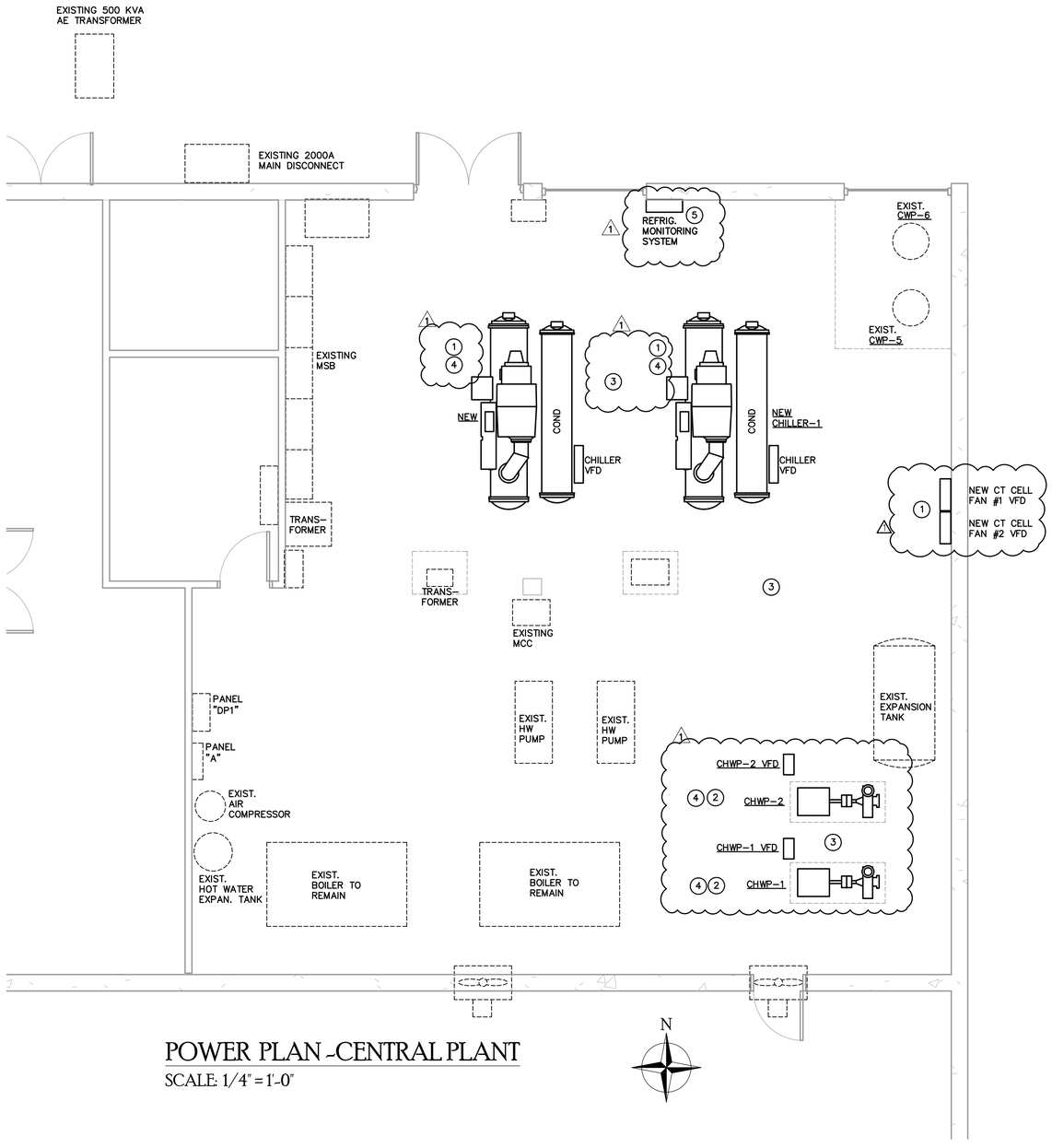
POWER PLAN CENTRAL PLANT

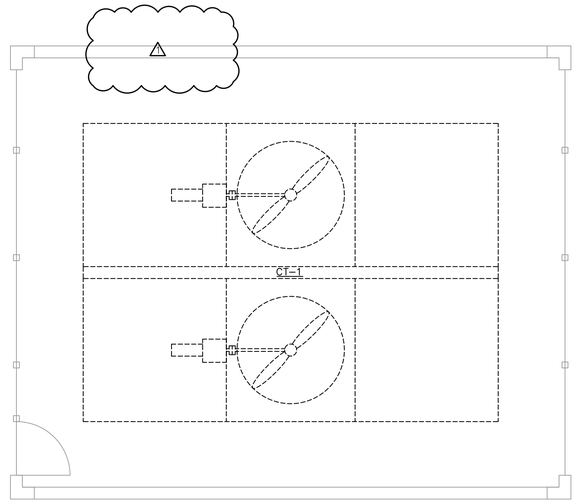
SHEET

E3.3



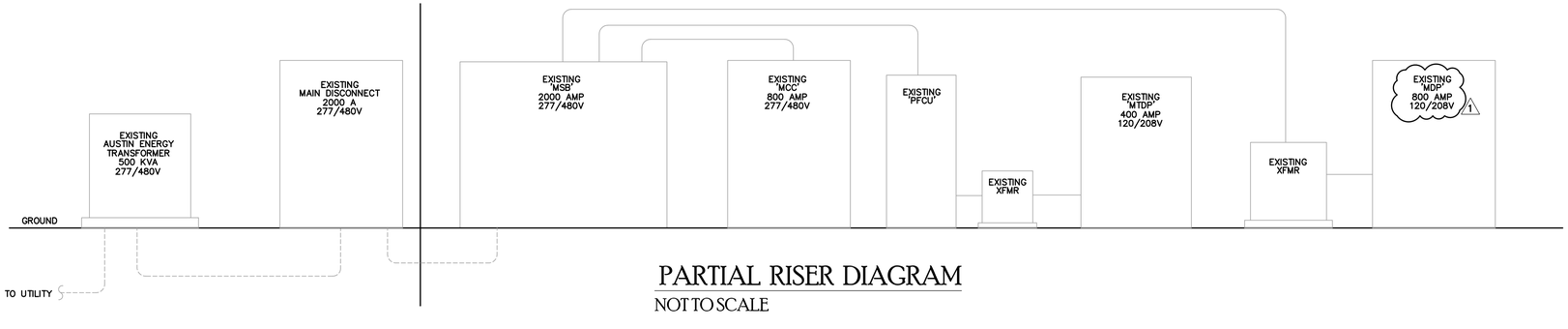
POWER PLAN -CENTRAL PLANT

SCALE: 1/4" = 1'-0"



POWER PLAN KEYED NOTES

1. NEW CHILLER-1 & CHILLER-2 TO REPLACE EXISTING. NEW CHILLERS TO BE PROVIDED WITH NEW DISCONNECTS AND VFD'S. REMOVE ALL EXISTING EQUIPMENT TO EXISTING UNITS, INCLUDING BUT NOT LIMITED TO DISCONNECTS, CONDUIT, WIRE, STARTERS, FUSES, ETC. RECONNECT TO EXISTING 400A SWITCHES IN EXISTING MSB AND PROVIDE NEW 350A RK5 FUSES. PROVIDE NEW (2) SETS 4#3/0 & #1 GND. IN 2" CONDUIT. PROVIDE ALL NECESSARY CONDUIT, WIRE AND ANY OTHER INTERCONNECTIONS FOR A COMPLETE WORKING SYSTEM.
2. PROVIDE NEW CONNECTION TO NEW CHWP-1 & CHWP-2 IN EXISTING LOCATIONS FOR CP-1 & CP-2. REMOVE EXISTING FEEDERS TO EXISTING PUMPS AND VFD'S DURING DEMOLITION. PROVIDE NEW 3#3 & 1#8 GND. IN 1 1/4" CONDUIT FROM EXISTING SWITCH TO NEW VFD WITH 100A/3P/NF/N1/HD/600A WIRING. REPLACE EXISTING FUSES IN EXISTING SWITCH WITH NEW 70A RK5 FUSES. PROVIDE ALL NECESSARY CONDUIT, WIRE AND ANY OTHER INTERCONNECTIONS FOR A COMPLETE WORKING SYSTEM.
3. ELECTRICIAN IS TO COORDINATE WITH MECHANICAL CONTRACTOR FOR ALL ELECTRICAL REQUIREMENTS FOR REPLACEMENT OF MECHANICAL EQUIPMENT. CONTRACTOR IS TO PROVIDE ALL ELECTRICAL EQUIPMENT REQUIRED BASED UPON ACTUAL MECHANICAL EQUIPMENT PROVIDED AND EXISTING FIELD CONDITIONS. FIELD VERIFY EXACT REQUIREMENTS PRIOR TO ANY WORK. COORDINATE WITH AISD SCHOOL ELECTRICIAN FOR EXACT EXISTING CONDITIONS.
4. ELECTRICAL CONTRACTOR TO COORDINATE WITH CONTROLS CONTRACTOR FOR POWER TO ALL NEW VALVES.
5. NEW REFRIGERANT MONITORING SYSTEM TO BE INSTALLED PER MECHANICAL DRAWINGS. REUSE EXISTING POWER AS REQUIRED.



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POWER PLAN CENTRAL PLANT - PHASE 4

SHEET

E3.3.1

PLUMBING LEGEND	
———	WASTE PIPING
– – – – –	VENT PIPING
—— – ——	COLD WATER PIPING
—— – – ——	HOT WATER PIPING HW– 140°
—— – – ——	TEPID WATER PIPING TW – 110°
——SD——	STORM PIPING
——C——	CONDENSATE PIPING
W	WASTE
V	VENT
VTR	VENT THRU ROOF
CW	COLD WATER
HW	HOT WATER
HWR	HOT WATER RETURN
WH	WALL HYDRANT
HB	HOSE BIBB
RD	ROOF DRAIN
RL	RAIN LEADER
SA	SHOCK ARRESTOR
TP	TRAP PRIMER
CO	CLEAN OUT
	GAS COCK
	BALL VALVE

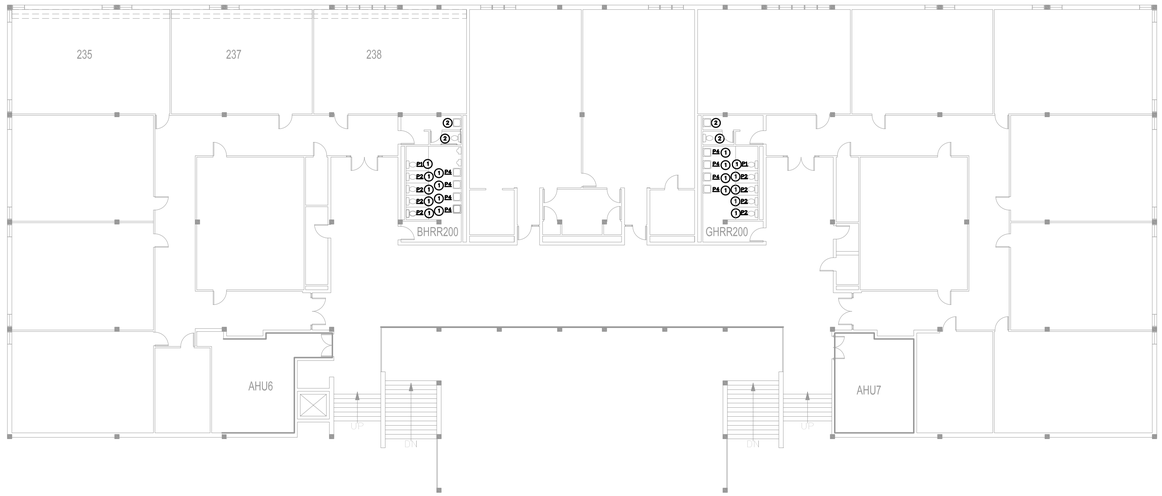
GENERAL PLUMBING NOTES

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH 2015 UNIFORM PLUMBING CODE AND APPLICABLE CODES. TO THE BEST OF THE ENGINEER'S KNOWLEDGE, ALL DRAWINGS AND SPECIFICATIONS COMPLY WITH MINIMUM EXISTING CODES.
2. CONTRACTOR SHALL PROVIDE ALL WORK CUSTOMARILY INCLUDED IF NOT SPECIFICALLY CALLED FOR ON THE PLANS. ALL WORK SHALL BE IN ACCORDANCE WITH BASE BUILDING PLANS AND SPECIFICATIONS.
3. CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH ALL DETAILS OF THE WORK AND EXISTING CONDITIONS. THE INTENT OF THESE NOTES AND MECHANICAL NOTES ON DRAWINGS IS TO CLARIFY THE SCOPE OF WORK AND ALERT CONTRACTOR OF EXISTING CONDITIONS.
4. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR ALL TRADES INSTALLATION SCHEDULES. FIXED WORK SUCH AS PLUMBING SHALL BE INSTALLED PRIOR TO ANY TRADE WORK THAT CAN BE EASILY RELOCATED OR OFFSET SUCH AS ELECTRICAL CONDUITS AND SMALL WATER LINES, ETC.
5. CONTRACTOR SHALL REVIEW STRUCTURAL DRAWINGS BEFORE INSTALLATION TO AVOID ANY BEAM CONFLICTS AND COORDINATE PIPING ACCORDINGLY.
6. ROUTE ALL PIPING CONCEALED ABOVE CEILING, WITHIN WALLS OR IN CHASES EXCEPT AS SPECIFICALLY NOTED. PATCH ALL EXISTING SURFACES AFFECTED TO MATCH ADJACENT SURFACES.
7. SEE ARCHITECTURAL DRAWINGS FOR FIXTURE LOCATIONS AND MOUNTING HEIGHTS.
8. SLEEVE AND FIRE STOP ALL PENETRATIONS OF RATED WALLS, CEILINGS, ETC., INCLUDING ROOF. FLASH AND COUNTERFLASH ROOF PENETRATIONS.
9. FIELD VERIFY EXISTING INSTALLATIONS OF ALL TRADES. MODIFY EXISTING PLUMBING SYSTEMS, WHICH ARE TO REMAIN ACTIVE, TO FACILITATE RECONNECTION AND EXTENSION UNDER THE NEW WORK.
10. UTILITIES AND SERVICES INDICATED ARE TAKEN FROM VARIOUS OLD AND NEW SURVEYS, AS–BUILT RECORDS, AND FIELD INVESTIGATION. IT IS TO BE UNDERSTOOD THAT UNFORESEEN CONDITIONS PROBABLY EXIST AND NEW WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON DRAWINGS.
11. PIPE ROUTING IS SCHEMATIC AND IS NOT INTENDED TO INDICATE EXACT ROUTING OR ANY ADDITIONAL OFFSETS OR FITTINGS REQUIRED FOR PROPER INSTALLATION AND CLEARANCES. CONTRACTOR TO VERIFY STRUCTURAL, MECHANICAL, ELECTRICAL INSTALLATIONS AND OBSTRUCTIONS OF ALL TRADES AND ROUTE PIPING TO AVOID ANY INTERFERENCES.
12. DOMESTIC WATER PIPING SHALL BE TYPE "L" COPPER ABOVE SLAB AND TYPE "K" BELOW SLAB.
13. SANITARY AND VENT PIPING SHALL BE SCHEDULE 40 PVC DWV.
14. WATER HAMMER ARRESTORS SHALL BE INSTALLED WHERE QUICK–CLOSING VALVES ARE UTILIZED.
15. ALL PLUMBING INSULATION SHALL INSTALLED IN ACCORDANCE WITH INTERNATIONAL ENERGY CONSERVATION CODE TABLE C403.2.10 CODE AND APPLICABLE CODES. MINIMUM PIPING INSULATION THICKNESS SHALL BE 1.5".

SPECIAL PLUMBING NOTES

(1) REMOVE EXISTING PLUMBING FIXTURE AND REPLACE WITH NEW AS SCHEDULED. EXTEND AND CONNECT TO EXISTING WATER, WASTE AND VENT SUPPLY TO MAINTAIN CONTINUITY.

(2) EXISTING PLUMBING FIXTURE TO REMAIN. PROVIDE REQUIRED MAINTENANCE AND REPAIRS TO ASSURE PROPER OPERATION. INFORM OWNER OF ANY DEFICIENCIES.



PLUMBING PLAN –SECOND FLOOR

SCALE: 1/16" = 1'-0"

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NOTE: NOT ALL FIXTURES NOTED BELOW MAY BE USED.

PLUMBING FIXTURE AND CONNECTION SCHEDULE

PNO	FIXTURE DESCRIPTION	MOUNTING HEIGHT	MIN. CONNECTIONS			SPECIFICATION						NOTES
			WASTE	CW	HW	MANUFACTURER	FIXTURE	TRIM	WASTE	TRAP	SUPPLY	
P1	ADA WATER CLOSET FLOOR MOUNTED FLUSHOMETER 1.28 GAL/FLUSH	FLOOR TO RIM 17 1/8"	4"	1"	---	AMERICAN–STAND.	3641.001	6065.121.002	---	---	–	SEAT – ELONGATED BOWL, TOP SPUD, WHITE. ULTIMA SELECTRONIC EXPOSED TOILET FLUSH VALVE – PISTON–TYPE, CR–PE LITHIUM BATTERY–POWERED.
						ZURN	EQUIVALENT	EQUIVALENT	---	---	–	
						KOHLER	EQUIVALENT	EQUIVALENT	---	---	–	
P2	WATER CLOSET FLOOR MOUNTED FLUSHOMETER 1.28 GAL/FLUSH	FLOOR TO RIM 15"	4"	1/2"	---	AMERICAN–STAND.	3451.528	6065.121	---	---	–	MADERA FLOWISE 15" TALL TOILET. SEAT – ELONGATED BOWL, TOP SPUD, WHITE. SELECTRONIC EXPOSED TOILET FLUSH VALVE – PISTON–TYPE, CR–PE LITHIUM BATTERY–POWERED.
						ZURN	EQUIVALENT	EQUIVALENT	---	---	–	
						KOHLER	EQUIVALENT	EQUIVALENT	---	---	–	
P3	ADA URINAL WALL HUNG FLUSHOMETER 1.0 GAL/FLUSH	FLOOR TO RIM 17"	2"	3/4"	---	AMERICAN–STAND.	6501.610	6063.101	---	---	---	0.125–1.0 GPF, VITREOUS CHINA. WHITE. TOP SPUD. SELECTRONIC EXPOSED TOILET FLUSH VALVE – PISTON–TYPE, CR–PE LITHIUM BATTERY–POWERED.
						ZURN	EQUIVALENT	---	---	---	---	
						KOHLER	EQUIVALENT	---	---	---	---	
P4	LAVATORY WALL HUNG 20–1/2"X18–1/4" SINGLE CENTER HOLE 0.5 GPM LAMINAR FLOW AERATORS	FLOOR TO BOTTOM OF APRON MIN. 29"	1 1/4"	1/2"	1/2"	AMERICAN–STAND.	0355.012	6053.205	M953455.0020A	McGuire 8872C	McGuire LFST07	0.5 GPM, 4" CENTERSET FAUCET. PWRX 10–YEAR BATTERY POWERED, VANDAL–RESISTANT, MULTI–LAMINAR SPRAY, WITH MIXING VALVE. PROVIDE PREMOLDED PREINSULATED COVER FOR TRAP & SUPPLIES PROVIDE DRAIN OFFSET TO PROVIDE HANDICAP CLEARANCE
						ZURN	EQUIVALENT	---	EQUIVALENT	EQUIVALENT	EQUIVALENT	
						KOHLER	EQUIVALENT	--	EQUIVALENT	EQUIVALENT	EQUIVALENT	
						CHICAGO FAUCET	---	EQUIVALENT	--	---	---	
						DELTA FAUCET	---	EQUIVALENT	---	---	---	

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HADDON+COWAN ARCHITECTS
2301 E. Riverside Drive, Bldg A, Suite 80
Austin, TX 78741 | haddoncowan.com

In Association w/
KINGS STRUCTURAL ENGINEERING

TBPE Firm #19701
WILSON & GIRGENTI, LLC
MECHANICAL - ELECTRICAL - PLUMBING
13785 Research Blvd., Suite 125
Austin, TX 78750
P.O. Box 1377
Safety Harbor, FL 34695
Office: 813-855-3330
Fax: 727-726-2070

Jose I. Guerra, Inc
Consulting Engineers

hcg hollon+cannon group, llc

AUSTIN I.S.D.

DEPARTMENT OF CONSTRUCTION MANAGEMENT

BEDICHEK MIDDLE SCHOOL RENOVATIONS

6800 Bill Hughes Rd. Austin, TX 78745

AISD PROJECT No. 200029-BEDCHK

STATE OF TEXAS
MELISSA B. COAD
93852
REGISTERED
PROFESSIONAL ENGINEER
09/30/2020

REVISIONS

No.	Issue	Date
1	ADDENDUM #4	09/30/2020

SHEET INFORMATION

Date	09/04/2020
Job Number	20-0029
Scale	AS NOTED
Drawn	W&G
Checked	W&G
Approved	W&G

TITLE

PLUMBING PLAN SECOND FLOOR

SHEET

P1.2