Solicitation 12736-1033

Fire Station 54 HVAC Retrofit (Re-Bid)

Bid Designation: Public

CITY OF FORT LAUDERDALE

City of Fort Lauderdale

Bid 12736-1033
Fire Station 54 HVAC Retrofit (Re-Bid)

Bid Number	**12736-1033**
Bid Title	**Fire Station 54 HVAC Retrofit (Re-Bid)**
Bid Start Date	**Oct 28, 2022 8:13:38 AM EDT**
Bid End Date	**Dec 5, 2022 2:00:00 PM EST**
Question & Answer End Date	**Nov 23, 2022 5:00:00 PM EST**
Bid Contact	**Erick Martinez** **Senior Procurement Specialist** **Finance** **954-828-4019** **emartinez@fortlauderdale.gov**
Contract Duration	**One Time Purchase**
Contract Renewal	**Not Applicable**
Prices Good for	**120 days**
Pre-Bid Conference	**Nov 15, 2022 10:00:00 AM EST** **Attendance is optional** **Location: Fort Lauderdale Fire Rescue Station 54** **3211 NE 32nd Street** **Fort Lauderdale, FL 33308**
Bid Comments	**The City of Fort Lauderdale, Florida (City) is seeking bids from qualified bidders, hereinafter referred to as the Contractor, to provide HVAC Retrofit services for the City's Public Works Department, in accordance with the terms, conditions, and specifications contained in this Invitation To Bid (ITB).** **This project is located at Fire Station 54, 3211 NE 32nd Street, in the City of Fort Lauderdale. The fire station is currently vacant. Its firefighters are currently housed in a mobile home on the opposite (south) side of Oakland Park Boulevard.** **The HVAC equipment will be purchased by the City. Therefore, this will be a demolition and installation project only, with the City purchasing the HVAC equipment directly from the manufacturer. A portion of the equipment is already in the Apparatus Bay of the fire station. The DOAS, RTU and CU are at a warehouse in Pompano Beach. Transportation of this equipment will be part of the project.** **Limited Commissioning to be performed by the City's Owner's Representative.** **The work to be accomplished under the resultant contract includes, but is not limited to: transportation of equipment from manufacturer to site; removal, disposal, fabrication of new ductwork, and installation of ceiling grid; removal disposal and installation of ductwork; floor penetrations for DOAS ductwork; structural analysis, design, materials, fabrication and installation (TBD) of new DOAS roof curb; removal and replacement of 2 RTU (6-7 ton), 1 split (20t) to be replaced by DOAS (15t), MAU, ceiling exhaust fans, VAVs, controls, and other HVAC equipment and controls. Equipment basis of design is specified in the Mechanical Permit Set plans but may be substituted by an "Approved Equal".** **Added on Nov 8, 2022:** **Addendum 1 is being issued to postpone the Pre-Bid Meeting/Site Visit to Tuesday, November 15, 2022 @ 10:00am Local Time.** **Added on Nov 30, 2022:** **Addendum 2 is being issued to change the Bid Due Date to Monday, December 5, 2022 at 2:00PM local time.**

Addendum # 1

New Documents	**ITB 12736-1033 - Fire Station 54 HVAC Retrofit Rebid Addendum 1.pdf**
Pre-Bid Conference Changes	**Pre-Bid Conference information has changed. Please review all Pre-Bid Conferences.**

Addendum # 2

New Documents	**ITB 12736-1033 - Fire Station 54 HVAC Retrofit Rebid Addendum 2.pdf**		
Previous End Date	**Nov 30, 2022 2:00:00 PM EST**	New End Date	**Dec 5, 2022 2:00:00 PM EST**

Item Response Form

Item	**12736-1033--01-01 - HVAC Retrofit Services**
Quantity	**1 ls**
Unit Price	
Delivery Location	**City of Fort Lauderdale** Fire Station #54 3211 NE 32nd Street Fort Lauderdale FL 33308 **Qty** 1

Description
HVAC retrofit services as stated in this solicitation.

CITY OF FORT LAUDERDALE
CONTRACT AND SPECIFICATIONS PACKAGE

BID NO. 12736-1033

PROJECT NO. 12735

Fire Station 54 HVAC Retrofit (Re-Bid)

Ana Ziegler
Project Manager II

Erick Martinez
Senior Procurement Specialist
Telephone: (954) 828-4019 E-mail: emartinez@fortlauderdale.gov

TABLE OF CONTENTS

Note: The following documents are available electronically for completion and must be returned with your bid along with your bid security, proof of insurance, and proof of required licenses/certifications.

CITB Questionnaire Sheet
Local Business Preference Certification
Disadvantaged Business Enterprise Preference Certification
Non-Collusion Statement
Non-Discrimination Certification Form
Contract Payment Method
Construction Bid Certification Page

INVITATION TO BID

Sealed bids will be received electronically until **2:00 p.m.**, local time, on **November 30, 2022,** and opened online immediately thereafter for **BID NO., 12736-1033, PROJECT NO., 12735, Fire Station 54 HVAC Retrofit (Re-Bid).**

All openings will be held on the BIDSYNC.COM platform. Once the Procurement Specialist opens the solicitation, the bid tabulations may be viewed immediately on a computer, laptop, cell phone, or any other device with WiFi access. The opening may also be viewed in real time through a "Microsoft Teams meeting" or similar type platform by using the following information:

Microsoft Teams meeting
Join on your computer, mobile app or room device
Click here to join the meeting

Meeting ID: 281 699 510 514
Passcode: No74GX
Download Teams | Join on the web

Or call in (audio only)
+1 954-686-7296,,435629560# United States, Fort Lauderdale
Phone Conference ID: 435 629 560#

Anyone requesting assistance or having further inquiry in this matter must contact the Procurement Specialist indicated on the solicitation, via the Question and Answer (Q&A) platform on Bidsync.com before the Last Day for Questions indicated in the Solicitation.

This project is located at Fire Station 54, 3211 NE 32nd Street, in the City of Fort Lauderdale. The fire station is currently vacant. Its firefighters are currently housed in a mobile home on the opposite (south) side of Oakland Park Boulevard.

The HVAC equipment will be purchased by the City. Therefore, this will be a demolition and installation project only, with the City purchasing the HVAC equipment directly from the manufacturer and staging/storing most of the equipment in the Apparatus Bay of the fire station.

Limited Commissioning to be performed by the City's Owner's Representative.

The work to be accomplished under the resultant contract includes, but is not limited to: removal, disposal and installation of ceiling grid; removal, disposal, fabrication and installation of ductwork; floor penetrations for DOAS ductwork; structural analysis, design, materials, fabrication of new ductwork, and installation (TBD) of new DOAS roof curb; removal and replacement of 2 RTU (6-7 ton), 1 split (20t) to be replaced by DOAS (15t), MAU, ceiling exhaust fans, VAVs, controls, and other HVAC equipment and controls. Equipment basis of design is specified in the Mechanical Permit Set plans but may be substituted by an "Approved Equal".

Drawing Plans: This Project consists of Drawing File No., N/A, (22) sheets. Drawing plans may be obtained **free of charge** at BIDSYNC.COM.

Licensing Requirements: Possession of a General Contractor License in the State of Florida, Mechanical License, and Electrical License are required for this project. The General Contractor may sub-contract the mechanical and electrical work.

NOTE: Payment on this contract will be made by Visa or MasterCard

Pre-Bid Meeting/Site visit: A pre-bid meeting and site visit will be held on Thursday, November 10, 2022, 10:00AM local time, at Fort Lauderdale Fire Rescue Station 54, 3211 NE 32nd Street, Fort Lauderdale, FL 33308.

While attendance is not mandatory, it is strongly suggested that all contractors attend the pre-bid conference. It will be the sole responsibility of the bidder to inspect the City's location and become familiar with the scope of the City's requirements and systems prior to submitting a bid. No variation in price or conditions shall be permitted based upon a claim of ignorance. Submission of a bid will be considered evidence that the proposer has familiarized himself with the nature and extent of the work, equipment, materials, and labor required.

Bid Security: A certified check, cashier's check, bank officer's check or bid bond for **FIVE** percent **(5%)** of the bid amount, made payable to the City of Fort Lauderdale, Florida, shall accompany each offer.

Bid Bonds:

Bidders can submit bid bonds for projects **four** different ways.

1) BidSync allows bidders to submit bid bonds electronically directly through their system using **Surety 2000**. For more information on this feature and to access it, contact BIDSYNC customer care department.

2) Bidders may **upload** their original executed bid bond on BIDSYNC to accompany their electronic bids and deliver the original, signed and sealed hard copy within **five (5)** business days after bid opening, with the company name, bid number and title clearly indicated.

3) Bidders can **hand deliver** their bid bond in a sealed envelope to the Finance Department, Procurement Services Division, 100 North Andrews Avenue, Room 619, Fort Lauderdale, Florida 33301-1016, before time of bid opening, with the company name, bid number and title clearly indicated on the envelope.

4) Bidders can **mail** their bid bond to the Finance Department, Procurement Services Division, 100 North Andrews Avenue, Room 619, Fort Lauderdale, Florida 33301-1016, before time of bid opening, with the company name, bid number and title clearly indicated on the envelope. NOTE: Bond must be received in Procurement and time stamped before bid opening.

It will be the sole responsibility of the bidder to ensure that his bid is submitted prior to the bid opening date and time listed. **PAPER BID SUBMITTALS WILL NOT BE ACCEPTED. BIDS MUST BE SUBMITTED ELECTRONICALLY VIA BIDSYNC.COM**

Certified Checks, Cashier's Checks and Bank Drafts:
These **CANNOT** be submitted via BIDSYNC, nor are their images allowed to be uploaded and submitted with your electronic bid. These forms of securities, as well as hard copy bid bonds, must be received on or before the Invitation to Bid (ITB) opening date and time, at the Finance Department, Procurement Services Division, 100 North Andrews Avenue, Room 619, Fort Lauderdale, Florida 33301-1016, with the bid number and title clearly indicated on the envelope.

It is the bidder's sole responsibility to ensure that his bid bond or other bid security is received by the Procurement Services Division before time of bid opening. Failure to adhere to this requirement may be grounds to consider the bid as non-responsive.

The City of Fort Lauderdale reserves the right to waive any informality in any or all bids and to reject any or all bids. For information concerning technical specifications, please utilize the Q&A platform

provided by BIDSYNC at www.bidsync.com. Questions of a material nature must be received prior to the cut-off date specified in the solicitation. Material changes, if any, to the scope of services or bidding procedures, will only be transmitted by written addendum. (See addendum section of BIDSYNC Site). **Bidders please note:** No part of your bid can be submitted via FAX. No variation in price or conditions shall be permitted based upon a claim of ignorance. Submission of a bid will be considered evidence that the bidder has familiarized himself with the nature and extent of the work, equipment, materials, and labor required. The entire bid response must be submitted in accordance with all specifications contained in this solicitation.

Information on bid results and projects currently out to bid can be obtained on the City's website – https://www.fortlauderdale.gov/government/departments-a-h/finance/procurement-services
For general inquiries, please call (954) 828-5933.

-BALANCE OF PAGE INTENTIONALLY LEFT BLANK-

INSTRUCTIONS TO BIDDERS

The following instructions are given for the purpose of guiding bidders in properly preparing their bids or proposals. These directions have equal force and weight with the specifications, and strict compliance is required with all of these provisions.

QUALIFICATIONS OF BIDDERS – No proposal will be accepted from, nor will any contract be awarded to, any person who is in arrears to the City of Fort Lauderdale, upon any debt or contract, or who has defaulted, as surety or otherwise, upon any obligation to the City, or who is deemed irresponsible or unreliable by the City Commission of Fort Lauderdale.

CONCERNING SUB-CONTRACTORS, SUPPLIERS, AND OTHERS - The amount of work that is sublet by the Bidder shall be limited by the condition that the Bidder shall, with his own organization, perform at least forty percent (40%) of the total dollar amount of the Work to be performed under the Agreement.

PERSONAL INVESTIGATION - Bidders shall satisfy themselves by personal investigation, and by such other means as they may think necessary or desirable, as to the conditions affecting the proposed work and the cost. No information derived from maps, plans, specifications, or from the Engineer, City Manager, or their assistants shall relieve the Contractor from any risk or from fulfilling all terms of the contract.

INCONSISTENCIES – Any seeming inconsistency between different provisions of the plans, specifications, proposal or contract, or any point requiring explanation must be inquired by the bidder, in writing, at least ten (10) days prior to the time set for opening proposals. After proposals are opened, the bidders shall abide by the decision of the Engineer as to such interpretation.

ADDENDA AND INTERPRETATIONS - No interpretations of the meaning of the plans, specifications or other contract documents will be made orally to any bidder. Prospective bidders must request such interpretation in writing as instructed in the bid package. To be considered, such request must be received by the Questions and Answers deadline as indicated in BIDSYNC.COM. Material changes, if any, to the scope of services or bidding procedures will only be transmitted by written addendum. **It is the bidder's responsibility to verify if addenda have been issued in BIDSYNC.COM.** Failure of any bidder to receive any such addenda or interpretation shall not relieve any bidder from any obligation under his bid as submitted. All addenda so issued shall become a part of the contract document. **Bidder** shall verify **in BIDSYNC.COM** that he has all addenda before submitting a bid.

LEGAL CONDITIONS - Bidders are notified to familiarize themselves with the provisions of the laws of the State of Florida relating to hours of labor on municipal work, and with the provisions of the laws of the State of Florida and the Charter and the ordinances of the City of Fort Lauderdale.

PUBLIC ENTITY CRIMES - A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, Florida Statutes, for Category Two for a period of thirty-six (36) months from the date of being placed on the convicted vendor list.

FORMS OF PROPOSALS - Each proposal and its accompanying statements must be made on the blanks provided. THE FORMS MUST BE SUBMITTED ELECTRONICALLY, IN GOOD ORDER WITH ALL BLANKS COMPLETED, and must show the name of the bidder and a statement as to its contents.

The proposal must be signed by one duly authorized to do so, and in case signed by a deputy or subordinate, the principal's properly written authority to such deputy or subordinate must accompany the proposal. No proposal will be accepted, for any reason whatsoever, which is not submitted to the City as stated above, within the specified time.

INSURANCE - Contractor shall provide and shall require all of its sub-contractors to provide, pay for, and maintain in force at all times during the term of the Agreement, such insurance, including Property Insurance (Builder's Risk), Commercial General Liability Insurance, Business Automobile Liability Insurance, Workers' Compensation Insurance, Employer's Liability Insurance, and Umbrella/Excess Liability, as stated below. Such policy or policies shall be issued by companies authorized to do business in the State of Florida and having agents upon whom service of process may be made in the State of Florida.

BID BOND - A certified check, cashier's check or bank officer's check made payable to the City of Fort Lauderdale, or a bid bond in favor of the City of Fort Lauderdale shall accompany each bid as evidence of the good faith and responsibility of the bidder. The amount of the check or bond shall be retained by the City as liquidated damages in the event the bidder whose bid is accepted refuses to or fails to enter into a contract for the execution of the work solicited in this Invitation to Bid.

The bid bond or check shall be a guarantee that the successful bidder will promptly execute a contract satisfactory to the City for the work solicited in this Invitation to Bid and furnish good and sufficient bonds.

Following the full execution of a contract for the work solicited in this Invitation to Bid and the successful bidder's provision of good and sufficient bonds, in the event bid security was provided by check, the amount of the bid security accompanying the successful bidder's bid will be refunded to the successful bidder, or in the event bid security was provided by a bond, the bond accompanying the successful bidder's bid will be returned to the successful bidder. In the event the successful bidder fails to enter into, execute, and deliver a contract and furnish the required bonds within ten (10) days after the City provides notice to the successful bidder to deliver the executed contract and the required bonds, the bid bond shall immediately be payable to the City of Fort Lauderdale, or in the case of a check, the City shall retain the amount of the check, as liquidated damages. The City's retention of such amount shall not be construed as a penalty or forfeiture

FILLING IN BIDS - All prices must be electronically submitted in the proposal pages, and all proposals must fully cover all items for which proposals are asked and no other. Where more than one person is interested, it is required that all persons interested or their legal representative make all verification and subscribe to the proposal.

PRICES QUOTED: Deduct any discount offered and quote firm net unit prices. In the case of a discrepancy in computing the amount of the bid, the unit price quoted will govern. All prices quoted shall be F.O.B. destination, freight prepaid (Bidder pays and bears freight charges, Bidder owns goods in transit and files any claims), unless otherwise stated in Special Conditions. Each item must be bid separately. No attempt shall be made to tie any item or items contained in the ITB with any other business with the City.

BIDS FIRM FOR ACCEPTANCE: Bidder warrants, by virtue of bidding, that his bid and the prices quoted in his bid will be firm for acceptance by the City for a period of one hundred and twenty (120) days from the date of bid opening unless otherwise stated in the ITB. The City shall award contract within this time period or shall request to the recommended awarded vendor an extension to hold pricing, until products/services have been awarded.

ADDITIONAL ITEMS OR SERVICES: The City may require additional items or services of a similar nature, but not specifically listed in the contract. The Contractor agrees to provide such items or

services, and shall provide the City prices on such additional items or services. If the price(s) offered are not acceptable to the City, and the situation cannot be resolved to the satisfaction of the City, the City reserves the right to procure those items or services from other vendors, or to cancel the contract upon giving the Contractor thirty (30) days written notice.

DELETION OR MODIFICATION OF SERVICES: The City reserves the right to delete any portion of the Contract at any time without cause, and if such right is exercised by the City, the total fee shall be reduced in the same ratio as the estimated cost of the work deleted bears to the estimated cost of the work originally planned. If work has already been accomplished on the portion of the Contract to be deleted, the Contractor shall be paid for the deleted portion on the basis of the estimated percentage of completion of such portion.

If the Contractor and the City agree on modifications or revisions to the task elements, after the City has approved work to begin on a particular task or project, and a budget has been established for that task or project, the Contractor will submit a revised budget to the City for approval prior to proceeding with the work.

CANCELLATION FOR UNAPPROPRIATED FUNDS**:** The obligation of the City for payment to a Contractor is limited to the availability of funds appropriated in a current fiscal period, and continuation of the contract into a subsequent fiscal period is subject to appropriation of funds, unless otherwise authorized by law.

CAUSES FOR REJECTION - No proposal will be canvassed, considered or accepted which, in the opinion of the City Commission, is informal or unbalanced, or contains inadequate or unreasonable prices for any items; each item must carry its own proportion of the cost as nearly as is practicable. Any alteration, erasure, interlineation, or failure to specify bids for all items called for in the schedule shall render the proposal informal.

REJECTION OF BIDS - The City reserves the right to reject any bid if the evidence submitted by the bidder, or if the investigation of such bidder, fails to satisfy the City that such bidder is properly qualified to carry out the obligations and to complete the work contemplated. Any or all proposals will be rejected, if there is reason to believe that collusion exists among bidders. A proposal will be considered irregular and may be rejected, if it shows serious omissions, alterations in form, additions not called for, conditions or unauthorized alternates, or irregularities of any kind. The City reserves the right to reject any or all proposals and to waive such technical errors as may be deemed best for the interests of the City.

BID PROTEST PROCEDURE: Any proposer or bidder who is not recommended for award of a contract and who alleges a failure by the City to follow the City's procurement ordinance or any applicable law may protest to the Procurement Division – Deputy Director of Finance, by delivering a letter of protest within five (5) days after a Notice of Intent to award is posted on the City's website at the following link: https://www.fortlauderdale.gov/government/departments-a-h/finance/procurement-services/notices-of-intent-to-award

The complete protest ordinance may be found on the City's website at the following link: https://library.municode.com/fl/fort_lauderdale/codes/code_of_ordinances?nodeId=COOR_CH2AD_ARTVFI_DIV2PR_S2-182DIREPRAWINAW

WITHDRAWALS - Any bidder may, without prejudice to himself, withdraw his proposal at any time prior to the expiration of the time during which proposals may be submitted. Such request for withdrawal must be in writing and signed in the same manner and by the same person who signed the proposal. After expiration of the period for receiving proposals, no proposal can be withdrawn, modified, or explained.

CONTRACT - The bidder to whom award is made shall execute a written contract to do the work and maintain the same in good repair until final acceptance by the proper authorities, and shall furnish good and sufficient bonds as specified within ten (10) days after receiving such contract for execution. If the bidder to whom the first award is made fails to enter into a contract as provided, the award may be annulled and the contract let to the next lowest bidder who is reliable, responsible, and responsive in the opinion of the City Commission, and that bidder shall fulfill every stipulation and obligation as if such bidder were the original party to whom award was made.

The contract shall provide that the Contractor agrees to correct any defective or faulty work or material, which may appear within one (1) year after completion of the work and receipt of final payment.

ENFORCEMENT OF SPECIFICATIONS - Copies of the specifications will be placed in the hands of all the assistants to the Engineer and Inspectors employed on the Work, who shall enforce each and every requirement of the contract. Such assistants shall have no authority to vary from such requirements.

DRAWING PLANS - Drawing plans may be obtained **free of charge** at BIDSYNC.COM.

SURETY BOND – The Contractor shall execute and record in the public records of Broward County, Florida, a payment and performance bond in an amount at least equal to the Contract Price with a surety insurer authorized to do business in the State of Florida as surety, ("Bond"), in accordance with Section 255.05, Florida Statutes (2021), as may be amended or revised, as security for the faithful performance and payment of all of the Contractor's obligations under the Contract Documents.

The successful bidder shall furnish a performance and payment bond in compliance with Section 255.05, Florida Statutes (2021), written by a Corporate Surety company, holding a Certificate of Authority from the Secretary of the Treasury of the United States as acceptable sureties on federal bonds, in an amount equal to the total amount payable by the terms of the contract, executed and issued by a Resident Agent licensed by and having an office in the State of Florida, representing such Corporate Surety, conditioned for the due and faithful performance of the work, and providing in addition to all other conditions, that if the Contractor, or his or its subcontractors, fail to duly pay for any labor, materials, or other supplies used or consumed by such Contractor, or his or its subcontractor or subcontractors, in performance of the work contracted to be done, the Surety will pay the same in the amount not exceeding the sum provided in such bonds, together with interest at the rate of fifteen percent (15%) per annum, and that they shall indemnify and hold harmless the City of Fort Lauderdale to the extent of any and all payments in connection with carrying out of the contract, which the City may be required to make under the law.

The Contractor is required at all times to have a valid surety bond in force covering the work being performed. A failure to have such bond in force at any time shall constitute a default on the part of the Contractor. A bond written by a surety, which becomes disqualified to do business in the State of Florida, shall automatically constitute a failure on the part of the Contractor to meet the above requirements.

Such bond shall continue in effect for one (1) year after completion and acceptance of the work with liability equal to at least twenty-five percent (25%) of contract price, or an additional bond shall be conditioned that the Contractor will correct any defective or faulty work or material which appear within one (1) year after completion of the contract, upon notification by the City, except in contracts which are concerned solely with demolition work, in which cases twenty-five percent (25%) liability will not be applicable.

AUDIT OF CONTRACTOR'S RECORDS - Upon execution of the Contract, the City reserves the right to conduct any necessary audit of the Contractor's records. Such an audit, or audits, may be conducted by the City or its representatives at any time prior to final payment, or thereafter, for a period up to three (3) years. The City may also require submittal of the records from either the Contractor, the Subcontractor, or both. For the purpose of this Section, records shall include all books of account,

supporting documents and papers deemed necessary by the City to assure compliance with the contract provisions.

Failure of the Contractor or Subcontractor to comply with these requirements may result in disqualification or suspension from bidding for future contracts or disapproval as a Subcontractor at the option of the City.

The Contractor shall assure that each of its Subcontractors will provide access to its records pertaining to the project upon request by the City.

PERIODIC ESTIMATE FOR PARTIAL PAYMENT - After the Contractor has submitted a periodic estimate for partial payment, approved and certified by the Public Works Department, the City shall make payment in the manner provided in the Contract Documents and in accordance with Florida's Prompt Payment Act, Section 218, Florida Statutes.

RESERVATION FOR AWARD AND REJECTION OF BIDS - The City reserves the right to accept or reject any or all bids, part of bids, and to waive minor irregularities or variations to specifications contained in bids, and minor irregularities in the bidding process. The City also reserves the right to award the contract on a split order basis, lump sum basis, individual item basis, or such combination as shall best serve the interest of the City. The City reserves the right to make an award to the responsive and responsible bidder whose product or service meets the terms, conditions, and specifications of the ITB and whose bid is considered to best serve the City's interest. In determining the responsiveness of the offer and the responsibility of the Bidder, the following shall be considered when applicable: the ability, capacity and skill of the Bidder to perform as required; whether the Bidder can perform promptly, or within the time specified, without delay or interference; the character, integrity, reputation, judgment, experience and efficiency of the Bidder; the quality of past performance by the Bidder; the previous and existing compliance by the Bidder with related laws and ordinances; the sufficiency of the Bidder's financial resources; the availability, quality and adaptability of the Bidder's supplies or services to the required use; the ability of the Bidder to provide future maintenance, service or parts; the number and scope of conditions attached to the bid.

LOCAL BUSINESS PREFERENCE **-** Section 2-186, Code of Ordinances of the City of Fort Lauderdale, provides for a local business preference. In order to be considered for a local business preference, a proposer must include the Local Business Preference Certification Statement of this ITB, as applicable to the local business preference class claimed at the time of Proposal submittal:

Upon formal request of the City, based on the application of a Local Business Preference, the Proposer shall, within ten (10) calendar days, submit the following documentation to the Local Business Preference Class claimed:

a. Copy of City of Fort Lauderdale current year business tax receipt, or Broward County current year business tax receipt, and

b. List of the names of all employees of the proposer and evidence of employees' residence within the geographic bounds of the City of Fort Lauderdale or Broward County, as the case may be, such as current Florida driver license, residential utility bill (water, electric, telephone, cable television), or other type of similar documentation acceptable to the City.

Failure to comply at time of proposal submittal shall result in the Proposer being found ineligible for the local business preference.

Definitions:

a. The term "Class A business" shall mean any business that has established and agrees to maintain a permanent place of business located in a non-residential zone, staffed with full-time employees within the limits of the city, and shall maintain a staffing level for the proposed work of at least fifty percent (50%) who are residents of the City of Fort Lauderdale.

b. The term "Class B business" shall mean any business that has established and agrees to maintain a permanent place of business located in a non-residential zone, staffed with full-time employees within the limits of the city, or shall maintain a staffing level for the proposed work of at least fifty percent (50%) who are residents of the City of Fort Lauderdale.

c. The term "Class C business" shall mean any business that has established and agrees to maintain a permanent place of business located in a non-residential zone, staffed with full-time employees within the limits of Broward County.

c. The term "Class D business" shall mean any business that does not qualify as a Class A, Class B, or Class C business.

The complete local business preference ordinance may be found on the City's web site at the following link:
https://library.municode.com/fl/fort_lauderdale/codes/code_of_ordinances?nodeId=COOR_CH2AD_ARTVFI_DIV2PR_S2-186LOBUPR

DISADVANTAGED BUSINESS ENTERPRISE PREFERENCE - Section 2-185, Code of Ordinances of the City of Fort Lauderdale, provides for a disadvantaged business preference. In order to be considered for a disadvantaged business preference, a proposer must include a certification from a government agency, as applicable to the disadvantaged business preference class claimed at the time of Proposal submittal:

Upon formal request of the City, based on the application of a Disadvantaged Business Preference the Proposer shall within ten (10) calendar days submit the following documentation to the Disadvantaged Business Enterprise Preference Class claimed:

a. Copy of City of Fort Lauderdale current year business tax receipt, or the Tri-County (Broward, Dade, West Palm Beach) current year business tax receipt, or proof of active Sunbiz status and

b. List of the names of all employees of the proposer and evidence of employees' residence within the geographic bounds of the City of Fort Lauderdale or the Tri-County, as the case may be, such as current Florida driver license, residential utility bill (water, electric, telephone, cable television), or other type of similar documentation acceptable to the City.

Failure to comply at time of proposal submittal shall result in the Proposer being found ineligible for the Disadvantaged Business Enterprise Preference business preference.

The complete Disadvantaged Business Preference ordinance may be found on the City's website at the following link: https://www.fortlauderdale.gov/home/showpublisheddocument?id=56883

DEBARRED OR SUSPENDED BIDDERS OR PROPOSERS - The bidder or proposer certifies, by submission of a response to this solicitation, that neither it nor its principals and subcontractors are presently debarred or suspended by any Federal department or agency.

LOBBYING ACTIVITIES - **ALL CONTRACTORS PLEASE NOTE**: Any contractor submitting a response to this solicitation must comply, if applicable, with City of Fort Lauderdale Ordinance No. C-

11-42 & Resolution No. 07-101, Lobbying Activities. Copies of Ordinance No., C-11-42, and Resolution No. 07-101, may be obtained from the City Clerk's Office on the 7th Floor of City Hall, 100 N. Andrews Avenue, Fort Lauderdale, Florida 33301. The Ordinance may also be viewed on the City's website at https://www.fortlauderdale.gov/home/showdocument?id=6036

-BALANCE OF PAGE INTENTIONALLY LEFT BLANK-

GENERAL CONDITIONS

Unless otherwise modified in the Project's Special Conditions, the following General Conditions shall be part of the Contract:

GC - 01 - DEFINITIONS - The following words and expressions, or pronouns used in their stead, shall wherever they appear in the Contract and the Contract Documents, be construed as follows:

"Addendum" or "Addenda" - shall mean the additional Contract provisions issued in writing, by the Engineer, prior to the receipt of bids.

"Bid" – shall mean the offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

"Bidder" – shall mean any person, firm, company, corporation or entity submitting a bid for the Work.

"Bonds" –shall mean bid, performance and payment bonds and other instruments of security, furnished by Contractor and his surety in accordance with the Contract Documents.

"City" – shall mean the City of Fort Lauderdale, Florida, a Florida municipal corporation. In the event the City exercises its regulatory authority as a government body, the exercise of such regulatory authority and the enforcement of any rules, regulations, codes, laws and ordinances shall be deemed to have occurred pursuant to City's authority as a governmental body and shall not be attributable in any manner to the City as a party to this Contract.

"Consultant" – shall mean a person, firm, company, corporation or other entity employed by the City to perform the professional services for the project.

"Contractor" – shall mean the successful Bidder who has been employed by the City to perform the construction and related services for the project.

"Contract Work" - shall mean everything expressed or implied to be required to be furnished and furnished by the Contractor by any one or more of the parts of the Contract Documents referred to in the Contract hereof. In the case of any inconsistency in or between any parts of this Contract, the Project Manager shall determine which shall prevail.

"Design Documents" – shall mean the construction plans and specifications included as part of a Bid/Proposal Solicitation prepared either by the City or by the Consultant under a separate Agreement with the City.

"Engineer" - shall include the terms "professional engineer" and "licensed engineer" and means a person who is licensed to engage in the practice of engineering under Florida Statute, Chapter 471. An Engineer may be a City employee or a consultant hired by the City.

"Extra Work" - shall mean work other than that required by the Contract.

"Inspector" – shall mean an authorized representative of the City assigned to make necessary inspections of materials furnished by Contractor and of the Work performed by Contractor.

"Notice" - shall mean written notice sent by certified United States mail, return receipt requested, or sent by commercial express carrier with acknowledgement of delivery, or via fax or email, or by hand delivery with a request for a written receipt of acknowledgment of delivery and shall be served upon the Contractor either personally or to its place of business listed in the Bid.

“Owner” - shall mean the City of Fort Lauderdale.

“Project Manager” - shall mean a professional designated by the City to manage the Project under the supervision and direction of the Public Works Director or designee.

"Public Works Director" – shall mean the Public Works Director of the City of Fort Lauderdale.

"Site" - shall mean the area upon or in which the Contractor's operations are carried out and such other areas adjacent thereto as may be designated as such by the Project Manager.

"Sub-contractor" - shall mean any person, firm, company, corporation or other entity, other than employees of the Contractor, who or which contracts with the contractor, to furnish, or actually furnishes labor and materials, or labor and equipment, or labor, materials and equipment at the site.

"Surety" - shall mean any corporation or entity that executes, as Surety, the Contractor's performance and payment bond securing the performance of this Contract.

GC - 02 - SITE INVESTIGATION AND REPRESENTATION - The Contractor acknowledges that it has satisfied itself as to the nature and location of the Work under the Contract Documents, the general and local conditions of the Site, particularly those bearing upon availability of transportation, disposal, handling and storage of materials, availability of labor, water, electric power, and roads, field conditions, the type of equipment and facilities needed preliminary to and during the prosecution of the Work and all other matters which can in any way affect the Work or the cost thereof under the Contract Documents.

The Contractor acknowledges that it has conducted extensive tests, examinations and investigations and represents and warrants a thorough familiarization with the nature and extent of the Contract Documents, the Work, locality, soil conditions, moisture conditions and all year-round local weather and climate conditions (past and present), and, in reliance on such tests, examination and investigations conducted by Contractor and the Contractor’s experts, has determined that no conditions exist that would in any manner affect the Bid Price and that the project can be completed for the Bid Price submitted.

Any failure by the Contractor to acquaint itself with all the Site conditions shall not relieve Contractor from responsibility for properly estimating the difficulty or cost thereof under the Contract Documents.

GC - 03 - SUBSTITUTIONS - If the Contractor desires to use materials and/or products of manufacturer's names different from those specified in the Contract Documents, the Bidder requesting the substitution shall make written application as described herein. The burden of proving the equality of the proposed substitution rests on the Contractor making the request. To be acceptable, the proposed substitution shall meet or exceed all expressed requirements of the Contract Documents and shall be submitted upon the Contractor's letterhead. The following requirements shall be met in order for the substitution to be considered:

1. Requests for substitution shall be accompanied by such technical data, as the party making the request desires to submit. The Project Manager will consider reports from reputable independent testing laboratories, verified experience records from previous users and other written information valid in the circumstances; and

2. Requests for substitution shall completely and clearly indicate in what respects the materials and/or products differ from those indicated in the Contract Documents; and

3. Requests for substitution shall be accompanied by the manufacturer's printed recommendations clearly describing the installation, use and care, as applicable, of the proposed substitutions; and

4. Requests for substitution shall be accompanied by a complete schedule of changes in the Contract Documents, if any, which must be made to permit the use of the proposed substitution.

If a proposed substitution is approved by the Project Manager, an addendum will be issued to prospective bidders not less than three (3) working days prior to the date set for opening of bids. Unless substitutions are received and approved as described above, the successful Bidder shall be responsible for furnishing materials and products in strict accordance with the Contract Documents.

GC- 04 – CONSTRUCTION RESOURCES – Contractor shall provide all labor and equipment necessary to complete the installation within a timely manner. Contractor shall provide details as to manpower and equipment to be dedicated to the project in its Work Plan. Contractor is responsible for making arrangements, obtaining and purchasing construction water services if required to complete the work.

GC - 05 - CONTROL OF THE WORK - The Project Manager shall have full control and direction of the Work in all respects. The Project Manager and/or his authorized designee(s) shall, at all times, have the right to inspect the Work and materials. The Contractor shall furnish all reasonable facilities for obtaining such information, as the Project Manager may desire respecting the quality of the Work and materials and the manner of conducting the Work. Should the Contractor be permitted to perform night Work, or to vary the period which work is ordinarily carried on in the daytime, he shall give ample notice to the Project Manager so that proper and adequate inspection may be provided. Such Work shall be done only under such regulations as are furnished in writing by the Project Manager, and no extra compensation shall be allowed to the Contractor therefore. In the event of night work, the Contractor shall furnish such light, satisfactory to the Project Manager, as will ensure proper inspection. Nothing herein contained shall relieve the Contractor from compliance with any and all City ordinances relating to noise or Work during prohibited hours.

GC - 06 - SUB-CONTRACTOR - The Contractor shall not sublet, in whole or any part of the Work without the written consent and approval of the Project Manager. Within ten (10) days after official notification of starting date, the Contractor must submit in writing, to the Project Manager, a list of all Sub-contractors. No Work shall be done by any sub-contractor until such Sub-contractor has been officially approved by the Project Manager. A sub-contractor not appearing on the original list will not be approved without written request submitted to the Project Manager and approved by the Public Works Director. In all cases, the Contractor shall give his personal attention to the Work of the Sub-contractors and the Sub-contractor is liable to be discharged by the Contractor, at the direction of the Project Manager, for neglect of duty, incompetence or misconduct.

Acceptance of any sub-contractor, other person, or organization by the Project Manager shall not constitute a waiver of any right of Project Manager to reject defective Work or Work not in conformance with the Contract Documents.

Contractor shall be fully responsible for all acts and omissions of its Sub-contractors and of persons and organizations directly or indirectly employed by them and of persons and organizations for whose acts any of them may be liable to the same extent that he is responsible for the acts and omissions of persons directly employed by him. Nothing in the Contract Documents shall create any contractual relationship between City and any sub-contractor or other person or organization having a direct contract with Contractor, nor shall it create any obligation on the part of City to pay or to see to the payment of any moneys due to any sub-contractor or other person, or organization, except as may otherwise be required by law.

GC - 07 - QUANTITIES - Contractor recognizes and agrees that the quantities shown on plans and Bid/Price Schedule are estimates only and may vary during actual construction. No change shall be made involving any departure from the general scheme of the Work and that no such change involving a material change in cost, either to the City or Contractor, shall be made, except upon written permission of the City. However, the Project Manager shall have the right to make minor alternations in the line, grade, plan, form or materials of the Work herein contemplated any time before the completion of the same. That if such alterations shall diminish the quantity of the Work to be done, such alterations shall not constitute a claim for damages or anticipated profits. That if such alterations increase the amount of the Work to be done, such increase shall be paid for according to the quantity actually performed and at the unit price or prices stipulated therefore in the Contract. The City shall, in all cases of dispute, determine the amount or quantity of the several kinds of Work which are to be paid for under this Contract, and shall decide all questions relative to the execution of the same, and such estimates and decisions shall be final and binding.

Any Work not herein specified, which might be fairly implied as included in the Contract, of which the City shall judge, shall be done by the Contractor without extra charge. However, such cost increases shall be authorized either by the Public Works Director or designee, or the City Commission based upon the purchasing threshold amounts provided for in Chapter 2 of the City of Fort Lauderdale's Code of Ordinances.

GC - 08 - NO ORAL CHANGES - Except to the extent expressly set forth in the Contract, no change in, or modification, termination or discharge of the Contract in any form whatsoever, shall be valid or enforceable unless it is in writing and signed by the parties charged, therewith or their duly authorized representative.

GC - 09 - PERMITS AND PROTECTION OF PUBLIC – Permits on file with the City and/or those permits to be obtained by the Contractor, shall be considered directive in nature, and will be considered a part of this Contract. A copy of all permits shall be given to the City and become part of the Contract Documents. Terms of permits shall be met prior to acceptance of the Work and release of the final payment.

Contractor shall secure all permits and licenses required for completing the Project. Contractor will obtain the necessary State, County, and City construction/work permits if required.

The Contractor shall comply with all applicable Codes, Standards, Specifications, etc. related to all aspects of the Project.

Where there are telephones, light or power poles, water mains, conduits, pipes or drains or other construction, either public or private, in or on the streets or alleys, the Work shall be so conducted that no interruption or delay will be caused in the operation or use of the same. Proper written notice shall be given to all affected parties prior to proceeding with the Work.

The Contractor shall not be permitted to interfere with public travel and convenience by grading or tearing up streets indiscriminately, but the Work of constructing the various items in this contract shall proceed in an orderly, systematic and progressive manner.

GC - 10 - DISEASE REGULATIONS - The Contractor shall enforce all sanitary regulations and take all precautions against infectious diseases as the Project Manager may deem necessary. Should any infectious or contagious diseases occur among his employees, he shall arrange for the immediate removal of the employee from the Site and isolation of all persons connected with the Work.

GC - 11 - CONTRACTOR TO CHECK PLANS, SPECIFICATIONS, AND DATA - The Contractor shall verify all dimensions, quantities, and details shown on the plans, supplementary drawings,

schedules, and shall notify the Project Manager of all errors, omissions, conflicts and discrepancies found therein within three (3) working days of discovery. Failure to discover or correct errors, conflictions, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction, or improper operation resulting therefrom nor from rectifying such condition at its own expense.

GC - 12 - MATERIALS AND WORKMANSHIP - All material shall be new and the workmanship shall, in every respect, be in conformity with approved modern practice and with prevailing standards of performance and quality. In the event of a dispute, the Project Manager's decision shall be final. Wherever the Plans, Specifications, Contract Documents, or the directions of the Project Manager are unclear as to what is permissible and/or fail to note the quality of any Work, that interpretation will be made by the Project Manager, which is in accordance with approved modern practice, to meet the particular requirements of the Contract.

GC - 13 - SAFEGUARDING MARKS - The Contractor shall safeguard all points, stakes, grade marks, monuments, and benchmarks made or established on the Work, bear the cost of re-establishing same if disturbed, or bear the entire expense of rectifying Work improperly installed due to not maintaining or protecting or for removing without authorization, such established points, stakes and marks. The Contractor shall safeguard all existing and known property corners, monuments and marks not related to the Work and, if required, shall bear the cost of having them re-established by a licensed Professional surveyor registered in the State of Florida if disturbed or destroyed during the course of construction.

GC - 14 - RESTROOM FACILITIES - Contractor shall provide portable toilet facilities for employee's use at a location within the Work site to be determined by the City.

GC - 15 - PROGRESS MEETINGS - Weekly Status meetings will be conducted with representatives from the City and the Contractor. Contractor shall budget time to participate in such meetings. A well-run Project should result in short meetings.

GC - 16 - ISSUE RESOLUTION - Should Contractor become engaged in a dispute with a resident or a City employee, the Contractor shall report the situation to the Project Manager immediately. It shall be mandatory that the City participate in any dispute resolution. Failure of Contractor personnel to notify the City shall obligate Contractor to replace the offending employee immediately if requested by the City.

GC - 17 - CITY SECURITY-CONTRACTOR AND SUBCONTRACTOR EMPLOYEE INFORMATION - Prior to commencing work, Contractor shall provide to the City a list of all personnel and sub-contractors on site. The list will include the name, address, birth date and driver's license number for all personnel. All personnel and subcontractors on site will have on their person a company photo ID during all stages of the construction. Contractor shall provide standard required personal information per current City procedures.

GC - 18 - POST-CONSTRUCTION SURVEY - The Contractor shall provide as-built survey, sealed and signed by a registered surveyor in the State of Florida, as a condition of final payment.

GC – 19 - KEY PERSONNEL - Contractor shall provide as part of the Work Plan, resumes for all key project personnel providing supervision and project management functions. Resumes shall include work history and years of experience performing this type of work.

GC - 20 - EXISTING UTILITY SERVICE - All existing utility service shall be maintained with a minimum of interruption at the expense of the Contractor.

GC - 21 - JOB DESCRIPTION SIGNS – Contractor, at Contractor's expense, shall furnish, erect, and maintain suitable weatherproof signs on jobs over $100,000 containing the following information:

1. City Seal (in colors)
2. Project or Improvement Number
3. Job Description
4. Estimated Cost
5. Completion Date

Minimum size of sign shall be four feet high, eight feet wide and shall be suitably anchored. The entire sign shall be painted and present a pleasing appearance. Exact location of signs will be determined in the field. Two (2) signs will be required, one at each end of the job. All costs of this work shall be included in other parts of the work.

GC - 22 - FLORIDA EAST COAST RIGHT-OF-WAY - Whenever a City contractor is constructing within the Florida East Coast Railway Company's Right-of-Way, it will be mandatory that the contractor carry bodily injury and property damage insurance in amounts satisfactory to the Florida East Coast Company. This insurance requirement shall be verified by the contractor with the Florida East Coast Company prior to commencing work, and maintained during the life of the Contract.

GC - 23 - ACCIDENTS - The Contractor shall provide such equipment and facilities as are necessary and/or required, in the case of accidents, for first aide services to be provided to a person who may be injured during the project duration. The Contractor shall also comply with the OSHA requirements as defined in the United States Labor Code 29 CFR 1926.50.

In addition, the Contractor must report immediately to the Project Manager every accident to persons or damage to property, and shall furnish in writing full information, including testimony of witnesses regarding any and all accidents.

GC - 24 - SAFETY PRECAUTIONS - Contractor must adhere to the applicable environmental protection guidelines for the duration of a project. If hazardous waste materials are used, detected or generated at any time, the Project Manager must be immediately notified of each and every occurrence. The Contractor shall comply with all codes, ordinances, rules, orders and other legal requirements of public authorities (including OSHA, EPA, DERM, the City, Broward County, State of Florida, and Florida Building Code), which bear on the performance of the Work.

The Contractor shall take the responsibility to ensure that all Work is performed using adequate safeguards, including but not limited to: proper safe rigging, safety nets, fencing, scaffolding, barricades, chain link fencing, railings, barricades, steel plates, safety lights, and ladders that are necessary for the protection of its employees, as well as the public and City employees. All riggings and scaffolding shall be constructed with good sound materials, of adequate dimensions for their intended use, and substantially braced, tied or secured to ensure absolute safety for those required to use it, as well as those in the vicinity. All riggings, scaffolding, platforms, equipment guards, trenching, shoring, ladders and similar actions or equipment shall be OSHA approved, as applicable, and in accordance with all Federal, State and local regulations.

GC - 25 - DUST PREVENTION - The Contractor shall, by means of a water spray, or temporary asphalt pavement, take all necessary precautions to prevent or abate a dust nuisance arising from dry weather or Work in an incomplete stage. All costs of this Work shall be included in the cost of other parts of the Work.

Should the Contractor fail to abate a dust nuisance the Project Manager may stop the Work until the issue is resolved to the City's satisfaction.

GC - 26 - SITE CLEANUP AND RESTORATION – The Contractor shall remove all debris and unused or discarded materials from the work site daily. Contractor shall clean the work site to remove all directional drilling "Driller's Mud" materials. No "Driller's Mud" residue shall be allowed to remain in the soil or on the surface of the land or vegetation. All debris and drilling materials must be disposed of offsite at an approved location.

The Contractor shall promptly restore all areas disturbed that are outside the Project limits in equal or better condition at no additional cost to the City.

GC - 27 - COURTEOUS BEHAVIOR AND RESPECT FOR RESIDENTS AND PROPERTY – The Contractor and its employees, associates and sub-contractors shall maintain courteous behavior at all times and not engage in yelling, loud music, or other such activities. Contractor's employees shall not leave trash or other discarded items at the Work Site, especially on any private property. In the event complaints arise, Contractor shall immediately remove such offending employees from the project if requested to do so by the Project Manager. Contractor's employees shall not trespass on any private property unless necessary to complete the work but with prior permission from the owner.

Contractor shall notify and obtain permission from the residents 24 hours in advance when planning to work within the resident's property. In addition, Contractor shall notify the resident prior to entering their property to perform work or inspect/investigate the work site. Contractor shall not block residents' driveways unnecessarily. Contractor shall not park equipment on landscaped areas when the vehicle is not needed for the current construction activities. Contractor shall be responsible for repair and/or replacement of all damaged landscaping within 48 hours including repairing vehicle wheel impressions, irrigation systems, lighting systems, structures, or any other items of resident's property. Contractor shall not destroy, damage, remove, or otherwise negatively impact any landscaping within or outside the right-of-way without prior approval from the Project Manager.

GC - 28 - PLACING BARRICADES AND WARNING LIGHTS - The Contractor shall furnish and place, at Contractor's own expense, all barricades, warning lights, automatic blinker lights and such devices necessary to properly protect the work and vehicular and pedestrian traffic. Should the Contractor fail to erect or maintain such barricades, warning lights, etc., the Project Manager may, after 24 hours' notice to the Contractor, proceed to have such barricades and warning lights placed and maintained by City or other forces and all costs incurred thereof charged to the Contractor and may be retained by the City from any monies due, or to become due, to the Contractor.

GC - 29 - TRAFFIC CONTROL - The Contractor shall coordinate all Work and obtain, through the City's Transportation and Mobility Department, Broward County, Florida Department of Transportation, as applicable, any permits required to detour traffic or close any street before starting to work in the road

All traffic control devices, flashing lights, signs and barricades shall be maintained in working condition at all times and conform to Manual of Uniform Traffic Control Devices (MUTCD), latest edition.

GC - 30 - COORDINATION - The Contractor shall notify all utilities, transportation department, etc., in writing, with a copy to the Project Manager before construction is started and shall coordinate its Work with them. The Contractor shall cooperate with the owners of any underground or overhead utility lines in their removal, construction and rearrangement operations in order that services rendered by these parties will not be unnecessarily interrupted.

The Contractor shall arrange its Work and dispose of its materials so as to not interfere with the operation of other contractors engaged upon adjacent work, and to join its Work to that of others in

a proper manner, and to perform its Work in the proper sequence in relation to that of other contractors as may be directed by the Project Manager.

Each Contractor shall be responsible for any damage done by it or its agents to the work performed by another contractor.

GC - 31 - WATER - Bulk water used for construction, flushing pipelines, and testing shall be obtained from fire hydrants. Contractor shall make payment for hydrant meter at Treasury Billing Office, 1st Floor, City Hall, 100 N. Andrews Avenue. With the paid receipt, contractor can pick up hydrant meter at the utility location office. No connection shall be made to a fire hydrant without a meter connected.

GC - 32 - PROHIBITION AGAINST CONTRACTING WITH SCRUTINIZED COMPANIES - Subject to *Odebrecht Construction, Inc., v. Prasad*, 876 F.Supp.2d 1305 (S.D. Fla. 2012), *affirmed*, *Odebrecht Construction, Inc., v. Secretary, Florida Department of Transportation*, 715 F.3d 1268 (11th Cir. 2013), with regard to the "Cuba Amendment," the Contractor certifies that it is not on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, and that it does not have business operations in Cuba or Syria, as provided in Section 287.135, Florida Statutes (2021), as may be amended or revised. The Contractor certifies that it is not on the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2021), as may be amended or revised, and that it is not engaged in a boycott of Israel. The City may terminate this Agreement at the City's option if the Contractor is found to have submitted a false certification as provided under subsection (5) of Section 287.135, Florida Statutes (2021), as may be amended or revised, or been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2021), as may be amended or revised, or is engaged in a boycott of Israel or has been engaged in business operations in Cuba or Syria, as defined in Section 287.135, Florida Statutes (2021), as may be amended or revised.

By submitting a proposal or response, the company, principals, or owners certify that it is not listed on the Scrutinized Companies with Activities in Sudan List or listed on the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or is engaged in business operations in Cuba or Syria.

GC - 33 - USE OF FLORIDA LUMBER TIMBER AND OTHER FOREST PRODUCTS - In accordance with Florida Statute 255.20 (3), the City specifies that lumber, timber, and other forest products used for this Project shall be produced and manufactured in the State of Florida if such products are available and their price, fitness, and quality are equal. This requirement does not apply to plywood specified for monolithic concrete forms, if the structural or service requirements for timber for a particular job cannot be supplied by native species, or if the construction is financed in whole or in part from federal funds with the requirement that there be no restrictions as to species or place of manufacture.

The Bidder affirms by submitting a bid response to this solicitation that they will comply with section 255.20 (3) Florida Statutes.

GC - 34 - PUBLIC RECORDS/TRADE SECRETS/COPYRIGHT: The Proposer's response to the Solicitation is a public record pursuant to Florida law, which is subject to disclosure by the City under the State of Florida Public Records Law, Florida Statutes Chapter 119.07 ("Public Records Law").

The City shall permit public access to all documents, papers, letters or other material submitted in connection with this Solicitation and the Contract to be executed for this Solicitation, subject to the provisions of Chapter 119.07 of the Florida Statutes.

Any language contained in the Proposer's response to the Solicitation purporting to require confidentiality of any portion of the Proposer's response to the Solicitation, except to the extent that certain information is in the City's opinion a Trade Secret pursuant to Florida law, shall be void. If a Proposer submits any documents or other information to the City which the Proposer claims is Trade Secret information and exempt from Florida Statutes Chapter 119.07 ("Public Records Laws"), the Proposer shall clearly designate that it is a Trade Secret and that it is asserting that the document or information is exempt. The Proposer must specifically identify the exemption being claimed under Florida Statutes 119.07. The City shall be the final arbiter of whether any information contained in the Proposer's response to the Solicitation constitutes a Trade Secret. The City's determination of whether an exemption applies shall be final, and the proposer agrees to defend, indemnify, and hold harmless the City and the City's officers, employees, and agent, against any loss or damages incurred by any person or entity as a result of the City's treatment of records as public records. In addition, the proposer agrees to defend, indemnify, and hold harmless the City and the City's officers, employees, and agents, against any loss or damages incurred by any person or entity as a result of the City's treatment of records as exempt from disclosure or confidential. Proposals purporting to be subject to copyright protection in full or in part will be rejected. The proposer authorizes the City to publish, copy, and reproduce any and all documents submitted to the City bearing copyright symbols or otherwise purporting to be subject to copyright protection.

EXCEPT FOR CLEARLY MARKED PORTIONS THAT ARE BONA FIDE TRADE SECRETS PURSUANT TO FLORIDA LAW, DO NOT MARK YOUR RESPONSE TO THE SOLICITATION AS PROPRIETARY OR CONFIDENTIAL. DO NOT MARK YOUR RESPONSE TO THE SOLICITATION OR ANY PART THEREOF AS COPYRIGHTED.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS AGREEMENT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT:

Telephone Number: **(954) 828-5002**

Mailing Address: **City Clerk's Office**
100 N. Andrews Avenue
Fort Lauderdale, Florida 33301-1016

E-mail: **prrcontract@fortlauderdale.gov**

Contractor shall:

1. Keep and maintain public records required by the City in order to perform the service.

2. Upon request from the City's custodian of public records, provide the City with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes (2021), as may be amended or revised, or as otherwise provided by law.

3. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the

duration of the contract term and following completion of this Agreement if the Contractor does not transfer the records to the City.

4. Upon completion of the Agreement, transfer, at no cost, to the City all public records in possession of the Contractor or keep and maintain public records required by the City to perform the service. If the Contractor transfers all public records to the City upon completion of this Agreement, the Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of this Agreement, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the City, upon request from the City's custodian of public records, in a format that is compatible with the information technology systems of the City.

-BALANCE OF PAGE INTENTIONALLY LEFT BLANK-

SPECIAL CONDITIONS

01. PURPOSE

The City of Fort Lauderdale, Florida (City) is seeking bids from qualified bidders, hereinafter referred to as the Contractor, to provide HVAC Retrofit services for the City's Public Works Department, in accordance with the terms, conditions, and specifications contained in this Invitation To Bid (ITB).

This project is located at Fire Station 54, 3211 NE 32nd Street, in the City of Fort Lauderdale. The fire station is currently vacant. Its firefighters are currently housed in a mobile home on the opposite (south) side of Oakland Park Boulevard.

The HVAC equipment will be purchased by the City. Therefore, this will be a demolition and installation project only, with the City purchasing the HVAC equipment directly from the manufacturer. A portion of the equipment is already in the Apparatus Bay of the fire station. The DOAS, RTU and CU are at a warehouse in Pompano Beach. Transportation of this equipment will be part of the project.

Limited Commissioning to be performed by the City's Owner's Representative.

The work to be accomplished under the resultant contract includes, but is not limited to: transportation of equipment from manufacturer to site; removal, disposal, fabrication of new ductwork, and installation of ceiling grid; removal disposal and installation of ductwork; floor penetrations for DOAS ductwork; structural analysis, design, materials, fabrication and installation (TBD) of new DOAS roof curb; removal and replacement of 2 RTU (6-7 ton), 1 split (20t) to be replaced by DOAS (15t), MAU, ceiling exhaust fans, VAVs, controls, and other HVAC equipment and controls. Equipment basis of design is specified in the Mechanical Permit Set plans but may be substituted by an "Approved Equal".

02. TRANSACTION FEES

The City uses BidSync (www.bidsync.com) to distribute and receive bids and proposals. There is no charge to vendors/contractors to register and participate in the solicitation process, nor will any fees be charged to the awarded contractor.

03. SUBMISSION OF BIDS

It is the sole responsibility of the Contractor to ensure that its bid is submitted electronically through BidSync at www.bidsync.com. and that any bid security not submitted via BidSync reaches the City of Fort Lauderdale, Procurement Services Division, 6th floor, Room 619, 100 N. Andrews Avenue, Fort Lauderdale, Florida 33301-1016, in a sealed envelope marked on the outside with the ITB solicitation number and Contractor's name, no later than the time and date specified in this solicitation. **PAPER BID SUBMITTALS WILL NOT BE ACCEPTED. PLEASE SUBMIT YOUR BID RESPONSE ELECTRONICALLY.**

04. INFORMATION OR CLARIFICATION

For information concerning procedures for responding to this solicitation, contact **Erick Martinez**, **Senior Procurement Specialist**, at (954) 828-4019 or email at emartinez@fortlauderdale.gov. Such contact shall be for clarification purposes only.

For information concerning technical specifications please utilize the Question/Answer platform provided by BidSync at www.bidsync.com. Questions of a material nature must be received prior

to the cut-off date specified in the solicitation. Material changes, if any, to the scope of services or bidding procedures will only be transmitted by written addendum. (See addendum section of BidSync site). **Bidders please note**: No part of your bid can be submitted via FAX. No variation in price or conditions shall be permitted based upon a claim of ignorance. Submission of a bid will be considered evidence that the bidder has familiarized himself with the nature and extent of the work, and the equipment, materials, and labor required. The entire bid response must be submitted in accordance with all specifications contained in this solicitation. The questions and answers submitted in BidSync shall become part of any contract that is created from this ITB.

05. CONTRACT TIME

5.1 The Contractor recognizes that TIME IS OF THE ESSENCE. The Work shall commence within **SEVEN** (7) calendar days of the date of the Notice to Proceed.

5.2 The Work shall be Substantially Completed within **NINETY** (90) calendar days after the date when the Contract Time commences to run as provided in the Notice to Proceed.

5.3 The Work shall be finally completed on the Final Completion Date and ready for final payment in accordance with this Agreement within **ONE HUNDRED TWENTY** (120) calendar days after the date when the Contract Time commences to run as provided in the Notice to Proceed.

06. BID SECURITY

A certified check, cashier's check, bank officer's check or bid bond for **FIVE percent (5%)** of the bid amount, made payable to the City of Fort Lauderdale, shall accompany each offer.

07. REQUIRED LICENSES/CERTIFICATIONS

Contractor must possess the following licenses/certifications to be considered for award:

Possession of a General Contractor License in the State of Florida, Mechanical License, and Electrical License are required for this project. The General Contractor may sub-contract the mechanical and electrical work.

Note: Contractor must have proper licensing and shall submit evidence of same with its bid response.

08. SPECIFIC EXPERIENCE REQUIRED

The following expertise is required to be considered for this Contract. Specific references attesting to this expertise must be submitted with the bid response.

The contractor shall have previous construction experience in constructing additions/modifications to existing public buildings, in the State of Florida within the last ten (10) years. Bidder shall submit proof of construction experience for a minimum of three (3) projects of similar scope and scale (or larger) and shall, for each project listed, identify location; dates of construction; project name and overall scope; scope of work that was self-performed by Contractor; and client's name, address, telephone number and e-mail address.

Experience shall include installation of ductwork, variable air volume (VAV), roof top unit (RTU), dedicated outdoor air system (DOAS) and controls. Additionally, the contractor's experience shall include structural reinforcement of bar joist rooftop, demolition and installation of ceiling grid, and concrete slab penetrations.

The contractor shall perform any reinforced concrete work with a State of Florida licensed contractor specializing in repair and restoration of reinforced concrete structures. The successful contractor shall provide a minimum of six (6) references for projects of similar scope performed in the last two (2) years.

Structural analysis will be required to determine the type of reinforcement needed to place the new equipment. The successful contractor shall provide (3) references for projects of similar scope in the last two (2) years.

NOTE: REFERENCES SHALL NOT INCLUDE ONLY CITY OF FORT LAUDERDALE EMPLOYEES OR WORK PERFORMED FOR THE CITY. THE CITY IS ALSO INTERESTED IN WORK EXPERIENCE AND REFERENCES FROM ENTITIES OTHER THAN THE CITY OF FORT LAUDERDALE.

By signing this bid solicitation, contractor is affirming that this expertise will be provided for this Contract at no additional charge.

09. BID ALLOWANCE

Allowance for permits: Payments will be made to the contractor based on the actual cost of permits upon submission of paid permit receipts. The City shall not pay for other costs related to obtaining or securing permits.

The amount indicated is intended to be sufficient to cover the entire project. If the City's permit fees exceed the allowance indicated, the City will reimburse the contractor the actual amount of the City's permit fees required for project completion.

Allowance	Allowance Amount
Permit fee allowance	$20,000.00
Other: Structural analysis, design, materials, fabrication and installation (to be confirmed with City).	$25,000.00
Total:	**$45,000.00**

Note: The City will add this allowance to your bid.

10. INSURANCE REQUIREMENTS *(See Article 10, Bonds and Insurance, of the Contract for details)*

INSURANCE

As a condition precedent to the effectiveness of this Agreement, during the term of this Agreement and during any renewal or extension term of this Agreement, the Contractor, at its sole expense, shall provide insurance of such types and with such terms and limits as noted below. Providing proof of and maintaining adequate insurance coverage are material obligations

of the Contractor. The Contractor shall provide the City a certificate of insurance evidencing such coverage. The Contractor's insurance coverage shall be primary insurance for all applicable policies. The limits of coverage under each policy maintained by the Contractor shall not be interpreted as limiting the Contractor's liability and obligations under this Agreement. All insurance policies shall be through insurers authorized or eligible to write policies in the State of Florida and possess an A.M. Best rating of A-, VII or better, subject to approval by the City's Risk Manager.

The coverages, limits, and/or endorsements required herein protect the interests of the City, and these coverages, limits, and/or endorsements shall in no way be relied upon by the Contractor for assessing the extent or determining appropriate types and limits of coverage to protect the Contractor against any loss exposures, whether as a result of this Agreement or otherwise. The requirements contained herein, as well as the City's review or acknowledgement, are not intended to and shall not in any manner limit or qualify the liabilities and obligations assumed by the Contractor under this Agreement.

The following insurance policies and coverages are required:

Commercial General Liability
Coverage must be afforded under a Commercial General Liability policy with limits not less than:

- $1,000,000 each occurrence and $2,000,000 aggregate for Bodily Injury, Property Damage, and Personal and Advertising Injury
- $1,000,000 each occurrence and $2,000,000 aggregate for Products and Completed Operations

Policy must include coverage for contractual liability and independent contractors.

The City, a Florida municipal corporation, its officials, employees, and volunteers are to be covered as an additional insured with a CG 20 26 04 13 Additional Insured – Designated Person or Organization Endorsement or similar endorsement providing equal or broader Additional Insured Coverage with respect to liability arising out of activities performed by or on behalf of the Contractor. The coverage shall contain no special limitation on the scope of protection afforded to the City, its officials, employees, and volunteers.

Professional Liability
Coverage must be afforded for Wrongful Acts in an amount not less than $1,000,000 each claim and $2,000,000 aggregate.

Contractor must keep the professional liability insurance in force until the third anniversary of expiration or early termination of this Agreement or the third anniversary of acceptance of work by the City, whichever is longer, which obligation shall survive expiration or early termination of this Agreement.

Pollution and Remediation Legal Liability (Hazardous Materials)
For the purpose of this section, the term "hazardous materials" includes all materials and substances that are designated or defined as hazardous by Florida or federal law or by the rules or regulations of Florida or any federal agency. If work being performed involves hazardous materials, the Contractor shall procure and maintain any or all of the following coverage, which will be specifically addressed upon review of exposure.

Contractors Pollution Liability Coverage

For sudden and gradual occurrences and in an amount not less than $1,000,000 per claim arising out of this Agreement, including but not limited to, all hazardous materials identified under the Agreement.

Asbestos Liability Coverage
For sudden and gradual occurrences and in an amount not less than $1,000,000 per claim arising out of work performed under this Agreement.

Business Automobile Liability
Coverage must be afforded for all Owned, Hired, Scheduled, and Non-Owned vehicles for Bodily Injury and Property Damage in an amount not less than $1,000,000 combined single limit each accident.

If the Contractor does not own vehicles, the Contractor shall maintain coverage for Hired and Non-Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Liability policy.

Crane and Rigging Liability
Coverage must be afforded for any crane operations under the Commercial General or Business Automobile Liability policy as necessary, in line with the limits of the associated policy.

Workers' Compensation and Employer's Liability
Coverage must be afforded per Chapter 440, Florida Statutes. Any person or entity performing work for or on behalf of the City must provide Workers' Compensation insurance. Exceptions and exemptions will be allowed by the City's Risk Manager, if they are in accordance with Florida Statute.

The Contractor waives, and the Contractor shall ensure that the Contractor's insurance carrier waives, all subrogation rights against the City, its officials, employees, and volunteers for all losses or damages. The City requires the policy to be endorsed with WC 00 03 13 Waiver of our Right to Recover from Others or equivalent.

The Contractor must be in compliance with all applicable State and federal workers' compensation laws, including the U.S. Longshore Harbor Workers' Act and the Jones Act, if applicable.

Insurance Certificate Requirements
a. The Contractor shall provide the City with valid Certificates of Insurance (binders are unacceptable) no later than ten (10) days prior to the start of work contemplated in this Agreement.
b. The Contractor shall provide to the City a Certificate of Insurance having a thirty (30) day notice of cancellation; ten (10) days' notice if cancellation is for nonpayment of premium.
c. In the event that the insurer is unable to accommodate the cancellation notice requirement, it shall be the responsibility of the Contractor to provide the proper notice. Such notification will be in writing by registered mail, return receipt requested, and addressed to the certificate holder.
d. In the event the Agreement term or any surviving obligation of the Contractor following expiration or early termination of the Agreement goes beyond the expiration date of the insurance policy, the Contractor shall provide the City with an updated Certificate of Insurance no later than ten (10) days prior to the expiration of the insurance currently in effect. The City reserves the right to suspend the Agreement until this requirement is met.
e. The Certificate of Insurance shall indicate whether coverage is provided under a claims-made or occurrence form. If any coverage is provided on a claims-made form, the

Certificate of Insurance must show a retroactive date, which shall be the effective date of the initial contract or prior.

f. The City shall be named as an Additional Insured on all liability policies, with the exception of Workers' Compensation and Professional Liability.

g. The City shall be granted a Waiver of Subrogation on the Contractor's Workers' Compensation insurance policy.

h. The title of the Agreement, Bid/Contract number, event dates, or other identifying reference must be listed on the Certificate of Insurance.

The Certificate Holder should read as follows:
City of Fort Lauderdale
100 N. Andrews Avenue
Fort Lauderdale, FL 33301

The Contractor has the sole responsibility for all insurance premiums and shall be fully and solely responsible for any costs or expenses as a result of a coverage deductible, co-insurance penalty, or self-insured retention; including any loss not covered because of the operation of such deductible, co-insurance penalty, self-insured retention, or coverage exclusion or limitation. Any costs for adding the City as an Additional Insured shall be at the Contractor's expense.

If the Contractor's primary insurance policy/policies do not meet the minimum requirements, as set forth in this Agreement, the Contractor may provide evidence of an Umbrella/Excess insurance policy to comply with this requirement.

The Contractor's insurance coverage shall be primary insurance as respects to the City, a Florida municipal corporation, its officials, employees, and volunteers. Any insurance or self-insurance maintained by the City, a Florida municipal corporation, its officials, employees, or volunteers shall be non-contributory.

Any exclusion or provision in any insurance policy maintained by the Contractor that excludes coverage required in this Agreement shall be deemed unacceptable and shall be considered breach of contract.

All required insurance policies must be maintained until the contract work has been accepted by the City, or until this Agreement is terminated, whichever is later. Any lapse in coverage shall be considered breach of contract. In addition, Contractor must provide to the City confirmation of coverage renewal via an updated certificate should any policies expire prior to the expiration of this Agreement. The City reserves the right to review, at any time, coverage forms and limits of Contractor's insurance policies.

The Contractor shall provide notice of any and all claims, accidents, and any other occurrences associated with this Agreement to the Contractor's insurance company or companies and the City's Risk Management office, as soon as practical.

It is the Contractor's responsibility to ensure that any and all of the Contractor's independent contractors and subcontractors comply with these insurance requirements. All coverages for independent contractors and subcontractors shall be subject to all of the applicable requirements stated herein. Any and all deficiencies are the responsibility of the Contractor.

NOTE: CITY PROJECT NUMBER, PROJECT NAME AND BID NUMBER MUST APPEAR ON EACH CERTIFICATE, AND THE CITY OF FORT LAUDERDALE MUST BE NAMED ON THE CERTIFICATE AS AN "ADDITIONAL INSURED" ON REQUIRED LIABILITY POLICIES.

A Sample Insurance Certificate shall be included with the proposal to demonstrate the firm's ability to comply with insurance requirements. Provide a previous certificate or other evidence listing the insurance companies' names for all required coverage, and the dollar amounts of the coverage.

11. PERFORMANCE AND PAYMENT BOND: 100%

12. CITY PROJECT MANAGER

The Project Manager is hereby designated by the City as Ana Ziegler whose address is 100 North Andrews, 4th Floor, Fort Lauderdale, Florida 33301-1016, telephone number: (954) 828-5817, and e-mail address is AZiegler@fortlauderdale.gov. The Project Manager will assume all duties and responsibilities and will have the rights and authorities assigned to the Project Manager in the Contract Documents in connection with completion of the Work in accordance with this Agreement.

13. LIQUIDATED DAMAGES *(See Article 16, Liquidated Damages, of the Contract for details)*

Upon failure of the Contractor to complete the Work within the time specified for completion, the Contractor shall pay to the City the sum of **Five Hundred Dollars ($500.00)** for each and every calendar day that the completion of the Work is delayed beyond the time specified in this Agreement for completion, as fixed and agreed liquidated damages and not as a penalty, so long as the delay is caused by the Contractor. (See Article 16, Liquidated Damages Clause, of the Contract)

14. PAYMENT (*See Article 7, Payment, of the Contract for other details*)

The City shall make payment to the Contractor through utilization of the City's P-Card Program. The City has implemented a Purchasing Card (P-Card) Program utilizing both the VISA and MASTERCARD networks. Purchases from this contract will be made utilizing the City's Purchasing Card. Contractor will receive payment from the purchasing card in the same manner as other credit card purchases. Accordingly, Contractor must presently have the ability to accept these credit cards or take whatever steps necessary to implement the ability before the start of the contract term, or contract award by the City. All costs associated with the Contractor's participation in this purchasing program shall be borne by the Contractor. The City reserves the right to revise this program as necessary.

Payment Card Industry (PCI) Compliance

Contractor agrees to comply with all applicable state, federal and international laws, as well as industry best practices, governing the collection, access, use, disclosure, safeguarding and destruction of Protected Information.

Contractor and/or any subcontractor that handles credit card data must be, and remain, PCI compliant under the current standards and will provide documentation confirming compliance upon request by the City of Fort Lauderdale, failure to produce documentation could result in termination of the contract.

15. WORK SCHEDULE (including overtime hours):

Regular work hours: **8:00 am to 4:30 pm, Monday through Friday.**
City Inspector Hours: **8:00 am to 4:30 pm, Monday through Friday.**

Any inspection requested by the contractor outside those hours will be considered overtime to be paid by the Contractor.

16. INSPECTION OVERTIME COST: $100/hr.

-BALANCE OF PAGE INTENTIONALLY LEFT BLANK-

CITY OF FORT LAUDERDALE
CONSTRUCTION AGREEMENT

THIS Agreement made and entered into this _____ day of _____, 20__, by and between the City of Fort Lauderdale, a Florida municipal corporation (City) and _____, a Florida _____ Company/Corporation (Contractor), ("Party" or collectively "Parties");

WHEREAS, the City desires to retain a contractor for the Project as expressed in its Invitation to Bid No., 12736-1033, Project Number, 12735, which was opened on _____; and,

WHEREAS, the Contractor has expressed its willingness and capability to perform the necessary work to accomplish the Project.

NOW, THEREFORE, the City and the Contractor, in consideration of the mutual covenants and conditions contained herein and for other good and valuable consideration, the receipt and sufficiency is hereby acknowledged, agree as follows:

ARTICLE 1 – DEFINITIONS

Whenever used in this Agreement or in other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural forms:

1.1 Agreement – This written Agreement between the City and the Contractor covering the work to be performed including other Contract Documents that are attached to or incorporated in the Agreement.

1.2 Application for Payment – The form accepted by the City which is to be used by the Contractor in requesting progress or final payment and which is to include such supporting documentation as is required by the Contract Documents.

1.3 Approve – The word approve is defined to mean review of the material, equipment or methods for general compliance with design concepts and with the information given in the Contract Documents. It does not imply a responsibility on the part of the City to verify in every detail conformance with plans and specifications.

1.4 Bid – The offer or Bid of the Contractor submitted on the prescribed form setting forth the total prices for the Work to be performed.

1.5 Bid Documents – Advertisement for Invitation to Bids, the Instructions to Bidders, the Bid Form (with supplemental affidavits and sample agreements), the Contract Forms, General Conditions, the Supplementary Conditions, the Specifications, and the Plans, which documents all become an integral part of the Contract Documents.

1.6 Certificate of Substantial Completion - Certificate provided by the City certifying that all Work, excluding the punch list items, has been completed, inspected, and accepted by the City.

1.7 Change Order - A written document ordering a change in the Contract Price or Contract Time or a material change in the Work.

1.8 City – The City of Fort Lauderdale, Florida, including but not limited to its employees, agents, officials, representatives, contractors, subcontractors, volunteers, successors and assigns, with whom the Contractor has entered into the Agreement and for whom the Work is to be provided.

1.9 Contract Documents – The Contract Documents shall consist of this Agreement, Exhibits to this Agreement, Public Construction Bond, Performance Bond, Payment Bond and Certificates of Insurance, Notice of Award and Notice to Proceed, General Conditions, Special Conditions, Technical Specifications, Plans/Drawings, Addenda, Bid Form and supplement Affidavits and Agreements, all applicable provisions of State and Federal Law and any modification, including Change Orders or written amendments duly delivered after execution of Agreement, Invitation to Bid, Instructions to Bidders and Bid Bond, Contractor's response to the City's Invitation to Bid, Schedule of Completion, Schedule of Values, all amendments, modifications and supplements, work directive changes issued on or after the Effective Date of the Agreement, as well as any additional documents that are required to be submitted under the Agreement.

Permits on file with the City and/or those permits to be obtained shall be considered directive in nature and will be considered a part of this Agreement. A copy of all permits shall be given to the City for inclusion in the Contract Documents. Terms of permits shall be met prior to acceptance of the Work and release of the final payment.

1.10 Contract Price – The amount established in the bid submittal and award by the City's City Commission, its successors and assigns, as may be amended by Change Order.

1.11 Contract Time – The number of calendar days stated in the Agreement for the completion of the Work. The dates on which the work shall be started and shall be completed as stated in the Notice to Proceed.

1.12 Contractor – The person, firm, company, or corporation with whom the City has entered into the Agreement, including but not limited to its employees, agents, representatives, contractors, subcontractors, their subcontractors and their other successors and assigns.

1.13 Day – A calendar day of twenty-four (24) hours ending at midnight.

1.14 Defective – When modifying the word "Work" refers to work that is unsatisfactory, faulty, or deficient, or does not conform to the Contract Documents or does not meet the requirements of any inspection, test or approval referred to in the Contract Documents, or has been damaged prior to the Project Manager's recommendation of final payment.

1.15 Effective Date of the Agreement – The effective date of the Agreement shall be the date the City Commission approves the work.

1.16 Final Completion Date – The date the Work is completed, including completion of the final punch list, and delivered along with those items specified in the Contract Documents and is accepted by the City.

1.17 Hazardous Materials (HAZMAT) - Any solid, liquid, or gaseous material that is toxic, flammable, radioactive, corrosive, chemically reactive, or unstable upon prolonged storage in quantities that could pose a threat to life, property, or the environment defined in Section 101(14) of Comprehensive Environmental Response, Compensation and Liability Act of 1980 and in 40 CFR 300.6. Also defined by 49 CFR 171.8 as a substance or material designated by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce and which has been so designated.

1.18 Hazardous Substance - As defined by Section 101(14) of the Comprehensive Environmental Response, Compensation and Liability Act; any substance designated pursuant to Section 311(b) (2) (A) of the Clean Water Act; any element, compound, mixture, solution or substance designated pursuant to Section 102 identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act {but not including any waste listed under Section 307[a] of the Clean Water Act}; any hazardous air pollutant listed under Section 112 of the Clean Air Act; and any imminently hazardous chemical substance or mixture pursuant to Section 7 of the Toxic Substances Control Act. The term does not include petroleum, including crude oil or any fraction thereof, which is not otherwise specifically listed or designated as a hazardous substance in the first sentence of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

1.19 Hazardous Waste - Those solid wastes designated by OSHA in accordance with 40 CFR 261 due to the properties of ignitability, corrosivity, reactivity, or toxicity. Any material that is subject to the Hazardous Waste Manifest requirements of the EPA specified in 40 CFR Part 262.

1.20 Holidays - Those designated non-work days as established by the City Commission of the City of Fort Lauderdale.

1.21 Inspection – The term “inspection” and the act of inspecting as used in this Agreement is defined to mean the examination of construction to ensure that it conforms to the design concept expressed in the plans and specifications. This term shall not be construed to mean supervision, superintending and/or overseeing.

1.22 Notice of Award - The written notice by City to the Contractor stating that upon compliance by the Contractor with the conditions precedent enumerated therein, within the time specified that the City will sign and deliver this Agreement.

1.23 Notice to Proceed – A written notice to Contractor authorizing the commencement of the activities identified in the notice or as described in the Contract Documents.

1.24 Plans - The official graphic representations of this Project that are a part of the Contract Documents.

1.25 Premises (otherwise known as Site or Work Site) – means the land, buildings, facilities, etc. upon which the Work is to be performed.

1.26 Project – The construction project described in the Contract Documents, including the Work described therein.

1.27 Project Manager - The employee of the City, or other designated individual who is herein referred to as the Project Manager, will assume all duties and responsibilities and will have the rights and authorities assigned to the Project Manager in the contract Documents in connection with completion of the Work in accordance with this Agreement. The Project Manager, or designee, shall be the authorized agent for the City unless otherwise specified.

1.28 Punch List - The City's list of Work yet to be done or be corrected by the Contractor, before the Final Completion date can be determined by the City.

1.29 Record Documents - A complete set of all specifications, drawings, addenda, modifications, shop drawings, submittals and samples annotated to show all changes made during the construction process.

1.30 Record Drawings or "As-Builts" - A set of drawings which show significant changes in the work made during construction and which are usually based on drawings marked up in the field and other data furnished by the Contractor. These documents will be signed and sealed by a Professional Engineer or a Professional Land Surveyor licensed in the State of Florida and employed by the Contractor at no cost to the City.

1.31 Substantially Completed Date – A date when the Contractor has requested in writing, stating that the Work is substantially completed and is ready for an inspection and issuance of a final punch list for the Project. If, at the time of inspection, it is determined the project is substantially completed, the City will issue a letter of Substantial Completion along with a punch list of incomplete or deficient items to be completed prior to requesting a Final Completion inspection.

1.32 Work – The construction and services required by the Contract Documents, whether completed or partially completed, and includes all labor, materials, equipment, and services provided or to be provided by Contractor to fulfill Contractor's obligations. The Work may constitute the whole or a part of the Project.

ARTICLE 2 – SCOPE OF WORK

2.1 The Contractor shall complete all work as specified or indicated in the Contract Documents. The Project for which the Work under the Contract Documents may be the whole or only part is generally described as follows:

Fire Station 54 HVAC Retrofit (Re-Bid)
ITB #12736-1033 PROJECT #12735

2.2 All Work for the Project shall be constructed in accordance with the approved plans and Specifications. The Work generally involves:

PROJECT DESCRIPTION

This project is located at Fire Station 54, 3211 NE 32nd Street, in the City of Fort Lauderdale. The fire station is currently vacant. Its firefighters are currently housed in a mobile home on the opposite (south) side of Oakland Park Boulevard.

The HVAC equipment will be purchased by the City. Therefore, this will be a demolition and installation project only, with the City purchasing the HVAC equipment directly from the manufacturer and staging/storing most of the equipment in the Apparatus Bay of the fire station.

Limited Commissioning to be performed by the City's Owner's Representative.

The work to be accomplished under the resultant contract includes, but is not limited to: transportation of equipment from manufacturer to site; removal, disposal, fabrication of new ductwork, and installation of ceiling grid; removal disposal and installation of ductwork; floor penetrations for DOAS ductwork; structural analysis, design, materials, fabrication and installation (TBD) of new DOAS roof curb; removal and replacement of 2 RTU (6-7 ton), 1 split (20t) to be replaced by DOAS (15t), MAU, ceiling exhaust fans, VAVs, controls, and other HVAC equipment and controls. Equipment basis of design is specified in the Mechanical Permit Set plans but may be substituted by an "Approved Equal".

2.3 Within ten (10) days of the execution of this Agreement, the Contractor shall submit a Construction Schedule, Schedule of Values and a listing of all personnel employed. The general sequence of the Work shall be submitted by the Contractor and approved by the City before any work commences. The City reserves the right to issue construction directives necessary to facilitate the Work or to minimize any conflict with operations.

ARTICLE 3 – PROJECT MANAGER

3.1 The Project Manager is hereby designated by the City as Ana Ziegler whose address is 100 North Andrews, 4th Floor, Fort Lauderdale, Florida 33301-1016, telephone number: (954) 828- 5817, and e-mail address is AZiegler@fortlauderdale.gov. The Project Manager will assume all duties and responsibilities and will have the rights and authorities assigned to the Project Manager in the Contract Documents in connection with completion of the Work in accordance with this Agreement.

ARTICLE 4 – CONTRACT DOCUMENTS

The Contract Documents, which comprise the entire Agreement between the City and Contractor, are incorporated herein and attached to this Agreement, and consist of the following:

4.1 This Agreement.

4.2 Exhibits to this Agreement: (Plans sheets [ ] to [ ] inclusive).

4.3 Public Construction Bond, Performance Bond, Payment Bond and Certificates of Insurance.

4.4 Notice of Award and Notice to Proceed.

4.5 General Conditions and Special Conditions.

4.6 Technical Specifications.

4.7 Plans/Drawings.

4.8 Addenda number _____ through _____, inclusive.

4.9 Bid Form and supplement Affidavits and Agreements.

4.10 All applicable provisions of State and Federal Law.

4.11 Invitation to Bid No., 12736-1033, Instructions to Bidders, and Bid Bond.

4.12 Contractor's response to the City's Invitation to Bid No., 12736-1033, dated _____.

4.13 Schedule of Completion.

4.14 All amendments, modifications and supplements, change orders and work directive Changes, issued on or after the Effective Date of the Agreement.

4.15 Any additional documents that are required to be submitted under the Agreement.

4.16 Permits on file with the City and or those permits to be obtained shall be considered directive in nature and will be considered a part of this Agreement.

In the event of any conflict between the documents or any ambiguity or missing specification or instruction, the following priority is established:

a. Approved change orders, addenda or amendments.

b. Specifications and Drawings.

c. Special Conditions.

d. General Conditions.

e. This Agreement dated _____, and any attachments.

f. Invitation to Bid No., 12736-1033, and the specifications prepared by the City.

g. Contractor's response to the City's Invitation to Bid No., 12736-1033, dated _____.

h. Schedule of Values.

i. Schedule of Completion.

If during the performance of the Work, Contractor finds a conflict, error or discrepancy in the Contract Documents, Contractor shall so report to the Project Manager, in writing, within five

(5) calendar days, and before proceeding with the Work affected shall obtain a written interpretation or clarification from the City.

Any Work that may reasonably be inferred from the specifications or plans as being required to produce the intended result shall be supplied whether or not it is specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials, or equipment, such works shall be interpreted in accordance with such meaning. Reference to standard specifications, manuals or codes of any technical society, organization or associations, or to the code of any governmental authority whether such reference be specific or implied, shall mean the latest standard specification, manual or code in effect as of the Effective Date of this Agreement, except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall change the duties and responsibilities of the City, the Contractor, or any of their agents or employees from those set forth in the Contract Documents.

ARTICLE 5 – CONTRACT TIME

5.1 The Contractor recognizes that **TIME IS OF THE ESSENCE**. The Work shall commence within **SEVEN** (7) calendar days of the date of the Notice to Proceed.

5.2 The Work shall be Substantially Completed within **NINETY** (90) calendar days after the date when the Contract Time commences to run as provided in the Notice to Proceed.

5.3 The Work shall be finally completed on the Final Completion Date and ready for final payment in accordance with this Agreement within **ONE HUNDRED TWENTY** (120) calendar days after the date when the Contract Time commences to run as provided in the Notice to Proceed.

ARTICLE 6 – CONTRACT PRICE

6.1 City shall pay Contractor for performance of the Work in accordance with Article 7, subject to additions and deletions by Change Order, as provided for in this Agreement.

6.2 The Parties expressly agree that the Contract Price, which shall not exceed the amount of **$**_____, constitutes the total maximum compensation payable to Contractor for performing the Work, plus any Work done pursuant to a Change Order. The Contract Price is in accordance with the line items unit prices listed in the Bid. Line items are based on a unit price cost multiplied by a defined quantity. Any additional duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change to the Contract Price.

6.3 The Contract Price constitutes the compensation payable to Contractor for performing the Work plus any Work done pursuant to a Change Order. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract price.

ARTICLE 7 – PAYMENT

7.1 Contractor shall submit Applications for Payment in accordance with the Contract Documents. Applications for Payment will be processed by City as provided for in the General Conditions.

7.2 Progress Payments. City shall make progress payments on account of the Contract Price on the basis of Contractor's monthly Applications for Payment, which shall be submitted by the Contractor between the first (1st) and the tenth (10th) day after the end of each calendar month for which payment is requested. All progress payments will be made on the basis of the progress of the Work completed.

7.3 Prior to Final Completion, progress payments will be made in an amount equal to ninety-five percent (95%) of the value of Work completed less in each case the aggregate of payments previously made.

7.4 Final Payment. Upon final completion of the Work in accordance with the General Conditions, as may be supplemented, the City shall pay Contractor an amount sufficient to increase total payments to one hundred percent (100%) of the Contract Price. However, not less than five percent (5%) of the Contract Price shall be retained until Record Drawings (as-builts), specifications, addenda, modifications and shop drawings, including all manufacturers' instructional and parts manuals are delivered to and accepted by the City.

7.5 City may withhold, in whole or in part, payment to such extent as may be necessary to protect itself from loss on account of:

7.5.1 Defective work not remedied.
7.5.2 Claims filed or reasonable evidence indicating probable filing of claims by other parties against Contractor or City because of Contractor's performance.
7.5.3 Failure of Contractor to make payments properly to subcontractors or for material or labor.
7.5.4 Damage to another contractor not remedied.
7.5.5 Liquidated damages and costs incurred by Consultant for extended construction administration, if applicable.
7.5.6 Failure of Contractor to provide any and all documents required by the Contract Documents.

When the above grounds are removed or resolved satisfactory to the Project Manager, payment shall be made in whole or in part.

7.6 The City shall make payment to the Contractor in accordance with the Florida Prompt Payment Act, Section 218.70, Florida Statutes (2021), as amended or revised, provided, however, complete and error free pay application is submitted.

7.7 The City shall make payment to the Contractor through utilization of the City's Purchasing Card (P-Card) Program. The City has implemented a P-Card Program utilizing the MASTERCARD and VISA networks. Purchases from this contract will be made utilizing the City's P-Card. Contractor will receive payment from the purchasing card in the same manner as other credit card purchases. Accordingly, Contractor must

presently have the ability to accept these credit cards or take whatever steps necessary to implement the ability before the start of the contract term, or contract award by the City. All costs associated with the Contractor's participation in this purchasing program shall be borne by the Contractor. The City reserves the right to revise this program as necessary.

7.8 Payment Card Industry (PCI) Compliance

Contractor agrees to comply with all applicable state, federal and international laws, as well as industry best practices, governing the collection, access, use, disclosure, safeguarding and destruction of Protected Information.

Contractor and/or any subcontractor that handles credit card data must be, and remain, PCI compliant under the current standards and will provide documentation confirming compliance upon request by the City of Fort Lauderdale. Failure to produce documentation could result in termination of the contract.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

In order to induce the City to enter into this Agreement, Contractor makes the following representations upon which the City has relied:

8.1 Contractor is qualified in the field of public construction and in particular to perform the Work and services set forth in this Agreement.

8.2 Contractor has visited the Work Site, has conducted extensive tests, examinations and investigations and represents and warrants a thorough familiarization with the nature and extent of the Contract Documents, the Work, locality, soil conditions, water table condition, moisture conditions and all year-round local weather and climate conditions (past and present), and examination and investigations conducted by Contractor and the Contractor's experts, has determined that no conditions exist that would in any manner affect the Proposed Price and that the project can be completed for the Proposed Price submitted within the Contract Time as defined in this Agreement.

Furthermore, Contractor warrants and confirms that it is totally familiar with, understands and obligates Contractor to comply with all federal, state and local laws, ordinances, rules, regulations and all market conditions that affect or may affect the cost and price of materials and labor needed to fulfill all provisions of this Agreement or that in any manner may affect cost, progress or performance of the Work.

8.3 The Contractor has satisfied itself as to the nature and location of the Work under the Contract Documents, the general and local conditions of the Project, particularly those bearing upon availability of transportation, disposal, handling and storage of materials, availability of labor, water, electric power, and roads, the conformation and conditions at the ground based on City provided reports, the type of equipment and facilities needed preliminary to and during the prosecution of the Work and all other matters which can in any way affect the Work or the cost thereof under the Contract Documents.

8.4 The Contractor has also studied on its own, investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Works, and finds and has further determined that no conditions exist that would in any manner affect the Proposed Price and that the Project can be completed for the Proposed Price submitted.

8.5 Contractor has made or caused to be made, examinations, investigations, tests and studies of such reports and related data in addition to those referred to in Paragraphs 8.2, 8.3 and 8.4 above as it deems necessary for the performance of the Work at the Contract Prices, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents; and no additional examinations, investigations, tests, reports or similar data are, or will be, required by Contractor for such purposes.

8.6 Contractor has correlated the results of all such observations, examinations, investigations, tests, reports and data with the terms and conditions of the Contract Documents.

8.7 Contractor has given City written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution by City is acceptable to the Contractor.

8.8 Labor

8.8.1 The Contractor shall provide competent, suitable qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. The Contractor shall at all times maintain good discipline and order at the site.

8.8.2 The Contractor shall, at all times, have a competent superintendent, capable of reading and thoroughly understanding the drawings and specifications, as the Contractor's agent on the Work, who shall, as the Contractor's agent, supervise, direct and otherwise conduct the Work.

8.8.3 The Contractor shall designate the superintendent on the job to the City, in writing, immediately after receipt of the Notice to Proceed. The Contractor understands and agrees that the superintendent's physical presence on the job site is indispensable to the successful completion of the Work. If the superintendent is frequently absent from the job site, the Project Manager may deliver written notice to the Contractor to stop work or terminate the Agreement in accordance with Article 17.

8.8.4 Where required and necessary, the contractor shall, at all times, have a certified "competent person" assigned to the job site. The Contractor shall assign personnel to the job site that have successfully completed training programs related to trench safety, confined space work, and maintenance of traffic (MOT). Personnel certified by the International Municipal Signal Associations with Florida Department of Transportation qualifications are required relative to MOT. Any other certifications that may be required by applicable permitting agencies for the Work shall also be complied with by the Contractor. Failure to pursue the Work

with the properly certified supervisory staff may result in notice to stop work or terminate the Agreement in accordance with Article 17.

8.9 Materials:

8.9.1 The Contractor shall furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water and sanitary facilities and all other facilities and incidentals necessary for the execution, testing, initial operation and completion of Work.

8.9.2 All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. Suppliers shall be selected and paid by the Contractor; the City reserves the right to approve all suppliers and materials.

8.10 Work Hours: Except in connection with the safety or protection of persons, or the Work, or property at the site or adjacent thereto, and except as otherwise indicated in the Supplementary Conditions, all work at the site shall be performed during regular working hours between 8 a.m. and 5:00 p.m., Monday through Friday.

Unless approved by the City in advance, the Contractor will not perform work on Saturday, Sunday or any legal holiday (designated by the City of Fort Lauderdale) without the Project Manager's written consent at least seventy-two (72) hours in advance of starting such work. For any overtime inspection required by City personnel, the Contractor shall pay for the additional charges to the City with respect to such overtime work. Such additional charges shall be a subsidiary obligation of the Contractor and no extra payment shall be made to the Contractor for overtime work. **It shall be noted that the City's Inspector work hours are from 8:00 a.m. to 4:30 p.m., Monday through Friday, and any work requiring inspection oversight being performed outside of this timeframe shall be paid for by the Contractor as Inspector overtime at a rate of $100.00 per hour.** The cost to the Contractor to reimburse the City for overtime inspection is established at direct-labor and overtime costs for each person or inspector required. Incidental overtime costs for engineering, testing and other related services will also be charged to the Contractor at the actual rate accrued.

8.11 Patent Fee and Royalties: The Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work, or any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. The Contractor hereby expressly binds himself or itself to indemnify and hold harmless the City from all such claims and fees and from any and all suits and action of every name and description that may be brought against City on account of any such claims, fees, royalties, or costs for any such invention or patent, and from any and all suits or actions that may be brought against said City for the infringement of any and all patents or patent rights claimed by any person, firm corporation or other entity.

8.12 Permits: The Contractor shall obtain and pay for all permits and licenses. There shall be no allowance for Contractor markup, overhead or profit for permits and licenses.

The Contractor shall pay all government charges which are applicable at the time of opening of proposals. It shall be the responsibility of the Contractor to secure and pay for all necessary licenses and permits of a temporary nature necessary for the prosecution of Work.

8.13 Law and Regulations: The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations applicable to the Work. If the Contractor observes that the specifications or plans are in conflict, the Contractor shall give the Project Manager prompt written notice thereof within five (5) calendar days, and any necessary changes shall be adjusted by any appropriate modifications. If the Contractor performs any work knowing or having reason to know that it is contrary to such laws, ordinances, rules, standards, specifications and regulations, and without such notice to the Project Manager, the Contractor shall bear all costs arising therefrom.

8.14 Taxes: The Contractor shall pay all sales, consumer, use and other similar taxes required to be paid by him in accordance with the laws of the City of Fort Lauderdale, County of Broward, and the State of Florida.

8.15 Contractor Use of Premises: The Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workmen to areas permitted by law, ordinances, permits and/or the requirements of the Contract Documents, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment.

The Contractor shall not enter upon private property for any purpose without first securing the permission of the property owner in writing and furnishing the Project Manager with a copy of said permission. This requirement will be strictly enforced, particularly with regard to such vacant properties as may be utilized for storage or staging by the Contractor.

The Contractor shall conduct its work in such a manner as to avoid damage to adjacent private or public property. Any damage to existing structures of work of any kind, including permanent reference markers or property corner markers, or the interruption of a utility service, shall be repaired or restored promptly at no expense to the City or property owner.

The Contractor will preserve and protect all existing vegetation such as trees, shrubs and grass on or adjacent to the site which do not reasonably interfere with the construction, as determined by the Project Manager. The Contractor will be responsible for repairing or replacing any trees, shrubs, lawns and landscaping that may be damaged due to careless operation of equipment, stockpiling of materials, tracking of grass by equipment or other construction activity. The Contractor will be liable for, or will be required to replace or restore at no expense to the City all properties and areas not protected or preserved as required herein that may be destroyed or damaged.

During the progress of the Work, the Contractor shall keep the premises free from accumulation of waste materials, rubbish and debris resulting from the Work. At the completion of the Work, the Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery, and surplus materials and shall leave the site clean and

ready for occupancy by the City. The Contractor shall restore to their original condition those portions of the site not designated for alteration by the Contract Documents at no cost to the City.

8.16 Project Coordination: The Contractor shall provide for the complete coordination of the construction effort. This shall include, but not necessarily be limited to, coordination of the following:

8.16.1 Flow of material and equipment from suppliers.
8.16.2 The interrelated work with affected utility companies.
8.16.3 The interrelated work with the City where tie-ins to existing facilities are required.
8.16.4 The effort of independent testing agencies.
8.16.5 Notice to affected property owners as may be directed by the Project Manager.
8.16.6 Coordination with and scheduling of all required inspections from all permitting agencies.

8.17 Project Record Documents and Final As-Builts (Record Drawings): Contractor shall be responsible for maintaining up-to-date redline as-built drawings, on site, at all times during construction. All as-built information shall be surveyed and verified by a professional land surveyor registered in the State of Florida. Contractor shall provide the City with a minimum of three (3) sets of signed and sealed record drawings (Final As-Builts) and a CD of the electronic drawings files created in AutoCad 2014 or later. All costs associated with survey work required for construction layout and as-built preparation shall be the responsibility of the Contractor.

8.18 Safety and Protection:

8.18.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

8.18.1.1 All employees working on the project and other persons who may be affected thereby.

8.18.1.2 All the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site.

8.18.1.3 Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

8.18.2 The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. The Contractor shall notify owners of adjacent property and utilities when execution of the Work may affect them at least seventy-two (72) hours in advance (unless otherwise required). All damage, injury or loss to any property caused, directly or indirectly, in whole or in part by the Contractor, any subcontractor or anyone

directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by the Contractor. The Contractor's duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and accepted by the City.

8.19 Emergencies: In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the City, is obligated to act to prevent threatened damage, injury or loss. The Contractor shall give the Project Manager prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby.

8.20 Risk of Loss: The risk of loss, injury or destruction shall be on the Contractor until acceptance of the Work by the City. Title to the Work shall pass to the City upon acceptance of the Work by the City.

8.21 Environmental: The Contractor has fully inspected the Premises and agrees, except as to the presence of any asbestos, to accept the Premises in an "as is" physical condition, without representation or warranty by the City of any kind, including, without limitation, any and all existing environmental claims or obligations that may arise from the presence of any "contamination" on, in or about the Premises. Further, Contractor and all entitles claiming by, through or under the Contractor, releases and discharges the City from any claim, demand, or cause of action arising out of or relating to the Contractor's use, handling, storage, release, discharge, treatment, removal, transport, decontamination, cleanup, disposal and/or presence of any hazardous substances including asbestos on, under, from or about the Premises. The Contractor shall have no liability for any pre-existing claims or "contamination" on the Premises.

The Contractor shall not use, handle, store, discharge, treat, remove, transport, or dispose of Hazardous Substances including asbestos at, in, upon, under, to or from the Premises until receipt of instructions from the City. At such time, a City approved Change Order, which shall not include any profit, shall authorize the Contractor to perform such services.

The Contractor shall immediately deliver to the Project Manager complete copies of all notices, demands, or other communications received by the Contractor from any governmental or quasi-governmental authority or any insurance company or board of fire underwriters or like or similar entities regarding in any way alleged violations or potential violations of any Environmental Law or otherwise asserting the existence or potential existence of any condition or activity on the Premises which is or could be dangerous to life, limb, property, or the environment.

For other and additional consideration, the Contractor hereby agrees, at its sole cost and expense, to indemnify and protect, defend, and hold harmless the City and its respective employees, agents, officials, officers, representatives, contractors and subcontractors, successors, and assigns (hereafter the "City") from and against any and all claims, demands, losses, damages, costs, expenses, including but not limited to mitigation, restoration, and natural restoration expenses, liabilities, assessments, fines, penalties charges, administrative and judicial proceedings and orders, judgments, causes of action, in law or in equity, remedial action requirements and/or enforcement

actions of any kind (including, without limitation, attorneys' fees and costs) directly or indirectly arising out of or attributable to, in whole or in part, the Contractor's use, handling, storage, release, threatened release, discharge, treatment, removal, transport, decontamination, cleanup, disposal and/or presence of a Hazardous Substance (excluding asbestos) on, under, from, to or about the Premises or any other activity carried on or undertaken on or off the Premises by the Contractor or its employees, agents or subcontractors, in connection with the use, handling, storage, release, threatened release, discharge, treatment, mitigation, natural resource restoration, removal, transport, decontamination, cleanup, disposal and/or presence or any Hazardous Substance including asbestos located, transported, or present on, undue, from, to, or about the Premises. This indemnity is intended to be operable under 42 U.S.C. Section 9607, as amended or revised, and any successor section.

The scope of the indemnity obligations includes, but is not limited to: (a) all consequential damages; (b) the cost of any required or necessary repair, cleanup, or detoxification of the applicable real estate and the preparation and implementation of any closure, remedial or other required plan, including without limitation; (i) the costs of removal or remedial action incurred by the United States government or the State of Florida or response costs incurred by any other person, or damages from injury to destruction of, or loss of, natural resources, including the cost of assessing such injury, destruction, or loss, incurred pursuant to the Comprehensive Environmental Response, Compensation and Liability Act, as amended; (ii) the clean-up costs, fines, damages, or penalties incurred pursuant to any applicable provisions of Florida law; and (iii) the cost and expenses of abatement, correction or cleanup, fines, damages, response costs, or penalties which arise from the provisions of any other statute, law, regulation, code ordinance, or legal requirement state or federal; and (c) liability for personal injury or property damage arising under any statutory or common law tort theory, including damages assessed for the maintenance of a public private nuisance, response costs, or for the carrying on of an abnormally dangerous activity.

8.22 No Extended Damages: For other and additional good and valuable consideration the receipt and sufficiency of which is hereby acknowledged, the Contractor covenants and agrees that in the event of any delay of construction or for any other reason or allegation or claim, and notwithstanding the reason of the delay, reason, claim or allegation or who caused them or the construction delay or whether they were caused by the City, that there will be no entitlement to Contractor to or for any direct or indirect financial damages or losses for extended corporate overhead impact, extended project overhead impacts, project support services, mobilization or demobilization or by whatever other label or legal concept or theory and types of names or labels or basis such claims may have, or any business damages or losses of whatever type or nature, and Contractor hereby waives any right to make any such claim or claims. This provision will have application and effect when construction delays are anticipated and agreed upon by both the City and the Contractor.

8.23 No Liens: If any subcontractor, supplier, laborer, or materialmen of Contractor or any other person directly or indirectly acting for or through Contractor files or attempts to file a mechanic's or construction lien against the real property on which the Work is performed or any part or against any personal property or improvements or claim against any monies due or to become due from the City to Contractor or from Contractor to a subcontractor, for or on account of any work, labor, services, material, equipment, or

other items furnished in connection with the Work or any Change Order, Contractor agrees to satisfy, remove, or discharge such lien or claim at its own expense by bond, payment, or otherwise within twenty (20) days of the filing or from receipt of written notice from the City.

Additionally, until such time as such lien or claim is satisfied, removed or discharged by Contractor, all monies due to Contractor, or that become due to Contractor before the lien or claim is satisfied, removed or otherwise discharged, shall be held by City as security for the satisfaction, removal and discharge of such lien and any expense that may be incurred while obtaining such. If Contractor shall fail to do so, City shall have the right, in addition to all other rights and remedies provided by this Agreement or by law, to satisfy, remove, or discharge such lien or claim by whatever means City chooses at the entire and sole cost and expense of Contractor which costs and expenses shall, without limitation, include attorney's fees, litigation costs, fees and expenses and all court costs and assessments.

8.24 Weather Emergencies: Upon issuance of a hurricane watch by the National Weather Service, the Contractor shall submit to the City a plan to secure the work area in the event a hurricane warning is issued. The plan shall detail how the Contractor will secure the Premises, equipment and materials in a manner as to prevent damage to the Work and prevent materials and equipment from becoming a hazard to persons and property on and around the Premises. The plan shall include a time schedule required to accomplish the hurricane preparations and a list of emergency contacts that will be available, and in the City before, during and immediately after the storm.

Upon issuance of a hurricane warning by the National Weather Service, if the Contractor has not already done so, the Contractor shall implement its hurricane preparedness plan. Cost of development and implementation of the hurricane preparedness plan shall be considered as incidental to construction. Cost of any clean up and rework required after the storm will be considered normal construction risk within Florida and shall not entitle the Contractor to any additional compensation. Contractor shall be entitled to request an extension in time for completion of the Work, in accordance with the provisions of Article 15 of this Agreement, equal to the time it is shut down for implementation of the preparedness plan, the duration of the storm and a reasonable period to restore the Premises.

8.25 Force Majeure: No Party shall hold the other responsible for damages or for delays in performance caused by force majeure, acts of God, or other acts or circumstances beyond the control of the other party or that could not have been reasonably foreseen and prevented. For this purpose, such acts or circumstances shall include, but not be limited to weather conditions affecting performance, floods, epidemics, pandemics, war, act of Governmental Authority, state of emergency, riots, strikes, lockouts, or other industrial disturbances, or protest demonstrations. Should such acts or circumstances occur, the parties shall use their best efforts to overcome the difficulties arising therefrom and to resume the Work as soon as reasonably possible with the normal pursuit of the Work.

Inclement weather, continuous rain for less than three (3) days or the acts or omissions of subcontractors, third-party contractors, materialmen, suppliers, or their subcontractors, shall not be considered acts of force majeure.

No Party shall be liable for its failure to carry out its obligations under the Agreement during a period when such Party is rendered unable by force majeure to carry out its obligation, but the obligation of the Party or Parties relying on such force majeure shall be suspended only during the continuance of the inability and for no longer period than the unexpected or uncontrollable event.

The Contractor further agrees and stipulates, that its right to excuse its failure to perform by reason of force majeure shall be conditioned upon giving written notice of its assertion that a Force Majeure delay has commenced within ninety-six (96) hours after such an occurrence. The Contractor shall use its reasonable efforts to minimize such delays. The Contractor shall promptly provide an estimate of the anticipated additional time required to complete the Project.

8.26 Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assisted Contracts: The recipient shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of any DOT-assisted contract or in the administration of its DBE program or the requirements of 49 CFR Part 26. The recipient shall take all necessary and reasonable steps under 49 CFR Part 26 to ensure nondiscrimination in the award and administration of DOT-assisted contracts. The recipient's DBE program, as required by 49 CFR Part 26 and as approved by DOT, is incorporated by reference in this Agreement. Implementation of this program is a legal obligation and failure to carry out its terms shall be treated as a violation of this Agreement. Upon notification to the recipient of its failure to carry out its approved program, the Department may impose sanctions as provided for under Part 26 and may, in appropriate cases, refer the matter for enforcement under 18 U.S.C. 1001 and/or the Program Fraud Civil Remedies Act of 1986 (31 U.S.C. 3801 *et seq.*).

Additionally, the Contractor assures that it, the sub-recipient or its subcontractors shall not discriminate on the basis of race, color, national origin, or sex in the performance of this Agreement. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this Agreement, which may result in the termination of this Agreement or such other remedy as the recipient deems appropriate. This additional language must be included in each subcontract the prime Contractor signs with a subcontractor.

ARTICLE 9 – CITY'S RESPONSIBILITIES

9.1 The City shall furnish the data required of the City under the Contract Documents promptly and shall make payments to the Contractor promptly after they are due as provided in Article 7.

9.2 The City shall provide public rights-of-way and easement, where available, for the installation of conduits, transformers pads and related appurtenances only.

9.3 Technical Clarifications and Interpretations:

9.3.1 The City shall issue, with reasonable promptness, such written clarifications or interpretations of the Contract Documents as it may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. Should the Contractor fail to request interpretation of questionable items in the Contract Documents, the City shall not entertain any excuse for failure to execute the Work in a satisfactory manner.

9.3.2 The City shall interpret and decide matters concerning performance under the requirements of the Contract Documents, and shall make decisions on all claims, disputes or other matters in question. Written notice of each claim, dispute or other matter will be delivered by claimant to the other Party but in no event later than five (5) days after the occurrence of event, and written supporting data will be submitted to the other Party within five (5) days after such occurrence. All written decisions of the City on any claim or dispute will be final and binding.

9.4 The Contractor shall perform all Work to the reasonable satisfaction of the City in accordance with the Contract Documents. In cases of disagreement or ambiguity, the City shall decide all questions, difficulties, and disputes of whatever nature, which may arise under or by reason of this Agreement or the quality, amount and value of the Work, and the City's decisions on all claims, questions and determination are final.

9.5 Cancellation for Unappropriated Funds**:** The obligation of the City for payment to a Contractor is limited to the availability of funds appropriated in a current fiscal period, and continuation of the contract into a subsequent fiscal period is subject to appropriation of funds, unless otherwise authorized by law.

ARTICLE 10 – BONDS AND INSURANCE

10.1 Public Construction and Other Bonds: The Contractor shall furnish Public Construction or Performance and Payment Bonds ("Bond"), each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all the Contractor's obligations under the Contract Documents. These Bonds shall remain in effect until at least one (1) year after the date of final payment, except as otherwise provided by law. All Bonds shall be furnished and provided by the surety and shall be in substantially the same form as prescribed by the Contract Documents and be executed by such sureties as (i) are licensed to conduct business in the State of Florida, and (ii) are named in the current list of Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department and (iii) otherwise meet the requirements set forth herein that apply to sureties. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

10.1.1 Performance Bond: The Contractor shall execute and record in the public records of Broward County, Florida, a payment and performance bond in an amount at least equal to the Contract Price with a surety insurer authorized to do business in the State of Florida as surety, ("Bond"), in accordance with Section 255.05, Florida Statutes (2021), as may be amended or revised, as security for

the faithful performance and payment of all of the Contractor's obligations under the Contract Documents.

A Corporate Surety Bond legally issued, meeting the approval of, and running to the City in an amount not less than the Contract Price of such improvements, conditioned that the Contractor shall maintain and make all repairs to the improvements constructed by the Contractor at their own expense and free of charge to the City, for the period of one (1) year after the date of acceptance of the Work within such period by reason of any imperfection of the material used or by reason of any defective workmanship, or any improper, imperfect or defective preparation of the base upon which any such improvement shall be laid.

10.2 Disqualification of Surety: If the Surety on any Bond furnished by the Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of Florida or it ceases to meet the requirements of clauses (i) and (ii) of Paragraph 10.1, the Contractor shall within five (5) days thereafter substitute another Bond and Surety, both of which shall be acceptable to the City.

10.3 Insurance

As a condition precedent to the effectiveness of this Agreement, during the term of this Agreement and during any renewal or extension term of this Agreement, the Contractor, at its sole expense, shall provide insurance of such types and with such terms and limits as noted below. Providing proof of and maintaining adequate insurance coverage are material obligations of the Contractor. The Contractor shall provide the City a certificate of insurance evidencing such coverage. The Contractor's insurance coverage shall be primary insurance for all applicable policies. The limits of coverage under each policy maintained by the Contractor shall not be interpreted as limiting the Contractor's liability and obligations under this Agreement. All insurance policies shall be through insurers authorized or eligible to write policies in the State of Florida and possess an A.M. Best rating of A-, VII or better, subject to approval by the City's Risk Manager.

The coverages, limits, and/or endorsements required herein protect the interests of the City, and these coverages, limits, and/or endorsements shall in no way be relied upon by the Contractor for assessing the extent or determining appropriate types and limits of coverage to protect the Contractor against any loss exposures, whether as a result of this Agreement or otherwise. The requirements contained herein, as well as the City's review or acknowledgement, are not intended to and shall not in any manner limit or qualify the liabilities and obligations assumed by the Contractor under this Agreement.

The following insurance policies and coverages are required:

Commercial General Liability
Coverage must be afforded under a Commercial General Liability policy with limits not less than:

- $1,000,000 each occurrence and $2,000,000 aggregate for Bodily Injury, Property Damage, and Personal and Advertising Injury
- $1,000,000 each occurrence and $2,000,000 aggregate for Products and Completed Operations

Policy must include coverage for contractual liability and independent contractors.

The City, a Florida municipal corporation, its officials, employees, and volunteers are to be covered as an additional insured with a CG 20 26 04 13 Additional Insured – Designated Person or Organization Endorsement or similar endorsement providing equal or broader Additional Insured Coverage with respect to liability arising out of activities performed by or on behalf of the Contractor. The coverage shall contain no special limitation on the scope of protection afforded to the City, its officials, employees, and volunteers.

Professional Liability
Coverage must be afforded for Wrongful Acts in an amount not less than $1,000,000 each claim and $2,000,000 aggregate.

Contractor must keep the professional liability insurance in force until the third anniversary of expiration or early termination of this Agreement or the third anniversary of acceptance of work by the City, whichever is longer, which obligation shall survive expiration or early termination of this Agreement.

Pollution and Remediation Legal Liability (Hazardous Materials)
For the purpose of this section, the term "hazardous materials" includes all materials and substances that are designated or defined as hazardous by Florida or federal law or by the rules or regulations of Florida or any federal agency. If work being performed involves hazardous materials, the Contractor shall procure and maintain any or all of the following coverage, which will be specifically addressed upon review of exposure.

Contractors Pollution Liability Coverage
For sudden and gradual occurrences and in an amount not less than $1,000,000 per claim arising out of this Agreement, including but not limited to, all hazardous materials identified under the Agreement.

Asbestos Liability Coverage
For sudden and gradual occurrences and in an amount not less than $1,000,000 per claim arising out of work performed under this Agreement.

Business Automobile Liability
Coverage must be afforded for all Owned, Hired, Scheduled, and Non-Owned vehicles for Bodily Injury and Property Damage in an amount not less than $1,000,000 combined single limit each accident.

If the Contractor does not own vehicles, the Contractor shall maintain coverage for Hired and Non-Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Liability policy.

Crane and Rigging Liability
Coverage must be afforded for any crane operations under the Commercial General or Business Automobile Liability policy as necessary, in line with the limits of the associated policy.

Workers' Compensation and Employer's Liability
Coverage must be afforded per Chapter 440, Florida Statutes. Any person or entity performing work for or on behalf of the City must provide Workers' Compensation insurance. Exceptions and exemptions will be allowed by the City's Risk Manager, if they are in accordance with Florida Statute.

The Contractor waives, and the Contractor shall ensure that the Contractor's insurance carrier waives, all subrogation rights against the City, its officials, employees, and volunteers for all

losses or damages. The City requires the policy to be endorsed with WC 00 03 13 Waiver of our Right to Recover from Others or equivalent.

The Contractor must be in compliance with all applicable State and federal workers' compensation laws, including the U.S. Longshore Harbor Workers' Act and the Jones Act, if applicable.

Insurance Certificate Requirements

a. The Contractor shall provide the City with valid Certificates of Insurance (binders are unacceptable) no later than ten (10) days prior to the start of work contemplated in this Agreement.
b. The Contractor shall provide to the City a Certificate of Insurance having a thirty (30) day notice of cancellation; ten (10) days' notice if cancellation is for nonpayment of premium.
c. In the event that the insurer is unable to accommodate the cancellation notice requirement, it shall be the responsibility of the Contractor to provide the proper notice. Such notification will be in writing by registered mail, return receipt requested, and addressed to the certificate holder.
d. In the event the Agreement term or any surviving obligation of the Contractor following expiration or early termination of the Agreement goes beyond the expiration date of the insurance policy, the Contractor shall provide the City with an updated Certificate of Insurance no later than ten (10) days prior to the expiration of the insurance currently in effect. The City reserves the right to suspend the Agreement until this requirement is met.
e. The Certificate of Insurance shall indicate whether coverage is provided under a claims-made or occurrence form. If any coverage is provided on a claims-made form, the Certificate of Insurance must show a retroactive date, which shall be the effective date of the initial contract or prior.
f. The City shall be named as an Additional Insured on all liability policies, with the exception of Workers' Compensation and Professional Liability.
g. The City shall be granted a Waiver of Subrogation on the Contractor's Workers' Compensation insurance policy.
h. The title of the Agreement, Bid/Contract number, event dates, or other identifying reference must be listed on the Certificate of Insurance.

The Certificate Holder should read as follows:
City of Fort Lauderdale
100 N. Andrews Avenue
Fort Lauderdale, FL 33301

The Contractor has the sole responsibility for all insurance premiums and shall be fully and solely responsible for any costs or expenses as a result of a coverage deductible, co-insurance penalty, or self-insured retention; including any loss not covered because of the operation of such deductible, co-insurance penalty, self-insured retention, or coverage exclusion or limitation. Any costs for adding the City as an Additional Insured shall be at the Contractor's expense.

If the Contractor's primary insurance policy/policies do not meet the minimum requirements, as set forth in this Agreement, the Contractor may provide evidence of an Umbrella/Excess insurance policy to comply with this requirement.

The Contractor's insurance coverage shall be primary insurance as respects to the City, a Florida municipal corporation, its officials, employees, and volunteers. Any insurance or self-insurance maintained by the City, a Florida municipal corporation, its officials, employees, or volunteers shall be non-contributory.

Any exclusion or provision in any insurance policy maintained by the Contractor that excludes coverage required in this Agreement shall be deemed unacceptable and shall be considered breach of contract.

All required insurance policies must be maintained until the contract work has been accepted by the City, or until this Agreement is terminated, whichever is later. Any lapse in coverage shall be considered breach of contract. In addition, Contractor must provide to the City confirmation of coverage renewal via an updated certificate should any policies expire prior to the expiration of this Agreement. The City reserves the right to review, at any time, coverage forms and limits of Contractor's insurance policies.

The Contractor shall provide notice of any and all claims, accidents, and any other occurrences associated with this Agreement to the Contractor's insurance company or companies and the City's Risk Management office, as soon as practical.

It is the Contractor's responsibility to ensure that any and all of the Contractor's independent contractors and subcontractors comply with these insurance requirements. All coverages for independent contractors and subcontractors shall be subject to all of the applicable requirements stated herein. Any and all deficiencies are the responsibility of the Contractor.

NOTE: CITY PROJECT NUMBER, PROJECT NAME AND BID NUMBER MUST APPEAR ON EACH CERTIFICATE, AND THE CITY OF FORT LAUDERDALE MUST BE NAMED ON THE CERTIFICATE AS AN "ADDITIONAL INSURED" ON REQUIRED LIABILITY POLICIES.

A Sample Insurance Certificate shall be included with the proposal to demonstrate the firm's ability to comply with insurance requirements. Provide a previous certificate or other evidence listing the insurance companies' names for all required coverage, and the dollar amounts of the coverage.

ARTICLE 11- WARRANTY AND GUARANTEE, TESTS AND INSPECTIONS, CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

11.1 Warranty: The Contractor warrants and guarantees to the City that all Work will be in accordance with the Contract Documents and will not be defective. Prompt notice of all defects shall be given to the Contractor. All defective work, whether or not in place, may be rejected, corrected or accepted as provided in this Article.

11.1.1 Warranty of Title: The Contractor warrants to the City that it possesses good, clear and marketable title to all equipment and materials provided and that there are no pending liens, claims or encumbrances against the equipment and materials.

11.1.2 Warranty of Specifications: The Contractor warrants that all equipment, materials and workmanship furnished, whether furnished by the Contractor, its subcontractors or suppliers, will comply with the specifications, drawings and other descriptions supplied or adopted and that all services will be performed in a workmanlike manner.

11.1.3 Warranty of Merchantability: The Contractor warrants that any and all equipment to be supplied pursuant to this Agreement is merchantable, free from defects,

whether patent or latent in material or workmanship, and fit for the ordinary purposes for which it is intended.

11.2 Tests and Inspections: Contractor shall retain the services of an independent, certified, testing lab to perform all testing as required by the specifications, contract drawings, and any applicable permitting agency. Contractor shall provide evidence of certification to the City before the work and testing is done. Testing results shall be submitted to the Project Manager for review and approval at the time the results are provided to the Contractor. The Contractor shall give the Project Manager and City Inspector a minimum of twenty-four (24) hours' advanced notice of readiness of the Work for all required inspections, tests, or approvals and shall notify all applicable permitting agencies in a timely manner based on requirements set forth in the permit documents.

11.2.1 Neither observations by the Project Manager nor inspections, tests or approvals by others shall relieve the Contractor from its obligations to perform the Work in accordance with the Contract Documents.

11.3 Uncovering Work: If any work that is to be inspected, tested or approved is covered without approval or consent of the Project Manager, it must, if requested by the Project Manager, be uncovered for observation and/or testing. Such uncovering and replacement shall be at the Contractor's sole expense unless the Contractor has given the Project Manager timely notice of the Contractor's intention to cover such Work and the Project Manager has not acted with reasonable promptness in response to such notice.

11.3.1 If the Project Manager considers it necessary or advisable that Work covered in accordance with Paragraphs 11.2.1 be observed by the City or inspected or tested by others, the Contractor at the City's request, shall uncover, expose or otherwise make available for observation, inspection or testing as the Project Manager may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, the Contractor shall bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, including compensation for additional professional services, and an appropriate deductive Change Order shall be issued. If, however, such work is not found to be defective, the Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection testing and reconstruction if it makes a claim therefore as provided in Articles 14 and 15.

11.4 City May Stop the Work: If the Work is defective, or the Contractor fails to supply sufficient skilled supervisory personnel or workmen or suitable materials or equipment or the work area is deemed unsafe, the City may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the City to stop the Work shall not give rise to any duty on the part of the City to exercise this right for the benefit of the Contractor or any other Party. The City will not award any increase in Contract Price or Contract Time if the Work is stopped due to the circumstances described herein.

11.5 Correction or Removal of Defective Work Before Final Payment: If required by the Project Manager, the Contractor shall promptly, without cost to the City and as specified by the Project Manager, either correct any defective Work, whether or not fabricated, installed or completed, or if the Work has been rejected by the City remove it from the site and replace it with non-defective Work.

11.6 One Year Correction Period After Final Payment: If within one (1) year after the date of final acceptance, or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any work is found to be defective, the Contractor shall promptly, without cost to the City and in accordance with the City's written instructions, either correct such defective Work, or, if it has been rejected by the City, remove it from the site and replace it with non-defective Work.

If the Contractor does not promptly comply with the terms of such instructions or in an emergency where delay would cause serious risk of loss or damage, the City may have the defective Work corrected or the rejected Work removed and replaced, and all direct and indirect costs for such removal and replacement, including compensation for additional professional services, shall be paid by the Contractor.

11.7 Acceptance of Defective Work, Deductions: If, instead of requiring correction or removal and replacement of defective Work, the City, at the City's sole option, prefers to accept it, the City may do so. In such a case, if acceptance occurs prior to the Project Manager's recommendation of final payments, a Change Order shall be issued incorporating the necessary revisions in the Contract's Documents, including appropriate reduction in the Contract Price; or if the acceptance occurs after such recommendation, an appropriate amount shall be paid by the Contractor to the City.

11.8 City May Correct Defective Work: If the Contractor fails within a reasonable time after written notice of the Project Manager to proceed to correct defective Work or to remove and replace rejected Work as required by the Project Manager in accordance with Paragraph 11.5, or if the Contractor fails to perform the Work in accordance with the Contract Documents, the City may, after seven (7) days' written notice to the Contractor, correct and remedy any such deficiency. In exercising its rights under this paragraph, the City shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, the City may exclude the Contractor from all or part of the site, take possession of all or part of the Work, suspend the Contractor's services related thereto and take possession of the Contractor's tools, construction equipment and materials stored at the site or elsewhere. The Contractor shall allow the City's representative agents and employees such access to the site as may be necessary to enable the City to exercise its rights under this paragraph. All direct and indirect costs of the City in exercising such rights shall be charged against the Contractor in an amount verified by the Project Manager, and a Change Order shall be issued incorporating the necessary revisions in the Contract Documents and a reduction in the Contract Price. Such direct and indirect costs shall include, in particular but without limitation, compensation for additional professional services required and costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of the Contractor's defective Work. The Contractor shall not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by the City of the City's right hereunder.

ARTICLE 12 – INDEMNIFICATION

12.1 Disclaimer of Liability: The City shall not at any time, be liable for injury or damage occurring to any person or property from any cause, whatsoever, arising out of Contractor's construction and fulfillment of this Agreement.

12.2 Indemnification: For other, additional good valuable consideration, the receipt and sufficiency of which is hereby acknowledged:

12.2.1 Contractor shall, at its sole cost and expense, indemnify and hold harmless the City, its representatives, employees and elected and appointed officials from or on account of all claims, damages, losses, liabilities and expenses, direct, indirect or consequential including but not limited to fees and charges of engineers, architects, attorneys, consultants and other professionals and court costs arising out of or in consequence of the performance of this Agreement at all trial and appellate levels. Indemnification shall specifically include but not be limited to claims, damages, losses, liabilities and expenses arising out of or from (a) the negligent or defective design of the project and Work of this Agreement; (b) any act, omission or default of the Contractor, its subcontractors, agents, suppliers, employees or laborers; (c) any and all bodily injuries, sickness, disease or death; (d) injury to or destruction of tangible property, including any resulting loss of use; (e) other such damages, liabilities, or losses received or sustained by any person or persons during or on account of any operations connected with the construction of this Project including the warranty period; (f) the use of any improper materials; (g) any construction defect including both patent and latent defects; (h) failure to timely complete the work; (i) the violation of any federal, state, county or City laws, ordinances or regulations by Contractor, its subcontractors, agents, servants, independent contractors or employees; (j) the breach or alleged breach by Contractor of any term of the Agreement, including the breach or alleged breach of any warranty or guarantee.

12.2.2 Contractor agrees to indemnify, defend, and hold harmless the City, its officers, agents and employees, from all damages, liabilities, losses, claims, fines and fees, and from any and all suits and actions of every name and description that may be brought against City, its officers, agents and employees, on account of any claims, fees, royalties, or costs for any invention or patent and/or for the infringement of any and all copyrights or patent rights claimed by any person, firm, or corporation.

12.2.3 Contractor shall pay all claims, losses, liens, settlements or judgments of any nature in connection with the foregoing indemnifications including, but not limited to, reasonable attorney's fees and costs for trials and appeals.

12.2.4 If any subcontractor, supplier, laborer, or materialmen of Contractor or any other person directly or indirectly acting for or through Contractor files or attempts to file a mechanic's or construction lien against the real property on which the work is performed or any part or against any personal property or improvements thereon or make a claim against any monies due or to become due from the City

to Contractor or from Contractor to a subcontractor, for or on account of any work, labor, services, material, equipment, or other items furnished in connection with the Work or any change order, Contractor agrees to satisfy, remove, or discharge such lien or claim at its own expense by bond, payment, or otherwise within five (5) days of the filing or from receipt of written notice from the City.

Additionally, until such time as such lien or claim is satisfied, removed or discharged by Contractor, all monies due to Contractor, or that become due to Contractor before the lien or claim is satisfied, removed or otherwise discharged, shall be held by City as security for the satisfaction, removal and discharge of such lien and any expense that may be incurred while obtaining the discharge. If Contractor shall fail to do so, City shall have the right, in addition to all other rights and remedies provided by this Agreement or by law, to satisfy, remove, or discharge such lien or claim by whatever means City chooses at the entire and sole cost and expense of Contractor which costs and expenses shall, without limitation, include attorney's fees, litigation costs, fees and expenses and all court costs and assessments, and which shall be deducted from any amount owing to Contractor. In the event the amount due Contractor is less than the amount required to satisfy Contractor's obligation under this, or any other article, paragraph or section of this Agreement, the Contractor shall be liable for the deficiency due the City.

12.2.5 The Contractor and the City agree that Section 725.06(2), Florida Statutes (2021), as may be amended or revised, controls the extent and limits of the indemnification and hold harmless provisions of this Agreement, if any, and that the Parties waive any defects in the wording of this Article that runs afoul of said statutory section.

ARTICLE 13 – CHANGES IN THE WORK

13.1 Without invalidating this Agreement, the City may, at any time or from time-to-time order additions, deletions or revisions in the Work through the issuance of Change Orders. Upon receipt of a Change Order, the Contractor shall proceed with the Work involved. All Work shall be executed under the applicable conditions of the Contract Documents. If any Change Order causes an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, an equitable adjustment will be made as provided in Article 14 or Article 15 on the basis of a claim made by either Party.

13.2 The Project Manager may authorize minor changes in the Work not involving an adjustment in the Contract Price or the Contract Time, which are consistent with the overall intent of the Contract Documents. Such changes must be in writing and signed by the City and the Contractor.

13.3 If notice of any change affecting the general scope of the Work or change in the Contract Price is required by the provisions of any Bond to be given to the Surety, it will be the Contractor's responsibility to so notify the Surety, and the amount of each applicable Bond shall be adjusted accordingly. The Contractor shall furnish proof of such adjustment to the City.

ARTICLE 14 – CHANGE OF CONTRACT PRICE

Change of Contract Price, approved by City, shall be computed as follows:

14.1 Cost of the Work: The term "Cost of the Work" means the sum of all direct costs necessarily incurred and paid by Contractor in the proper performance of the Work. Except as otherwise may be agreed to in writing by the City, these costs shall be in amounts no higher than those prevailing in the City and shall include only the following items and shall not include any of the costs itemized in Paragraph 14.3:

14.1.1 Payroll costs for employees in the direct employ of the Contractor in the performance of the Work under schedules of job classifications agreed upon by the City and the Contractor. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work.

Payroll costs shall include, but not be limited to, salaries and wages plus cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, worker's compensation, health and retirement benefits, bonuses, sick leave, vacation and applicable holiday pay.

14.1.2 Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage, and required suppliers and field services. All cash discounts, rebates and refunds and all returns from sale of surplus materials and equipment shall accrue to the City, and the Contractor shall make provisions so that they may be obtained.

14.1.3 Supplemental costs including the following:

14.1.3.1 Cost, including transportation and maintenance of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of the Work.

14.1.3.2 Rentals of all construction equipment and machinery and the parts whether rented from the Contractor or others in accordance with rental agreements approved by the City, and the costs of transporting, loading, unloading, installation, dismantling and removal. The rental of any such equipment, machinery or parts shall cease when the use is no longer necessary for the Work.

14.1.3.3 Sales, consumer, use or similar taxes related to the Work and for which the Contractor is liable, imposed by laws and regulations.

14.1.3.4 Royalty payments and fees for permits and licenses.

14.1.3.5 The cost of utilities, fuel and sanitary facilities at the Work site.

14.1.3.6 Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

14.1.3.7 Cost of premiums for additional bonds and insurance required because of changes in the Work.

14.2 The Contract Price may only be increased by a Change Order when Work is modified in accordance with Article 13 and approved by the City in writing. Any claim for an increase in the Contract Price resulting from a Change Order shall be based on written notice delivered to the Project Manager within ten (10) days of the occurrence of the Change Order giving rise to the claim. Notice of the amount of the claim with supporting data shall be included in the Change Order and delivered within twenty (20) days of such occurrence unless Project Manager allows an additional period of time to ascertain accurate cost data. Any change in the Contract Price resulting from any such claim shall be incorporated in the Change Order. **IT IS EXPRESSLY AND SPECIFICALLY AGREED THAT ANY AND ALL CLAIMS FOR CHANGES TO THE CONTRACT PRICE SHALL BE WAIVED IF NOT SUBMITTED IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THIS SECTION.**

14.3 Not Included in the Cost of the Work: The term "Cost of the Work" shall not include any of the following:

14.3.1 Payroll costs and other compensation of the Contractor's officers executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditor, accountants, purchasing and contracting agents, expediters, timekeepers, clerks and other personnel employed by the Contractor whether at the site or in the Contractor's principal or branch office for general administration of the work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 14.1.1, all of which are to be considered administrative costs covered by the Contractor's fee.

14.3.2 Expenses of the Contractor's principal and branch offices other than the Contractor's office at the site.

14.3.3 Any part of the Contractor's capital expenses, including interest on the Contractor's capital employed for the Work and charges against the Contractor for delinquent payments.

14.3.4 Cost of premiums for all bonds and for all insurance whether or not the Contractor is required by the Contract Documents to purchase and maintain the same.

14.3.5 Costs due to the negligence of the Contractor, any subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

14.3.6 Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 14.1.

14.4 Basis of Compensation: The Contractor's compensation, allowed to the Contractor for overhead and profit, shall be determined as follows:

14.4.1 A mutually acceptable negotiated fee:

14.4.1.1 For costs incurred under Paragraphs 14.1.1 and 14.1.2, the Contractor's fee shall not exceed five percent (5%).

14.4.1.2 No fee shall be payable on the basis of costs itemized under Paragraphs 14.1.3.1, 14.1.3.2, 14.1.3.3, 14.1.3.4, 14.1.3.5, 14.1.3.6, 14.1.3.7, 14.3.1, 14.3.2, 14.3.3, 14.3.4, 14.3.5 and 14.3.6.

14.4.1.3 The amount of credit to be allowed by the Contractor to the City for any such change which results in a net decrease plus a deduction in the Contractor's fee by an amount equal to five percent (5%) for the net decrease.

14.4.1.4 When both additions and credits are involved in any one change the combined overhead and profit shall be figured on the basis of net increase if any, however, not to exceed five percent (5%) of the agreed compensation. Profit will not be paid on any Work not performed.

14.5 Cost Breakdown Required: Whenever the cost of any Work is to be determined pursuant to this Article, the Contractor will submit in form acceptable to the City an itemized cost breakdown together with supporting documentation. Whenever a change in the Work is to be based upon mutual acceptance of a lump sum, whether the amount is an addition, credit, or no-charge-in-cost, the Contractor shall submit an estimate substantiated by a complete itemized breakdown:

14.5.1 The breakdown shall list quantities and unit prices for materials, labor, equipment and other items of cost.

14.5.2 Whenever a change involves the Contractor and one (1) or more subcontractors and the change is an increase in the agreed compensation, the overhead and profit percentage for the Contractor and each subcontractor shall be itemized separately.

14.6 Time for the City to Approve Extra Work: Any Extra Work in an amount up to and not exceeding a cumulative amount of $25,000 for a specific project can be approved by the City Manager and shall require a written Change Order proposal to be submitted to the Public Works Director for submittal and approval by the City Manager. Extra Work exceeding the cumulative amount of $25,000 for a specific project must be approved by the City Commission and a written Change Order proposal must be submitted to the Public Works Director for submittal and approval by the City Manager and City Commission. No financial or time claim for delay to the project resulting from the Change Order approval process outlined above under Section 14.6 will be allowed.

ARTICLE 15 – CHANGE OF THE CONTRACT TIME

15.1 The Contract Time may only be changed by a Change Order. Any claim for an extension in the Contract Time shall be based on written notice delivered to the Project Manager within five (5) days of the occurrence of the event giving rise to the claim. Any change in the Contract Time resulting from any such claim shall be incorporated in a Change Order.

15.2 The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of the Contractor if a claim is made therefore as provided in Paragraph 15.1. Such delays shall include but not be limited to, acts or neglect by the City, or to fires, floods, labor disputes, epidemics, abnormal weather conditions, pandemics, act of Governmental Authority, state of emergency, or acts of God.

15.3 All time limits stated in the Contract Documents are of the essence. The provisions of this Article 15 shall not exclude recovery for damages for delay by the Contractor.

15.4 Delays caused by or resulting from entities, contractors or subcontractors who are not affiliated with the Contractor (non-affiliated Contractors) shall not give rise to a claim by the Contractor for damages for increases in material and/or labor costs. Such entities, contractors and subcontractors include, but are not limited to, the City's contractors and subcontractors, Florida Power and Light Company, AT&T and Florida East Coast Railway, LLC.

15.5 Rights of Various Interests: Whenever work being done by City's forces or by other contractors is contiguous to or within the limits of work covered by this Agreement, the respective rights of the various interests involved shall be established by the Project Manager to secure the completion of the various portions of the Work in general harmony.

ARTICLE 16 – LIQUIDATED DAMAGES

16.1 Upon failure of the Contractor to complete the Work within the time specified for completion, the Contractor shall pay to the City the sum of **Five Hundred Dollars ($500.00)** for each and every calendar day that the completion of the Work is delayed beyond the time specified in this Agreement for completion, as fixed and agreed liquidated damages and not as a penalty, so long as the delay is caused by the Contractor. Should an act of God or the acts or omissions of the City, its agents or representatives, in derogation to the terms of this Agreement cause the delay, the Contractor shall not be responsible for the delay nor liquidated damages. Liquidated damages are fixed and agreed upon between the Parties, recognizing the impossibility of precisely ascertaining the amount of damages that will be sustained by the City as a consequence of such delay and both Parties desiring to obviate any question of dispute concerning the amount of damages and the cost and effect of the failure of the Contractor to complete the Work on time. Liquidated damages shall apply separately to each portion of the Work for which a time of completion is given. The City shall have the right to deduct from or retain any compensation which may be due or which may become due and payable to the Contractor the amount of liquidated damages, and if the amount retained by the City is insufficient to pay in full such liquidated damages, the

Contractor shall pay all liquidated damages in full. The Contractor shall be responsible for reimbursing the City, in addition to liquidated damages or other damages for delay, for all costs of engineering, architectural fees, and inspection and other costs incurred in administering the construction of the Project beyond the completion date specified or beyond an approved extension of time granted to the Contractor whichever is later. Delays caused by or resulting from entities, contractors or subcontractors who are not affiliated with the Contractor shall not give rise to a claim by Contractor for damages for increase in material and/or labor costs. Such entities, contractors and subcontractors include, but are not limited to, the City's contractors and subcontractors, Florida Power and Light Company, AT&T, and Florida East Coast Railway, LLC.

16.2 No Extended Damages: For other and additional good and valuable consideration the receipt and sufficiency of which is hereby acknowledged, the Contractor covenants and agrees that in the event of any delay of construction or for any reason, allegation or claim, and notwithstanding the reason of the delay, reason, claim or allegation or who caused them or the construction delay or whether they were caused by the City, that there will be no entitlement to Contractor to or for any direct or indirect financial damages or losses for extended corporate overhead impact, extended project overhead impacts, project support services, mobilization or demobilization or by whatever other label or legal concept or theory and types of names or labels or basis such claims may have, or any business damages or losses of whatever type or nature, and Contractor hereby waives any right to make any such claim or claims. This provision will have application and effect when construction delays are anticipated and agreed upon by both the City and the Contractor.

ARTICLE 17 – SUSPENSION OF WORK AND TERMINATION

17.1 City May Suspend Work: The City may, at any time and without cause, suspend the Work or any portion of the Work for a period of not more than ninety (90) days by notice in writing to the Contractor which shall fix the date on which Work shall be resumed. The Contractor shall resume the Work on the date fixed. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension, if the Contractor makes a claim as provided in Articles 14 and 15.

17.2 City's Right to Terminate Contract: The City may terminate this Agreement upon fifteen (15) calendar days' written notice upon the occurrence of any one or more of the following events:

17.2.1 If the Contractor makes a general assignment for the benefit of creditors.

17.2.2 If a trustee, receiver, custodian or agent of the Contractor is appointed under applicable law or under Contract, whose appointment or authority to take charge of property of the Contractor is for the purpose of enforcing a lien against such property or for the purpose of general administration of such property for the benefit of the Contractor's creditors.

17.2.3 If Contractor fails to begin the Work within fifteen (15) calendar days after the Project Initiation Date, or fails to perform the Work with sufficient workers and equipment or with sufficient materials to ensure the prompt completion of the

Work, or shall perform the Work unsuitably, or cause it to be rejected as defective and unsuitable, or shall discontinue the prosecution of the Work pursuant to the accepted schedule or if Contractor shall fail to perform any material term set forth in the Contract Documents, or from any other cause whatsoever shall not carry on the Work in an acceptable manner, Project Manager may give notice in writing to Contractor and its Surety of such delay, neglect or default, specifying the same.

17.2.4 If the Contractor repeatedly fails to make prompt payments to subcontractors or for labor, material or equipment.

17.2.5 If the Contractor repeatedly disregards proper safety procedures.

17.2.6 If the Contractor disregards any local, state or federal laws or regulations.

17.2.7 If the Contactor otherwise violates any provisions of this Agreement.

17.3 If Contractor, within a period of ten (10) calendar days after such notice, shall not proceed in accordance therewith, the City may exclude the Contractor from the Work site and take the prosecution of the Work out of the hands of the Contractor, and take possession of the Work and all of the Contractor's tools, appliances, construction equipment and machinery at the site and use them without liability to the City for trespass or conversion, incorporate in the Work all materials and equipment stored at the site or for which the City has paid the Contractor but which are stored elsewhere, and finish the Work as the City may deem expedient. In this instance, the Contractor shall not be entitled to receive any further compensation until the Work is finished.

17.3.1 If after notice of termination of Contractor's right to proceed, it is determined for any reason that Contractor was not in default, the rights and obligations of City and Contractor shall be the same as if the notice of termination had been issued pursuant to the Termination for Convenience clause as set forth in Section 17.5 below.

17.3.2 Upon receipt of Notice of Termination pursuant to Sections 17.2 or 17.5, Contractor shall promptly discontinue all affected work unless the Notice of Termination directs otherwise and deliver or otherwise make available to City all data, drawings, specifications, reports, estimates, summaries and such other information as may have been required by the Contract Documents whether completed or in process.

17.4 If the Contractor commits a default due to its insolvency or bankruptcy, the following shall apply:

17.4.1 Should this Agreement be entered into and fully executed by the Parties, funds released and the Contractor (Debtor) files for bankruptcy, the following shall occur:

17.4.1.1 In the event the Contactor files a voluntary petition under 11 U.S.C. 301 or 302, or an order for relief is entered under 11 U.S.C. 303, the Contractor shall acknowledge the extent, validity, and priority of the lien recorded in favor of the City. The Contractor further agrees that in the

event of this default, the City shall, at its option, be entitled to seek relief from the automatic stay pursuant to 11 U.S.C. 362. The City shall be entitled to relief from the automatic stay pursuant to 11 U.S.C. 362(d) (1) or (d) (2), and the Contactor agrees to waive the notice provisions in effect pursuant to 11 U.S.C. 362 and any applicable Local Rules of the United States Bankruptcy Court. The Contactor acknowledges that such waiver is done knowingly and voluntarily.

17.4.1.2 Alternatively, in the event the City does not seek stay relief, or if stay relief is denied, the City shall be entitled to monthly adequate protection payments within the meaning of 11 U.S.C. 361. The monthly adequate protection payments shall each be in an amount determined in accordance with the Note and Mortgage executed by the Contractor in favor of the City.

17.4.1.3 In the event the Contractor files for bankruptcy under Chapter 13 of Title 11, United States Code in additional to the foregoing provisions, the Contractor agrees to cure any amounts in arrears over a period not to exceed twenty-four (24) months from the date of the confirmation order, and such payments shall be made in addition to the regular monthly payments required by the Note and mortgage. Additionally, the Contractor shall agree that the City is over secured and, therefore, entitled to interest and attorney's fees pursuant to 11 U.S.C. 506(b). Such fees shall be allowed and payable as an administrative expense. Further, in the event the Contractor has less than five (5) years of payments remaining on the Note, the Contractor agrees that the treatment afforded to the claim of the City under any confirmed plan of reorganization shall provide that the remaining payments shall be satisfied in accordance with the Note, and that the remaining payments or claim shall not be extended or amortized over a longer period than the time remaining under the Note.

17.4.2 Should this Agreement be entered into and fully executed by the parties, and the funds have not been forwarded to Contractor, the following shall occur:

17.4.2.1 In the event the Contractor files a voluntary petition pursuant to 11 U.S.C. 301 or 302, or an order for relief is entered under 11 U.S.C. 303., the Contractor acknowledges that the commencement of a bankruptcy proceeding constitutes an event of default under the terms of this Agreement. Further, the Contractor acknowledges that this Agreement constitutes an executory contract within the meaning of 11 U.S.C. 365. The Contractor acknowledges that this Agreement is not capable of being assumed pursuant to 11 U.S.C. 365(c)(2), unless the City expressly consents in writing to the assumption. In the event the City consents to the assumption, the Contractor agrees to file a motion to assume this Agreement within ten (10) days after receipt of written consent from the City, regardless of whether the bankruptcy proceeding is pending under Chapter 7, 11, or 13 of Title 11 of the United States Code. The Contractor further acknowledges that this Agreement is not capable of being assigned pursuant to 11 U.S.C. 365(b)(1).

17.5 Termination for Convenience: This Agreement may be terminated for convenience in writing by City upon thirty (30) days' written notice to Contractor (delivered by certified mail, return receipt requested) of intent to terminate and the date on which such termination becomes effective. In such case, Contractor shall be paid for all work executed and expenses incurred prior to termination in addition to termination settlement costs reasonably incurred by Contractor relating to commitments which had become firm prior to the termination. Payment shall include reasonable profit for work/services satisfactorily performed. No payment shall be made for profit for work/services which have not been performed.

17.6 Where the Contractor's service has been so terminated by the City, the termination shall not affect any rights of the City against the Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due the Contractor by the City will not release the Contractor from liability.

17.7 The Contractor has no right, authority or ability to terminate the Work except for the wrongful withholding of any payments due the Contractor from the City.

ARTICLE 18 – DISPUTE RESOLUTION

18.1 Resolution of Disputes: Questions, claims, difficulties and disputes of whatever nature which may arise relative to the technical interpretation of the Contract Documents and fulfillment of this Agreement as to the character, quality, amount and value of any work done and materials furnished, or proposed to be done or furnished under, or by reason of, the Contract Documents which cannot be resolved by mutual agreement of City Project Manager and Contractor shall be submitted to the City Manager or his designee and Contractor's representative for resolution. Prior to any litigation being commenced, for any disputes which remain unresolved, within sixty (60) days after final completion of the Work, the Parties shall participate in mediation to address all unresolved disputes to a mediator agreed upon by the Parties. Should any objection not be resolved in mediation, the Parties retain all their legal rights and remedies provided under the laws of Florida. Failure by a Party to comply in strict accordance with the requirements of this Article, then said Party specifically waives all of its rights provided hereunder, including its rights and remedies under the laws of Florida.

18.1.1 All non-technical administrative disputes (such as billing and payment) shall be determined by Contract Administrator.

18.1.2 During the pendency of any dispute and after a determination thereof, Contractor and Contract Administrator shall act in good faith to mitigate any potential damages including utilization of construction schedule changes and alternate means of construction. During the pendency of any dispute arising under this Agreement, other than termination herein, Contractor shall carry on the Work and adhere to the progress schedule. The Work shall not be delayed or postponed pending resolution of any disputes or disagreements.

18.1.3 For any disputes which remain unsolved, within sixty (60) calendar days after Final Completion of the Work, the Parties shall participate in mediation to address all unresolved disputes. A mediator shall be mutually agreed upon by the Parties. Should any objection not be resolved in mediation, the Parties retain all their legal rights and remedies under applicable law. If a Party objecting to a determination, fails to comply in strict accordance with the requirements of this Article, said Party specifically waives all of its rights provided hereunder, including its rights and remedies under applicable law.

ARTICLE 19 – NOTICES

19.1 All notices required by any of the Contract Documents shall be in writing and shall be deemed delivered upon mailing by certified mail, return receipt requested to the following:

To the City:

City Manager
City of Fort Lauderdale
100 North Andrews Avenue
Fort Lauderdale, Florida 33301-1016

with copy to the:

Project Manager and City Attorney
City of Fort Lauderdale
100 North Andrews Avenue
Fort Lauderdale, Florida 33301-1016

To the Contractor:

_____
_____
_____
_____

ARTICLE 20 – LIMITATION OF LIABILITY

20.1 The City desires to enter into this Agreement only if in so doing the City can place a limit on the City's liability for any cause of action arising out of this Agreement, so that the City's liability for any breach never exceeds the sum of $1,000. For other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Contractor expresses its willingness to enter into this Agreement with the knowledge that the Contractor's recovery from the City to any action or claim arising from the Agreement is limited to a maximum amount of $1,000, which amount shall be reduced by the amount actually paid by the City to the Contractor pursuant to this Agreement, for any action or claim arising out of this Agreement. Nothing contained in this paragraph or elsewhere in this Agreement is in any way intended either to be a waiver of the limitation placed upon the City's liability as set forth in Section 768.28, Florida Statutes (2021), as may be amended or revised, or to extend the City's liability beyond the limits

established in said Section 768.28, Florida Statutes (2021), as may be amended or revised; and no claim or award against the City shall include attorney's fees, investigative costs, expert fees, suit costs or pre-judgment interest.

20.2 No Extended Damages: For other and additional good and valuable consideration the receipt and sufficiency of which is hereby acknowledged, the Contractor covenants and agrees that in the event of any delay of construction or for any reason, allegation or claim, and notwithstanding the reason of the delay, reason, claim or allegation or who caused them or the construction delay or whether they were caused by the City, that there will be no entitlement to Contractor to or for any direct or indirect financial damages or losses for extended corporate overhead impact, extended project overhead impacts, project support services, mobilization or demobilization or by whatever other label or legal concept or theory and types of names or labels or basis such claims may have, or any business damages or losses of whatever type or nature, and Contractor hereby waives any right to make any such claim or claims. This provision will have application and effect when construction delays are anticipated and agreed upon by both the City and the Contractor.

ARTICLE 21 – GOVERNING LAW; WAIVER OF JURY TRIAL

21.1 The Agreement shall be interpreted and construed in accordance with, and governed by, the laws of the state of Florida. The Parties agree that the exclusive venue for any lawsuit arising from, related to, or in connection with this Agreement shall be in the state courts of the Seventeenth Judicial Circuit in and for Broward County, Florida. If any claims arising from, related to, or in connection with this Agreement must be litigated in federal court, the Parties agree that the exclusive venue for any such lawsuit shall be in the United States District Court or United States Bankruptcy Court for the Southern District of Florida. **BY ENTERING INTO THIS AGREEMENT, THE PARTIES HEREBY EXPRESSLY WAIVE ANY AND ALL RIGHTS EITHER PARTY MIGHT HAVE TO A TRIAL BY JURY OF ANY ISSUES RELATED TO THIS AGREEMENT. IF A PARTY FAILS TO WITHDRAW A REQUEST FOR A JURY TRIAL IN A LAWSUIT ARISING OUT OF THIS AGREEMENT AFTER WRITTEN NOTICE BY THE OTHER PARTY OF VIOLATION OF THIS SECTION, THE PARTY MAKING THE REQUEST FOR JURY TRIAL SHALL BE LIABLE FOR THE REASONABLE ATTORNEYS' FEES AND COSTS OF THE OTHER PARTY IN CONTESTING THE REQUEST FOR JURY TRIAL, AND SUCH AMOUNTS SHALL BE AWARDED BY THE COURT IN ADJUDICATING THE MOTION.**

ARTICLE 22 – MISCELLANEOUS

22.1 The duties and obligations imposed by this Agreement and the rights and remedies available to the Parties and, in particular but without limitation, the warranties, guaranties and obligations imposed upon the Contractor and all of the rights and remedies available to the City, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by laws or regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this Paragraph will be as effective as

if repeated specifically in the Contract Documents, and the provisions of this Paragraph will survive final payment and termination or completion of this Agreement.

22.2 The Contractor shall not assign or transfer this Agreement or its rights, title or interests. The obligations undertaken by the Contractor pursuant to this Agreement shall not be delegated or assigned to any other person or firm. Violation of the terms of this Paragraph shall constitute a material breach of Agreement by the Contractor and the City any, at its discretion, cancel this Agreement and all rights, title and interest of the Contractor which shall immediately cease and terminate.

22.3 The Contractor and its employees, volunteers and agents shall be and remain as independent contractor and not agents or employees of the City with respect to all of the acts and services performed by and under the terms of this Agreement. This Agreement shall not in any way be constructed to create a partnership, association or any other kind of joint undertaking or venture between the Parties.

22.4 The City reserves the right to audit the records of the Contractor relating in any way to the Work to be performed pursuant to this Agreement at any time during the performance and term of this Agreement and for a period of three (3) years after completion and acceptance by the City. If required by the City, the Contractor agrees to submit to an audit by an independent certified public accountant selected by the City. The Contractor shall allow the City to inspect, examine and review the records of the Contractor at any and all times during normal business hours during the term of this Agreement.

22.5 The remedies expressly provided in this Agreement to the City shall not be deemed to be exclusive but shall be cumulative and in addition to all other remedies in favor of the City now or later existing at law or in equity.

22.6 Should any part, term or provisions of this Agreement be decided by the courts to be invalid, illegal or in conflict with any state or federal law, the validity of the remaining portion or provision shall not be affected.

22.7 Prohibition Against Contracting With Scrutinized Companies: Subject to *Odebrecht Construction, Inc., v. Prasad*, 876 F.Supp.2d 1305 (S.D. Fla. 2012), *affirmed*, *Odebrecht Construction, Inc., v. Secretary, Florida Department of Transportation*, 715 F.3d 1268 (11th Cir. 2013), with regard to the "Cuba Amendment," the Contractor certifies that it is not on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, and that it does not have business operations in Cuba or Syria, as provided in Section 287.135, Florida Statutes (2021), as may be amended or revised. The Contractor certifies that it is not on the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2021), as may be amended or revised, and that it is not engaged in a boycott of Israel. The City may terminate this Agreement at the City's option if the Contractor is found to have submitted a false certification as provided under subsection (5) of Section 287.135, Florida Statutes (2021), as may be amended or revised, or been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2021), as may be amended or revised, or is

engaged in a boycott of Israel or has been engaged in business operations in Cuba or Syria, as defined in Section 287.135, Florida Statutes (2021), as may be amended or revised.

By submitting a proposal or response, the company, principals, or owners certify that it is not listed on the Scrutinized Companies with Activities in Sudan List or listed on the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or is engaged in business operations in Cuba or Syria.

22.8 Public Entity Crimes: In accordance with the Public Crimes Act, Section 287.133, Florida Statutes (2021), as may be amended or revised, a person or affiliate who is a contractor, consultant or other provider, who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to the City, may not submit a bid on a contract with the City for the construction or repair of a public building or public work, may not submit bids on leases of real property to the City, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with the City, and may not transact any business with the City in excess of the threshold amount provided in Section 287.017, Florida Statutes (2021), as may be amended or revised, for category two purchases for a period of thirty-six (36) months from the date of being placed on the convicted vendor list. Violation of this section by Contractor shall result in cancellation of the City purchase and may result in Contractor debarment.

22.9 Attorney Fees: If City or Contractor incurs any expense in enforcing the terms of this Agreement through litigation, the prevailing Party in that litigation shall be reimbursed for all such costs and expenses, including but not limited to court costs, and reasonable attorney fees incurred during litigation.

22.10 Public Records

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS AGREEMENT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT PRRCONTRACT@FORTLAUDERDALE.GOV, 954-828-5002, CITY CLERK'S OFFICE, 100 N. ANDREWS AVENUE, FORT LAUDERDALE, FLORIDA 33301.

Contractor shall:

1. Keep and maintain public records required by the City in order to perform the service.

2. Upon request from the City's custodian of public records, provide the City with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes (2021), as may be amended or revised, or as otherwise provided by law.

3. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of this Agreement if the Contractor does not transfer the records to the City.

4. Upon completion of the Agreement, transfer, at no cost, to the City all public records in possession of the Contractor or keep and maintain public records required by the City to perform the service. If the Contractor transfers all public records to the City upon completion of this Agreement, the Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of this Agreement, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the City, upon request from the City's custodian of public records, in a format that is compatible with the information technology systems of the City.

22.12 E-Verify

As a condition precedent to the effectiveness of this Agreement, pursuant to Section 448.095, Florida Statutes (2022), as may be amended or revised, the Contractor and its subcontractors shall register with and use the E-Verify system to electronically verify the employment eligibility of newly hired employees.

1. The Contractor shall require each of its subcontractors, if any, to provide the Contractor with an affidavit stating that the subcontractor does not employ, contract with, or subcontract with an unauthorized alien. The Contractor shall maintain a copy of the subcontractor's affidavit for the duration of this Agreement and in accordance with the public records requirements of this Agreement.

2. The City, the Contractor, or any subcontractor who has a good faith belief that a person or entity with which it is contracting has knowingly violated Section 448.09(1), Florida Statutes (2022), as may be amended or revised, shall terminate the Agreement with the person or entity.

3. The City, upon good faith belief that a subcontractor knowingly violated the provisions of Section 448.095(2), Florida Statutes (2022), as may be amended or revised, but that the Contractor otherwise complied with Section 448.095(2), Florida Statutes (2022), as may be amended or revised, shall promptly notify Contractor and order the Contractor to immediately terminate the contract with the subcontractor, and the Contractor shall comply with such order.

4. An Agreement terminated under Sections 448.095(2)(c)1. or 2., Florida Statutes (2022), as may be amended or revised, is not a breach of contract and may not be considered as such. If the City terminates this Agreement under Section448.095(2)(c), Florida Statutes (2022), as may be amended or revised, the Contractor may not be awarded a public contract for at least one year after the date on which the Agreement was terminated. The Contractor is liable for any additional costs incurred by the City as a result of termination of this Agreement.

5. Contractor shall include in each of its subcontracts, if any, the requirements set forth in this section 22.11, including this subparagraph, requiring any and all

subcontractors, as defined in Section 448.095(1)(j), Florida Statutes (2022), as maybe amended or revised, to include all of the requirements of this section 22.11 in its subcontracts. Contractor shall be responsible for compliance by any and all subcontractors, as defined in Section 448.095(1)(j), Florida Statutes (2022), as maybe amended or revised, with the requirements of Section 448.095, Florida Statutes (2022), as may be amended or revised.

[THIS SPACE WAS INTENTIONALLY LEFT BLANK]

Fire Station 54 HVAC Retrofit (Re-Bid)
(Contractor)
Project #12735

CITY

IN WITNESS OF THE FOREGOING, the Parties have set their hands and seals the day and year first written above.

CITY OF FORT LAUDERDALE, a Florida municipal corporation

By: _____
CHRISTOPHER J. LAGERBLOOM
City Manager

Date: _____

ATTEST:

By: _____
DAVID R. SOLOMAN
City Clerk

Approved as to Legal Form:
Alain E. Boileau, City Attorney

By: _____
RHONDA MONTOYA HASAN
Assistant City Attorney

CONTRACTOR

WITNESSES:

CONTRACTOR.,
a Florida company/corporation.

_____ By:_____

_____ Print Name:_____
Print Name

Title:_____

ATTEST:

_____

_____
Print Name

By:_____
Secretary

(CORPORATE SEAL)

STATE OF _____:

COUNTY OF _____:

The foregoing instrument was acknowledged before me by means of ☐ physical presence or ☐ online notarization, this _____ day of _____, 2021, by _____, (NAME OF AUTHORIZED OFFICER) as _____ (TITLE OF AUTHORIZED OFFICER), for _____ (NAME OF COMPANY), a Florida _____(TYPE OF COMPANY).

_____
(Signature of Notary Public - State of Florida)

_____
(Print, Type, or Stamp Commissioned Name of Notary Public)

Personally Known_____ OR Produced Identification_____
Type of Identification Produced: _____

SECTION 011200

SPECIAL WORKING CONDITIONS

PART 1 - GENERAL

1.1 SPECIAL CONDITIONS

A. Status of Project Location: This project is to be performed at Fire Station 54 building, located at 3211 NE 32nd Street, Ft Lauderdale FL. The fire station is currently vacated by firefighters now housed in a mobile home on the opposite (south) side of Oakland Park Boulevard.

B. Equipment Purchase by the City: This will be a demolition and installation project only, with the City purchasing the HVAC equipment directly and staging/storing most of the equipment in the Apparatus Bay of the fire station.

C. Limited Commissioning to be conducted by a third-party Owners Representative (OR) and assigned Public Works personnel.

D. Coordination of Schedule: Contractor shall give a two (2) week look-ahead for all work on said five (5) business day's notices. A weekly meeting to review two (2) weeks look-ahead shall be held on site or with videoconference, as required.

E. Contractor is responsible for the protection of surrounding areas and the demolition and/or disposal of existing equipment and ducts as necessary for the performance of the Work. All work areas, including elevator, hallways, and stairways, shall always be kept clean and unobstructed.

F. Contractor to prepare and submit As-Built drawings after the HVAC retrofit is completed.

G. Contractor shall follow all local and national safety ordinances as well as all Center for Disease Control and Prevention (CDC) COVID 19 regulations. If required at the time of work performance by the City Safety Officer, facial coverings/masks will be worn by all workers on site.

1.2 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed inside the construction site during normal business working hours of 8:00 a.m. to 4:00 p.m., Monday through Friday, unless otherwise indicated. The work will not be performed on holidays. Contractor shall coordinate with the City of Fort Lauderdale the timing and scheduling of on-site inspections for this project. Contractor's foreman will be given an access card by the Owner (City) and it will be that person's responsibility to escort workers to and from the work area daily. Workers can only enter or exit the facility and designated work areas with the foreman.

B. DEFINITIONS:

1. Work Hours: 8:00 AM through 4:00 PM, Monday through Friday.

2. Business Hours: 8:00 AM through 4:00 PM, Monday through Friday.

3. Off-Hours: Hours outside of Work Hours defined above.

4. Early morning Hours: 7:00 AM through 8:00 AM, Monday through Friday.

5. Staging Areas: Contractor's staging area will be defined by the Owner (City) and/or WLC. It is expected that HVAC equipment will be stored in the vacant Apparatus Bay of the station, designated crane yard or contractor's place of business.

6. Toilets: Contractor's personnel are permitted to use toilet facilities at the fire station. These facilities are to be cleaned daily and at project conclusion.

7. Parking: Parking for contractor's personnel shall be arranged by Owner's (City) representative and contractor's personnel shall make sure their vehicles do not in any away affect normal operations at any time. The Owner will try to accommodate parking during the project, but parking is not guaranteed. Contractor's vehicles should not expect to use toll parking nearby without paying the tolls.

8. Elevators: Contractor shall be permitted to use the existing elevator during construction and for bringing up materials in small 'safe load' quantities per ride, considering the weight loads for the existing elevator. The elevator shall be used with care, and it shall be kept clean at all times. Heavy items must be brought up with a crane or other equipment. The elevator cannot be used for lifting heavy equipment.

9. Temporary Cooling: Contractor shall be responsible for supplying temporary cooling and air conditioning during phases of the work that will take the system or part of the system for more than two (2) hours or indoor temperatures higher than 75 degrees.

1.4 WORK SEQUENCE

A. Work Sequence (Phasing): Conduct the Project in phases to provide the least possible interference to activities of the Owner's personnel, and to permit the orderly transfer of personnel and equipment in the facility. Coordinate construction efforts with Owner to minimize interference with Owner's operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200

SECTION 012500
SUBSTITUTION PROCEDURES

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 administrative and procedural requirements for substitutions.

B. Related Sections:
1. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
2. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or City that are not required in order to meet other Project requirements but may offer advantage to the City either in terms of time or cost.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with Florida Building Code in effect for Project.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
c. No substitutions will be allowed after bidding unless requested by the City.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 10 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will only consider requests for substitution if received within 7 days after the Notice to the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.

d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012900

PAYMENT PROCEDURES

PART 4 - GENERAL

4.1 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.

4.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:

1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

4.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

4.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

   a. City’s Form - Periodic Estimate for Partial Payment.
   b. Submittals Schedule.
   c. Contractor's Construction Schedule.

2. Submit the Schedule of Values to City Representative at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

   a. Project name and location.
   b. Project Number
   c. Contractor's name and address.
   d. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.

      1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration, documentation, and training in the amount of 5 percent of the Contract Sum.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as General Conditions expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

4.5 APPLICATIONS FOR PAYMENT

A. The General Contractor must meet with the City Representative on or about the 25th of each month. The City Representative will go over the pay items and agree on the quantities and the dollar amounts of the work completed during the month. A copy of the agreed amounts will be signed by the parties and a copy will be left with each representative.

B. The General Contractor will make up a partial pay request using the City-supplied forms and submit the request to the City Representative before the first of the upcoming month.

C. Each pay request must be accompanied by a partial release of lien by the General Contractor and by all Subcontractors, suppliers, and for all labor, as outlined below.

1. Starting with the second (2nd) pay request and for each and every pay request thereafter, the General Contractor shall submit partial release of liens from all Subcontractors, suppliers, and laborers covering the preceding month's request (SEE FOLLOWING EXAMPLE).
2. EXAMPLE: In the first (1st) pay request, payment is requested by General Contractor for the asbestos contractor and the electrician. The General Contractor must attach his partial release of lien.
3. For the second (2nd) pay request, the General Contractor must attach his partial release of lien from the asbestos contractor and the electrician for the amounts billed in the 1st pay request, i.e., the General Contractor will be running one (1) month behind with the releases from the Subcontractors, suppliers, etc., until the final pay request.

D. For the final pay request, the General Contractor will be required to submit FINAL release of liens for ALL Subcontractors, suppliers, etc., and for ALL labor BEFORE FINAL PAYMENT WILL BE MADE.

E. No partial payments, after the first payment, will be made until all partial release of liens are submitted for the preceding month's billing, as described.

F. Each Application for Payment shall be consistent with previous applications and payments as certified by and paid for by City.

G. Payment Application Forms: Use City Form “PERIODIC ESTIMATE FOR PARTIAL PAYMENT” as form for Applications for Payment.

1. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. City will return incomplete applications without action.

2. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

H. Release of Lien: With each Application for Payment, submit release of lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial release of lien on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit final release of lien.
3. City reserves the right to designate which entities involved in the Work must submit release of lien forms.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire City's insurance.
16. Initial settlement survey and damage report if required.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Evidence that claims have been settled.
5. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when City took possession of and assumed responsibility for corresponding elements of the Work.
6. Final, liquidated damages settlement statement.

PART 5 - PRODUCTS (Not Used)

PART 6 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100
PROJECT MANAGEMENT AND COORDINATION

PART 7 - GENERAL

7.1 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.

7.2 SUMMARY

A. Owner's Representative (OR): The City will designate an owners Representative (OR) to perform primary coordination for this project. Designated project manager(s) from the City may be assisting.

B. Project Documents: Contractors shall review all project documents provided by OR and the City to gain a full understanding of the fire stations issues history, HVAC retrofit project objectives, Basis of Design, and Current Facility Requirements (CFR).

C. Modes of Coordination: Contractors shall establish mobile phone, email, text, videoconference, and file sharing contact with OR and City's project Manager to facilitate coordination.

D. Limited Commissioning: Designated HVAC equipment and controls will be commissioned in this project. A Commissioning Plan will identify HVAC equipment and controls to be commissioned and test procedures. Contractors are to provide required documentation and testing support as required, to include submittal of startup, test and balance, prefunctional and functional performance reports, as well as personnel to operate HVAC equipment and controls to be commissioned.

E. Project Staging: Contractors shall anticipate coordination of the expected sequence:
   1. Removal, disposal, and replacement of ceiling grid on both floors.
   2. Removal, disposal, and replacement of all ductworks on both floors.
   3. Floor penetrations for DOAS supply air risers.
   4. Securement of electrical and devices.
   5. Installation of new electrical.
   6. Structural analysis, design, materials, fabrication, and installation if found to be required for the installation of the new DOAS. Allowances for same are provided by the City.
   7. Installation of HVAC equipment and controls per mechanical and electrical plans.
   8. Test and balancing.
   9. Commissioning preparation, to include submittal of TAB report, startup checklists, and prefunctional checklists.
   10. Contractor support of functional performance tests for all commissionable HVAC equipment and controls.

F. This following include details of administrative provisions for coordinating construction operations on Project including, but not limited to:

1. Coordination
2. Special Project Procedures
3. Administrative and supervisory personnel
4. Project meetings
5. Requests for Interpretation (RFIs)

G. Related Sections include the following:

1. Division 01 Section "Summary of Multiple Contracts" for a description of the division of Work among separate contracts and responsibility for coordination activities not in this Section.
2. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
3. Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

7.3 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

7.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for City and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid

conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

7.5 SUBMITTALS

A. Key Personnel Names: Within 15 days of notice to proceed, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

7.6 SPECIAL PROJECT PROCEDURES

A. Discrepancies, Errors: Should discrepancies or errors appear in the drawings or specifications concerning materials, workmanship, or quantity of work to be performed, the Contractor will be required to immediately notify the City before proceeding with the work. If the Contractor fails to notify the City and proceeds with the work, Contractor will be required to correct the errors at his/her own expense. In the event of a conflict between the drawings and specifications, the City will decide on the way to perform the work or supply the materials. See also General Conditions Section GC-29, "Contractor to Check Plans Specifications, and Data."

B. Dimensions and Measurements: The figured dimensions on the drawings or notes including dimensions shall be used for construction instead of measurements of the drawings by scale. No scale measurements shall be used as a dimension for construction. Dimensions on all drawings as well as the detail drawings themselves are subject in every case to measurements of adjacent or previously completed work. All such measurements necessary shall be taken before undertaking any work dependent upon such data. Field verification of dimensions on plans is mandatory since actual locations, distances, and levels will be governed by actual field conditions.

C. Discrepancies or Inconsistencies: Should any discrepancy or inconsistency appear between larger and smaller scale drawings in any of the divisions of the specifications or in any of the contract documents, such discrepancy shall be immediately submitted to the City for correction before proceeding with the work in question. In no case shall the Contractor make any alterations, erasures, changes or modifications in the drawings or specifications.

1. Should it appear that any of the work as specified or shown by the drawings is not sufficiently detailed or explained, the Contractor shall apply to the City for such further

details or information as may be necessary for full understanding of the work in question.

2. The data set forth in these specifications and indicated on the drawings are as accurate as can be obtained, but their extreme accuracy is not guaranteed. Final application thereto shall be determined on the job as conditions may demand and subject to the approval of the City.

D. Plans and Specifications Acknowledgment by Subcontractors and Suppliers: All Subcontractors and suppliers must submit, through the General Contractor to the City Engineer, a statement on their individual letterhead stationery, signed and sealed with their corporate seal, or a notarized statement on their letterhead stationery in the absence of a corporate seal, that the individual Subcontractor or Supplier:

1. Has received or reviewed a FULL set of approved plans and specifications for the project,
2. Is aware that items concerning their particular trade may be shown and/or detailed in other trades or sections of the plans and specifications, and
3. Will comply with said plans, specifications and all applicable codes and permit requirements.

E. In the event a Subcontractor or Supplier notes a mistake or details appear incomplete, or if there are questions or concerns with the plans and specifications, the Subcontractor or Supplier will immediately notify the General Contractor. No work will proceed until such conflicts or questions are resolved in writing.

F. The Subcontractor will not be permitted to start work, nor will any Shop drawings/submittals be accepted for review from a supplier until this letter of acknowledgment is received and approved by the General Contractor and City Engineer. Also, the City will not process any pay request for the work of any Subcontractor or Supplier whose acknowledgment letter is not on file with the City.

7.7 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. The Contractor shall employ a competent superintendent who can communicate with spoken English, and who shall be in attendance at the site full-time when any work is in progress. The superintendent shall be satisfactory to the City's Engineer and shall not be changed except with the consent of the City's Engineer.

B. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

7.8 PROJECT MEETINGS

A. General: Attend meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
2. Minutes: Record of significant discussions and agreements achieved.

a. Minutes from all meetings shall be prepared by the OR, reflecting all items discussed as well as agreed upon or suggested solutions. These minutes shall

be a true reflection of what actually happened at the meeting.

b. Items discussed and not resolved or being handled by any one of the parties present shall be reflected along with the name of the person responsible in all ongoing minutes until it is resolved.

c. Minutes shall be typewritten within 24 hours from the completion of the meeting. They shall immediately be emailed to all parties present.

d. All items requiring information and not resolved shall be reflected in each and every set of minutes thereafter until it is totally resolved

B. Preconstruction Meeting: After the contract(s) has been awarded, executed, and a tentative work schedule has been composed, and prior to the start of the work, the Contractor(s), the Architect, the City's Representative, and other persons and/or governmental agencies that are involved shall meet. The minimum agenda is to include but is not limited to the following:

1. Distribute and discuss list of major Subcontractors
2. Tentative construction schedule
3. Phasing
4. Critical work sequencing and long-lead items
5. Relation and coordination of Prime Contractor
6. Designation of key personnel and their duties
7. Procedures for processing field decisions and Change Orders
8. Procedures for RFIs
9. Procedures for Limited Commissioning to be performed by the OR
10. Adequacy of distribution of contract documents
11. Submittal of Shop drawings, project data, Test and Balance Reports, Startup checklists, Functional Performance checklists , samples and other documents.
12. Procedures for maintaining Record documents
13. Use of premises
14. Protection of existing construction including landscape materials
15. Work restrictions
16. City's occupancy requirements
17. Responsibility for temporary facilities and controls
18. Major equipment deliveries and priorities
19. Construction waste management and recycling
20. Parking availability
21. Working hours
22. Safety and first-aid procedures
23. Security procedures
24. Housekeeping procedures including progress cleaning.
25. Schedule of values.
26. Processing of payments or contract.
27. DHS Security Requirements

C. Progress Meetings: Progress meetings shall be held at bi-weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of City and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Review and approve minutes of previous Progress Meeting.
    b. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time. Contractor shall submit a two-week look ahead schedule for review at each progress meeting.

        1) Review schedule for next period.

    c. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of correction of deficient items.
        14) Field observations.
        15) RFIs.
        16) Status of proposal requests.
        17) Pending changes.
        18) Status of Change Orders.
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.

3. Minutes: OR shall record the meeting minutes. These minutes shall indicate all items discussed as well as agreed upon or suggested solutions. They shall be a true reflection of what occurred at the meeting.
4. Reporting: Within 24 hours, distribute minutes of the meeting by email to each party present and to parties who should have been present.

    a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

7.9 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and

submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. City Project Number
2. City Project Name.
3. Date.
4. Name of Contractor.
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Hard-Copy RFIs: Form at end of this Section.

1. Identify each page of attachments with the RFI number and sequential page number.

D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above. Word Template is available upon request from the City Engineer’s Office.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Architect's actions on submittals.
    f. Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case

Architect's time for response will start again.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Include the following:

1. Project name.
2. Name and address of Contractor.
3. RFI number including RFIs that were dropped and not submitted.
4. RFI description.
5. Date the RFI was submitted.
6. Date Architect's response was received.
7. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
8. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 8 - PRODUCTS (Not Used)

PART 9 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 10 - GENERAL

10.1 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.

10.2 SUMMARY

A. Progress Reporting: The OR shall determine a construction progress documentation scheme appropriate for the scope and scale of this HVAC Retrofit project. Contractor submittals and reports shall comply with City guidelines defined below

B. Submittals Schedule: Project documents provided include the submittals for basis of design HVAC equipment and controls. Additional submittals shall be provided per City procedures described below.

C. The following sections include administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Submittals Schedule.
2. Daily construction reports.
3. Field condition reports.
4. Special reports.

D. Related Sections include the following:
1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
4. Division 01 Section "Photographic Documentation" for submitting construction photographs.
5. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

10.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as

scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

C. CPM: Critical Path Method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either City or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

10.4 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

B. Contractor's Construction Schedule: Submit three opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or

Updated) and date on label.

C. CPM Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

D. Daily Construction Reports: Submit two copies at monthly intervals.

E. Material Location Reports: Submit two copies at monthly intervals.

F. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

G. Special Reports: Submit two copies at time of unusual event.

10.5 QUALITY ASSURANCE

A. Scheduling Personnel Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

10.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 11 - PRODUCTS

11.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.

2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule network diagram. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

    a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

11.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. The schedule shall clearly indicate the critical path and all activities associated with it. The dependencies shall be clearly delineated.
2. All activities with a time duration exceeding five (5) days shall be shown as separate items.
3. Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Where materials require more than one (1) week fabrication or order time, this order/fabrication time shall be shown.
5. Include not less than 3 days for startup and testing.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by City: Include a separate activity for each portion of the Work performed by City.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. City-Furnished Products: Include a separate activity for each product. Include delivery

date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

6. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Permanent space enclosure.
    c. Completion of mechanical installation.
    d. Completion of electrical installation.
    e. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, Final Completion, and Certificate of Occupancy.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.

2. Contractor shall assign cost to construction activities on the CPM schedule. Costs

shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

3. Each activity cost shall reflect an accurate value subject to approval by Architect.
4. Total cost assigned to activities shall equal the total Contract Sum.

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

H. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

1. Microsoft Project 2007 for Windows operating system.

11.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating, and feedback was received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

11.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 7 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time. Include list of nonworking days and holidays

incorporated into the schedule.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by City that may affect or be affected by Contractor's activities.
    i. Testing and commissioning.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediately preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the Schedule of Values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.

4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests, coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

11.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Approximate count of personnel at Project site.
3. Equipment at Project site.
4. Material deliveries.
5. High and low temperatures and general weather conditions.
6. Accidents.
7. Meetings and significant decisions.
8. Unusual events (refer to special reports).
9. Stoppages, delays, shortages, and losses.
10. Emergency procedures.
11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.
13. Construction Change Directives received and implemented.
14. Services connected and disconnected.
15. Equipment or system tests and startups.
16. Partial Completions and occupancies.
17. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request

for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

11.6 SPECIAL REPORTS

A. General: Submit special reports directly to the OR and the City within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise the OR and the City in advance when these events are known or predictable.

PART 12 - EXECUTION

12.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: City may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect, City Representative, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233
PHOTOGRAPHIC DOCUMENTATION

PART 13 - GENERAL

13.1 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.

13.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Time lapse photographs.
4. Final Completion construction photographs.

B. Related Sections include the following:
1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
2. Division 01 Section "Closeout Procedures" for submitting digital media and construction videotapes as Project Record Documents at Project closeout.

13.3 SUBMITTALS

A. Construction Photographs: Submit digital media files of as found condition and completed installation of each commissionable HVAC equipment and controls, within two days of successful functional performance test.

PART 14 - PRODUCTS

14.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in highest quality JPEG format produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1600 by 1200 pixels.

PART 15 - EXECUTION

END OF SECTION 013233

SECTION 013300
SUBMITTAL PROCEDURES

PART 16 - GENERAL

16.1 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.

16.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 01 Section "Photographic Documentation" for submitting construction photographs and construction videotapes.
5. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
6. Division 01 Section "Closeout Procedures" for submitting warranties.
7. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
8. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
9. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of City's personnel.
10. Divisions 02 through 48 Sections for specific requirements for submittals in those Sections.

16.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect’s responsive action.

B. Informational Submittals: Written information that does not require Architect’s responsive action. Submittals may be rejected for not complying with requirements.

16.4 SUBMITTAL PROCEDURES

A. General: Architect may provide electronic copies of CAD Drawings of the Contract Drawings for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of

construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 10 days for review of each resubmittal.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Contractor.
    d. Name and address of subcontractor.
    e. Name and address of supplier.
    f. Name of manufacturer.
    g. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

    h. Number and title of appropriate Specification Section.
    i. Drawing number and detail references, as appropriate.
    j. Location(s) where product is to be installed, as appropriate.

k. General Contractor’s stamp of approval must be on all submittals, indicating that the Contractor has reviewed and approved prior to submitting to the City.

F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Transmittal number numbered consecutively.
k. Remarks.
l. Signature of transmitter.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Approved as submitted" or “Approved as noted”.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating "Approved as submitted" or “Approved as noted” by Architect.

16.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:

1. CAD files will only be provided to the contractor upon written request by the contractor and upon receipt by the Architect of the signed release form provided by the Architect.

PART 17 - PRODUCTS

17.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.
    j. Standard product operation and maintenance manuals.
    k. Compliance with specified referenced standards.
    l. Testing by recognized testing agency.
    m. Application of testing agency labels and seals.
    n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit five copies of Product Data, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Architect's CAD Drawings are otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.

k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 24 by 36 inches (750 by 1000 mm).
3. Number of Copies: Submit five opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit seven copies where copies are required for operation and maintenance manuals. Architect will retain three copies; remainder will be returned. Submit one additional copy for any submittal that must be reviewed by consultant,

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as City's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches

showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit five copies of product schedule or list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.

G. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit four copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

17.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and City’s, and other information specified.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization

acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized

service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

V. Construction Photographs: Comply with requirements specified in Division 01 Section “Photographic Documentation."

1. Material Safety Data Sheets (MSDSs): Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.

17.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 18 - EXECUTION

18.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been

reviewed, checked, and approved for compliance with the Contract Documents.

18.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Approved as submitted
2. Approved as noted
3. Revise and resubmit
4. Rejected.

C. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000
QUALITY REQUIREMENTS

PART 19 - GENERAL

19.1 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.

19.2 SUMMARY

A. Limited Commissioning: The OR will be performing Limited Commissioning for this project and will provide the Commissioning Plan, checklists and other documents required. Contractor shall provide documentation and support for inspection and testing, to include submittal of startup checklists, Test and Balance Reports, prefunctional checklists and personnel for Functional Performance testing of all commissionable equipment and controls. The OR will provide a Commissioning Plan, guidance and checklists. Contractors will fill out and submit manufacturer O&M checklists, to include shipment inspection, startup and other checklists.

B. Equipment to be Commissioned: The following HVAC equipment and controls will be commissioned, to include functional performance testing in all major sequences of operation:
   1. Dedicated Outdoor Air System (DOAS)
   2. Rooftop Units (RTUs)
   3. Split and mini–Split Units
   4. VAV
   5. Exhaust Fans

C. Commissioning Procedures- Contractors shall participate or support the following Cx procedures:
   1. Provide Start Up checklists from Manufacturer IO&M manuals
   2. Provide Test and Balance Report(s)
   3. Provide Prefunctional Checklists, templates to be provided by WLC
   4. Provide personnel to operate HVAC equipment and controls during Functional Performance Testing
   5. Resolve all identified Issues per WLC-provided Issues and Resolutions Log.
   6. Provide IO&M manuals in electronic form (PDF) for development of a Systems Manual
   7. Provide personnel to perform one day (8 hours) of training for City’s building staff and occupants

D. The following sections describe the City’s administrative and procedural requirements for quality assurance and quality control.

E. Related Sections include the following:

1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Divisions 02 through 48 Sections for specific test and inspection requirements.

19.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being

familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

19.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

19.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For City's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

19.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.

   a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 49. Contractor shall submit shop drawings for review by all agencies and City.

19.7 QUALITY CONTROL

A. City Responsibilities: Where quality-control services are indicated as City's responsibility, City will engage a qualified testing agency to perform these services.

1. City will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made by the City directly to the testing agency.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Tests and inspections not explicitly assigned to City are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by City, unless agreed to in writing.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with City and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify City and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.

1. Distribution: Distribute schedule to City, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 20 - PRODUCTS (Not Used)

PART 21 - EXECUTION

21.1 ISSUES AND RESOLUTIONS LOG

A. The OR will prepare and share an Issues and Resolutions Log of all observed issues on this project. The log will include date, Issue description, recommendation, and responsibility for resolution.

B. The Log will be shared electronically, and a copy maintained on site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

21.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. This includes all site work adjacent to property.
2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200
REFERENCES

PART 22 - GENERAL

22.1 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.

22.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

22.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

22.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530

AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute	(703) 524-8800

	www.ari.org	
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industry International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCSC)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood-Preservers' Association www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880

CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee	(703) 295-5000

	www.ejdc.org	
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FM Approvals	FM Approvals www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
IAS	International Approval Services (Now CSA International)	
ICEA	Insulated Cable Engineers Association, Inc.	(770) 830-0369

	www.icea.net	
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA www.intertek.com	(972) 238-5591
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LEED	Leadership in Energy Conscious and Environmental Design	
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190

MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (303) 697-8441
NFPA	NFPA (National Fire Protection Association)	(800) 344-3555 (617) 770-3000

	www.nfpa.org	
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America)	(800) 395-2522 (703) 736-9666

	www.landcarenetwork.org	
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611

SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)	(800) 223-2301 (847) 299-5200

	www.wdma.com	
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
FBC	Florida Building Code	(850) 487-1824

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220

EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664

DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program www.dps.dla.mil	
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.

DCA	Florida Department of Community Affairs Florida Emergency Management www.dca.state.fl.us	(850) 488-8466
FDEP	Florida Department of Environmental Protection www.dep.state.fl.us	(850) 245-2118

PART 23 - PRODUCTS (Not Used)

PART 24 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015900 – PROJECT SIGN

PART 1 GENERAL

Contractor, at contractor's expense, shall furnish and install a **4' x 8'** sign (with white painted posts) prior to start of construction. A sample sign template is below but is not specific to the project. The exact style and design of the sign will be provided by the CITY to the Contractor during the preconstruction meeting in PDF format.

See Page 2, "Construction Sign Request Form", for information on the sign for this Project.

END OF SECTION

SECTION 016000
PRODUCT REQUIREMENTS

PART 25 - GENERAL

25.1 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.

25.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
   1. Division 01 Section "References" for applicable industry standards for products specified.
   2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   3. Divisions 02 through 48 Sections for specific requirements for warranties on products and installations specified to be warranted.

25.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or were indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Contractor to use the specific product specified unless permission has been given to the contractor for substitution of comparable product, by the Architect.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

25.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Completed List: Within 60 days after date of Notice to Proceed, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
4. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. To be considered part of the original bid, all such requests must be submitted to the Architect (10) ten calendar days prior to the bid-opening day. Unless the City has specifically approved a proposed substitution in writing, it will not be considered, under any circumstances, a part of the bid proposal.
2. Documentation: All approvals of substitution shall be accomplished before the completion of the bidding process. Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by City and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. List of similar installations for completed projects with project names and

addresses and names and addresses of architects and cities.

g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with Florida Building Code from an organization acceptable to Building Official.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Change Order or Change Directive.
b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

25.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

25.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage,

deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

25.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to City.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for City.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 26 - PRODUCTS

26.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. City reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.

9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

26.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect. Specific product as called out in the drawings or specifications shall be used and other products as mentioned may be considered for approval by Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers City a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities City must assume. City's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by City, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

26.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and cities, if requested.
5. Samples, if requested.

PART 27 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017700
CLOSEOUT PROCEDURES

PART 28 - GENERAL

28.1 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.

28.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 01 Section "Photographic Documentation" for submitting Final Completion construction photographs and negatives.
3. Division 01 Section "Execution Requirements" for progress cleaning of Project site.
4. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
6. Divisions 02 through 48 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

28.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Submit list of all subcontractors including names, addresses (with zip code) and telephone numbers and dollar amount of work performed.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting City unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by City. Label with manufacturer's name and model number where applicable.

7. Make final changeover of permanent locks and deliver keys to City. Advise City's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Complete final cleaning requirements, including touchup painting.
12. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

28.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit final releases of lien from all subcontractors and suppliers
3. Submit pest-control final inspection report and warranty.
4. Instruct City's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
5. No later than 30 days after completion of the job, the contractor shall provide IA/SMD with all blueprints of the space and all associated areas (i.e. roof, garage) on AutoCAD and a hard copy of the floor plan.
6. The security system shall be included in the blueprints after the initial floor design. The security system shall be on a separate layer. It shall not be included on the same layer of the electrical system. The security system shall be treated as sensitive information and shall not be given to any contractor who does not have a need to know. A hardcopy of as-built of the Security System along with the AutoCAD copy shall be provided to SMD no later than 30 days after the completion of the job. (This shall include any changes made during the construction phase). Security plan shall include furniture layout.
7. The CBP/Security Management Division requires one business week after the space has been totally built out (including carpet, painting, electrical, plumbing, HVAC, communication cable, and video cable, except for the installation of the ceiling tile) to complete our security and communication inspections once these inspections are completed. After that, a final walk through shall take place by the SMD and GSA to prepare a punch list to present to the contractor/lessor. No security project shall be considered substantially complete without a final walk through.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled

requirements. Final payment will only be made after ALL unconditional release of liens from all subcontractors and suppliers are received by the City.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

28.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project number.
    b. Project name
    c. Date.
    d. Name of Contractor.
    e. Page number.

28.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within [15] days of completion of designated portions of the Work that are completed and occupied or used by City during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

E. Submit Certificate of Occupancy to the Architect.

PART 29 - PRODUCTS

29.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 30 - EXECUTION

30.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    g. Sweep concrete floors broom clean in unoccupied spaces.
    h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    j. Remove labels that are not permanent.
    k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

        1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to unusual operating conditions.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on City's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017823
OPERATION AND MAINTENANCE DATA

PART 31 - GENERAL

31.1 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.

31.2 SUMMARY

A. Training for City Maintenance Personnel- This HVAC retrofit project shall provide training to City personnel tasked with the operation and maintenance of the installed equipment and controls. Contractors shall provide personnel for one day of onsite training.

B. Systems Manual – A Systems Manual to facilitate understanding of equipment design basis, operation, controls and maintenance shall be provided by the OR. Contractors shall provide the OR with IO&M manuals of all installed HVAC equipment and controls in electronic form (PDF).

C. The following sections include the City's administrative and procedural requirements for preparing Training and Maintenance documentation.

D. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 02 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

31.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

31.4 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final

inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

31.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 32 - PRODUCTS

32.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

32.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Date of submittal.
4. Name, address, and telephone number of Contractor.

5. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

32.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of City's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

32.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

32.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

32.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 33 - EXECUTION

33.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by City's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by City's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 34 - GENERAL

34.1 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.

34.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Sections include the following:

1. Division 01 Section "Closeout Procedures" for general closeout procedures.
2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 02 through 48 Sections for specific requirements for Project Record Documents of the Work in those Sections.

34.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. No later than 30 days after completion of the job, the Contractor shall provide City/IA/SMD with record prints of the Contract Drawings as well as Auto CAD files. A hard-copy of the security system as-built, as well as the Auto CAD files, shall also be provided to the City/IA/SMD no later than 30-days after completion of the job.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 35 - PRODUCTS

35.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
        1) Document with photographs.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Work Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
7. Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. Make corrections where required.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

    a. Project number.
    b. Project name.
    c. Date.
    d. Designation "PROJECT RECORD DRAWINGS."
    e. Name of Contractor.

35.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

35.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

35.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 36 - EXECUTION

36.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

C. Record Documents of water, sewer and drainage must be provided for the General Contractor by a Professional Land Surveyor and must be satisfactory for approval by the Broward County Health Department and the Broward County Department of Planning and Environmental Protection.

D. Final pay request will not be processed until Record Documents have been completed and submitted to the City.

END OF SECTION 017839

SECTION 017900
DEMONSTRATION AND TRAINING

PART 37 - GENERAL

37.1 RELATED DOCUMENTS

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

37.2 SUMMARY

A. Trainer- Contractor shall provide a single qualified trainer to support the training of City personnel in the operation and maintenance of the project HVAC equipment and controls, in collaboration with The OR. The training is to be performed on site after completion of the Systems Manual.

B. This section includes administrative and procedural requirements for instructing City's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

A. Related Requirements:

1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

37.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: The OR will provide an outline of the training program, supported by the Systems Manual.

37.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

37.5 COORDINATION

A. Coordinate instruction schedule with City's operations. Adjust schedule as required to minimize disrupting City's operations and to ensure availability of City's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 38 - PRODUCTS

38.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.

c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 39 - EXECUTION

39.1 PREPARATION

39.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and City for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct City's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. City will furnish an instructor to describe City's operational philosophy.
3. City will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with City, through Architect and, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and a written performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to City. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

1. Additional Guidance for Structural
    a. The Contractor shall hire a Structural Engineer to conduct a Structural Analysis to address all Structural issues related to the roof-mounted equipment.
    b. Existing RTU-1 replacement with DOAS-1 involves increased weight (>10%) and larger roof opening and curb. See submittal for generic DOAS-1 roof curb by Trane. Options are a cost-effective expansion of the existing roof opening or capping of the existing roof opening and installation of new curb with any required structural reinforcement, as determined by structural engineer. Either option should provide the required service clearances for DOAS-1.
    c. Existing RTU-2 replacement with new/smaller RTU-2 will not require curb replacement.

2. Additional Guidance for Split System-1 (AHU-1 and CU-1)
    a. Contractor is to perform field installation of Trane-supplied Rawal Valve for CU-1. See new submittal by Trane.
    b. Contractor will provide thermal expansion valve (TXV) for AHU-1.
    c. Contractor will provide duct mounted dampers for AHU-1 and others per M-101 note.

COMMISSIONING PLAN

CONTENTS

LIST OF TABLES

LIST OF FIGURES

PURPOSE

This Commissioning Process Plan (Cx Plan) has the purpose of insuring that the HVAC Retrofit for Fire Station 54 is installed, tested, operated, and maintained to achieve the Current Facility Requirements developed by the City of Fort Lauderdale ("Owner"). Contractors shall adhere to the requirements of this plan in combination with other project documents, as listed in Appendix A. These are working documents which will evolve as the project progresses.

PROJECT INFORMATION SUMMARY

Fire Station 54 is a two story, 10,064 square foot building completed in 2018. It was designed to house a permanent fire fighter staff of 2 units consisting of up to 7 personnel operating 24 hours a day, 7 days a week. The original HVAC system design, dated 2013, used typical indoor design conditions of 72°F and 50% relative humidity (RH), and specified a dedicated outdoor air system (DOAS) in series with one packaged rooftop unit (RTU) and one split AC system. VAV units were to serve the bunk rooms and other spaces. Exhaust included kitchen, bathroom, and apparatus bay exhaust systems. Thermostat controls were wall mounted and wireless. The design was altered in 2017 with deletion of the DOAS, replaced with a second RTU without humidity control or reheat capabilities.

Issues being resolved with this HVAC Retrofit

Shortly after occupancy, the Fire Station experienced issues with high humidity, indoor condensation, negative pressurization, and microbial growth. The primary causes of the comfort issues were identified as poor HVAC design, to include the lack of a dedicated outdoor air system (DOAS) to provide adequate dehumidification and excessive cooling capacity overall. Secondary issues included poor controls and exceedingly low and manually controlled temperature setpoints. Numerous investigations, remediation and HVAC equipment retrofits were attempted without resolution of the issues and the station was finally abandoned for safety reasons in 2021.

HVAC Retrofit Design

CES Engineering was engaged to redesign the fire station to permanently resolve its issues. It performed detailed load and other analysis. The Basis of Design was to include a 15-ton DOAS, two RTUs, VAVs, and other equipment. Overall cooling capacity was significantly reduced. Consequently, the entire ductwork system was to be replaced.

Installation Concept

The HVAC retrofit will require the following task sequence:

- Removal, disposal and re-installation of the existing ceiling grid and ductwork.

- Slab penetrations and new duct risers for the DOAS.
- New electrical for VAV and other systems.
- Structural analysis for the DOAS and possible design, materials, fabrication and installation of rooftop curb and support system. Allowances are provided for that purpose.
- Rooftop and ground installation of new HVAC systems, to include DOAS, RTU, split, mini-split, and VAV.
- New controls and fire system integration.
- Commissioning- Conduct of Functional Performance Tests (FPT) to verify all sequences of operation, interlocks, safeties and system integration of commissionable HVAC equipment and controls.

ROLES AND RESPONSIBILITIES

Mechanical Contractor

1. Adhere to City of Fort Lauderdale General Conditions and Commissioning Plan and Specifications, provided in attached Appendices.
2. Provide documentation to support commissioning of this project, to include:
    a. Submittals, other than those provided in the Project Documents for basis of design HVAC equipment and controls.
    b. Shop drawings
    c. HVAC equipment start up reports, per manufacturer Installation Manual for commissionable equipment.
    d. Test and Balance Report
    e. Start UP checklists, per manufacturer and/or provided by Owner's Representative.
3. Provide personnel to operate HVAC equipment and controls during Functional Performance Testing.
4. Provide equipment Installation and O&M manuals in digital format (PDF) for development of the building's System Manual
5. Provide As Built drawings in collaboration with CES engineering

COMMISSIONING SCOPE OF WORK

Equipment to be Commissioned

1. DOAS
2. RTU2
3. Split System 1 (AHU1 & CU1)
4. Split System 2 (AHU2 & CU2)
5. VAVs
6. Controls and Sequences of Operations

Tasks to be Performed by Mechanical Contractor

1. Submittal of manufacturer checklists (from O&M manuals)
2. Submittal of startup checklists
3. Operation of equipment and controls during functional testing
4. Resolution of Issues identified during Functional Performance Testing
5. Submittal of IOM and other documents to prepare Systems Manual
6. Provide certified person to perform building staff Systems and Maintenance Training

GENERAL SCHEDULE

To be provided by Owner's Representative as an update to this plan

APPLICABLE CODES AND STANDARDS

- Florida Building Code 5th Edition
- Florida Fire Prevention Code 5th Edition
- National Electrical Code 2011 Edition
- ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quality
- ASHRAE Standard 55-2020 Thermal Environmental Conditions for Human Occupancy
- ASHRAE Standard 90.1
- ASHRAE Standard 202-2018 The Commissioning Process

APPENDIX 1- PROJECT DOCUMENTS

Project documents are filed and maintained by Owner's Representative on a shared One Drive folder. Contractor shall request a link to same and be notified of any document changes, e.g., updates to the Cx Plan or submittals.

Source	Document
CES Engineering	Mechanical Plans-Permit Set
CES Engineering	Electrical Plans -Permit Set
CES Engineering	Electrical CAD (Folder)
CES Engineering	Structural CAD (Folder)
CES Engineering	Basis of Design Narrative Review- FS 54
CES Engineering	Fire Protection CAD (Folder)
City of Ft Lauderdale	011200 Special conditions WLC modified
City of Ft Lauderdale	012500 SUBSTITUTION PROCEDURES WLC Reviewed
City of Ft Lauderdale	012900 PAYMENT PROCEDURES WLC reviewed
City of Ft Lauderdale	013100 PROJECT MANAGEMENT & COORDINATION modified WLC
City of Ft Lauderdale	013200 CONSTRUCT PROGRESS DOCUMENTATION modified WLC
City of Ft Lauderdale	013233 PHOTOGRAPHIC DOC modified WLC
City of Ft Lauderdale	013300 SUBMITTAL PROCEDURES modified WLC
City of Ft Lauderdale	014000 QUALITY REQUIREMENTS modified WLC
City of Ft Lauderdale	014200 REFERENCES reviewed WLC
City of Ft Lauderdale	015900 CONSTRUCTION PROJECT SIGN REQUEST reviewed WLC
City of Ft Lauderdale	015900 Construction Sign Request Form.Pg. 1 rev WLC
City of Ft Lauderdale	016000 PRODUCT REQUIREMENTS_reviewed WLC
City of Ft Lauderdale	017700 CLOSEOUT PROCEDURES reviewed WLC
City of Ft Lauderdale	017823 OPERATION AND MAINTENANCE DATA modified WLC
City of Ft Lauderdale	017839 PROJECT RECORD DOCS reviewed WLC
City of Ft Lauderdale	017900 DEMONSTRATION AND TRAINING modified WLC
Trane	Submittal AHU1 Trane BOD
Trane	Submittal CU1 Trane BOD
Trane	Submittal DOAS1 Trane BOD
Trane	Submittal Mini Split 2
Trane	Submittal VAV-B
Trane	Submittal VAV-C
Trane	Submittal VAV-D
Trane	Submittal - Mini Split 2 Multi Room
Trane	Submittal RTU2
Trane	Submittal AHU1 Trane p1
Trane	IOM Manuals (folder)
Whiskey Lima Corp.	Cx Plan v1- Fire Station 54 FLL

Table 1- Project Documents

Commissioning Plan

APPENDIX 2- CURRENT FACILITY REQUIREMENTS

Excerpted from original report.

Purpose

These Current Facility Requirements (CFR) are provided by the Owner's Representative for the City of Fort Lauderdale, to guide the planning, design, installation, and testing of a retrofit HVAC system for Fire Station 54. This is a working document which will evolve as the project progresses. All contractors for this project should read, understand, and comply with this CFR. Inability to comply with this CFR should be communicated in writing to the Owner's Representative for resolution.

Background

Fire Station 54 is a two story, 10,064 square foot building belonging to the City of Fort Lauderdale (Owner). It was designed to house a permanent fire fighter staff of 2 units consisting of up to 7 personnel operating 24 hours a day, 7 days a week.

Layout

The ground floor includes an apparatus bay, multipurpose/community room, offices, gymnasium, mechanical, electrical and storage spaces The second floor consists of seven firefighter bunk rooms, bath/shower rooms, fully equipped kitchen, dining area and day room.

HVAC Design

The original HVAC system design, dated 2013, used typical indoor design conditions of 72°F and 50% relative humidity (RH), and specified a dedicated outdoor air system (DOAS) in series with one packaged rooftop unit (RTU) and one split AC system. VAV units were to serve the bunk rooms and other spaces. Exhaust included kitchen, bathroom, and apparatus bay exhaust systems. Thermostat controls were wall mounted and wireless. The design was altered in 2017 with deletion of the DOAS, replaced with a second RTU without humidity control or reheat capabilities.

HVAC Issues History

The building was placed into service in the fall of 2018 and occupants began operating the HVAC system well below the design temperature (62°F -68°F). In the spring of 2019, high humidity (>70% RH) and indoor condensation were first reported. An HVAC assessment provided in July 2019 concluded that the installed

Commissioning Plan

HVAC system was incapable of providing sufficient dehumidification under the preferred and lower temperature setpoints and should be replaced with a DOAS, as per the original design. It also noted that persistent high humidity would result in microbial/mold growth. The first of two IAQ investigations in December 2019 reported surface microbial and mold growth in seven sampled areas, to include supply air diffusers, interior drywalls and inside the wall system. The consultant (Terracom) recommended temperature and relative humidity adjustments, among other measures. The severity of the issues was addressed in the subsequent two years with multiple measures, to include portable air conditioners, outside air damper closure, freeze stat replacements, Rawal valve installation, and VAV upgrades with reheat strips. Four test and balance projects, and one additional HVAC assessment was performed. The measures failed to resolve the high humidity and microbial growth issues, and the building was evacuated in the fall of 2021.

Project Objective

The current project was initiated to seek permanent problem resolution with a comprehensive redesign and installation of an HVAC system retrofit, expected to be a DOAS. The Owner requires redesign and installation of upgrades necessary to meet the actual (atypical) operating conditions and elimination of the temperature, humidity, and indoor condensation issues. The design team shall thoroughly understand and target the correction of all previous issues described in the Issues Log attached and the historical documents listed in Table 2. Given the past history, failure to do so may result in a non-reversible loss of confidence in the building by its firefighter occupants.

Current Facility Requirements

The Design Team shall provide a Basis of Design to the Owner's Representative for acceptance by the Owner. Guidance is as follows:

Heat Load

The Design Team shall perform a heat load calculation per ASHRAE standards, with emphasis on quantifying the indoor humidity generated by the showers and kitchen use typical for these occupants. The heat load calculation is to be provided to the OR in word, excel, acrobat or other Microsoft office based digital format for review.

Occupancy

The design team shall use revised occupancy as provided by the Owner, as follows:

- First Floor – Maximum occupancy is 30 personnel when community room is in use only.
- Second Floor- Continuous occupancy is 7 firefighters, 2 units/apparatus operating 24/7

Commissioning Plan

Ventilation

Outdoor air intake shall consider the following:

- Revised occupancy as listed above.
- Demand Control ventilation with occupancy/CO2 sensing and modulating outdoor air dampers to limit OA intake to the actual required amount.
- Apparatus Bay ventilation under continuous and purge exhaust modes, to be defined.
- Bunker gear storage room ventilation as code required and to isolate contamination in that space

Indoor Design Operating Conditions

The redesign should be based on the atypical temperature requirements of the occupants, while avoiding excessive relative humidity (>60% continuous) and risk of microbial/mold growth (>60F dew point continuous). It is understood that these new design conditions will not conform with ASHRAE Standard 55-2020 for Acceptable Thermal Environment, as the sensible temperatures required by the firefighters are too low. Desired setpoints have been verified by building officials and are as follows:

- Occupied: 68F db., 50% RH, <60F dew point
- Unoccupied: 72F db., 55% RH, <60F dew point (to be confirmed). 1st floor unoccupied in evening hours (1800-0600).

Humidity Controls

Indoor humidity and dew point temperature control being of paramount concern, the Design Team shall consider the following HVAC system features:

- Dedicated Outdoor Air System (DOAS) with Reheat capability and Energy Recovery Ventilation (ERV).
- Consider using a DOAS for all outdoor air dehumidification and closing OA dampers on existing RTUs and AHU-1.
- Space Humidity and Dew Point Sensors. Include RH or DPT sensors in appropriate spaces. Trane reported that there are no humidity sensors on the first floor (AHU-1).
- VAV reheat: Design team should seek to integrate the newly installed VAV reheat system.

Building Pressurization

Commissioning Plan

The design team shall provide air balance calculations and documentation for correct pressure relationships between the occupied building (positive), apparatus bay (negative) and contaminated ("hot zone") areas, with consideration of the following:

- Building pressure sensors and alarms
- Interlock between DOAS and exhaust system
- DOAS with ERV and connected exhausts
- Detailed notes and schedules for the use of TAB and HVAC maintenance contractors
- Proper pressurization between "hot" and other zones in the apparatus bay, bunker room, and other spaces

Air Distribution

The design team shall add required ductwork and equipment and correct known deficiencies, as follows:

- Provide DOAS air flow directly to selected spaces or to RTU-2 and AHU-1.
- Avoid rooftop duct work if possible.
- Repair/replace the RTU1 and 2 return air ducts, reported to be undersized.
- Repair ZD-1 VAV air flows to corridor 1 (bunk rooms), reported by Richard Flanders TAB (8/24/21) as only sized to provide 49% of design air flows.
- Repair/replace VAV-1 controller, reported to be inoperable in ICTB test and balance report dated October 10, 2021.
- Repair static pressure fault for AHU-1, reported by ICTB TAB report (10/1/21) to be at 2.28" wc versus a design static pressure of 1" wc
- Assess the lack of return air grill(s) in second floor kitchen/dining area to prevent humidity migration into the bunk room area.
- Add missing access doors and balancing dampers for first floor electric room and bathrooms 4 and 5. Reported by Richard Flanders TAB report dated August 24, 2021.

Exhaust

- Apparatus Bay- exhaust should activate on motion sensors (occupancy) to ventilate the space before vehicles are started through the departure of firefighters from the bay. Ventilate based on eliminating diesel particulate in the bay area, if possible, instead of existing carbon monoxide (CO) detection.
- Kitchen Exhaust and Make Up Air (MAU)- Review calculations and air balance and modify from existing design as required, in combination with review of the return air that is lacking in the adjacent dining room area. Verify backdraft damper repair on the existing MUA unit.
- Bathroom Exhaust- Consider increasing the flow rate of shower exhaust in the bunk room area. Existing flow rates of 50 cfm may be insufficient to remove humidity from this space.
- Control and DOAS/ERV Integration- Determine whether constant, intermittent, occupancy controlled, or DOAS/ERV options are best to control OA intake and exhaust to preserve positive building pressurization.

Commissioning Plan

Controls

- Apparatus Bay- disconnect the app bay system from Trane BMS
- Bunk Rooms- limit minimum cooling temperature setpoint to 68°F to prevent indoor condensation

Other Indoor Environmental Quality

- COVID Measures- In addition to improvement in temperature and humidity control, the design team should comply with recent guidelines to reduce the risk of airborne transmission of pathogens, to include COVID.
- Air Cleaning- To reduce any residual air contamination and produce higher equivalent air changes per hour (eACH), add Ultraviolet Germicidal Irradiation (UVGI) units to supply air ductwork.

Special Functional Areas

- Bunk Rooms- It is understood that bunk room thermostats have been disabled to only provide monitoring of temperature and RH. Restore control of the VAVs with recently installed reheat strips. Per Owner review and acceptance, limit thermostat setting to a minimum cooling temperature of 68F and 50% relative humidity.
- Medical Storage- Subject to frequent door opening. needs to be isolated from app bay and other humidity source.
- Fire Poles- design to prevent upward flow of contamination from app bay into the living quarters/offices
- Kitchen - Review and adjust kitchen exhaust and makeup air design and operational settings. Verify that the unit has a fully operational backdraft damper, which was reported missing after original installation. Assess and correct the lack of return air from the kitchen area, with emphasis on preventing humidity migration from the kitchen area into the bunk room area.
- Showers - Bath and shower exhaust rates are 50 cfm, which may be inadequate for humidity control in the adjacent corridor and bunk room areas. Assess and adjust as required.

Commissioning Plan

Schedule

The design team shall consider existing/new occupancy and other sensor capabilities that might allow optimal control of HVAC operation. Humidity and dew point control must be preserved at any higher unoccupied sensible temperatures. The Owner requires the following:

- First Floor- occupied between 0600-2100 daily; timed operator overrides of unoccupied setpoint
- Second Floor- continuously occupied at setpoint 68°F

Test and Balance

TAB data will be critical to verifying that installation and equipment operation conforms to this CFR. The design team shall specify in notes and detail drawings that the TAB contractor will perform the following testing in addition to their NEBB standard testing:

- DOAS measurements
  - Outdoor Air Intake Temperature (F)
  - Outdoor Air Intake flow rate (cfm)
  - Supply Air Temperature (F)
  - Supply Air flow (cfm)
  - Space or Return Air Relative Humidity (%RH)
  - Space or Return Air Dew Point Temperature (F)
  - Static Pressure (in wc)
- RTU 1 and 2 measurements
  - Outdoor Air Intake Temperature (F)
  - Outdoor Air Intake flow rate (cfm)
- Supply Air Diffusers
  - Supply Air Temperature (F)
  - Dew Point Temperature (F)

Limited Retrocommissioning

The Owner's Representative has been contracted to perform a limited scope RCx to verify that critical planning, design, and installation tasks comply with this CFR. Contracted tasks and deliverables include the following:

Development of Current Facility Requirements (CFR)

This CFR was developed by the OR based on knowledge of Fire Station 54 history, review of Owner-provided reports, plans and other documents, and review and acceptance of the drafted CFR by the Owner.

Commissioning Plan

Provide a Commissioning Plan

The OR will develop an RCx Plan to be used by the installation contractors (mechanical, test and balance, etc.) to guide and document their installation and testing.

Perform Design Review

Pursuant to this CFR, the design team shall provide a Basis of Design (BoD) document which explains in narrative form how the CFR will be achieved with design, equipment selection, controls, etc. This BoD will be reviewed and accepted by the Owner before commencement of the design phase. The OR will then review the overall design for compliance with the CFR. An Issues and Resolutions Log will be provided to address and document discrepancies and actions taken.

Construction Monitoring and Testing

The OR will inspect and monitor installation and review all Cx Plan testing by contractors. An Issues and Resolutions Log will be provided to address and document discrepancies and actions taken.

Commissioning Plan

APPENDIX 3- SYSTEMS TO BE COMMISSIONED

See Mechanical Plans Equipment Schedule details of the following equipment to be commissioned:

1 each DOAS

1 each RTU2

1 each Split 1 (AHU1 and CU1)

1 each Mini Split 2 (AHU2 and CU2)

6 each VAVB/C/D

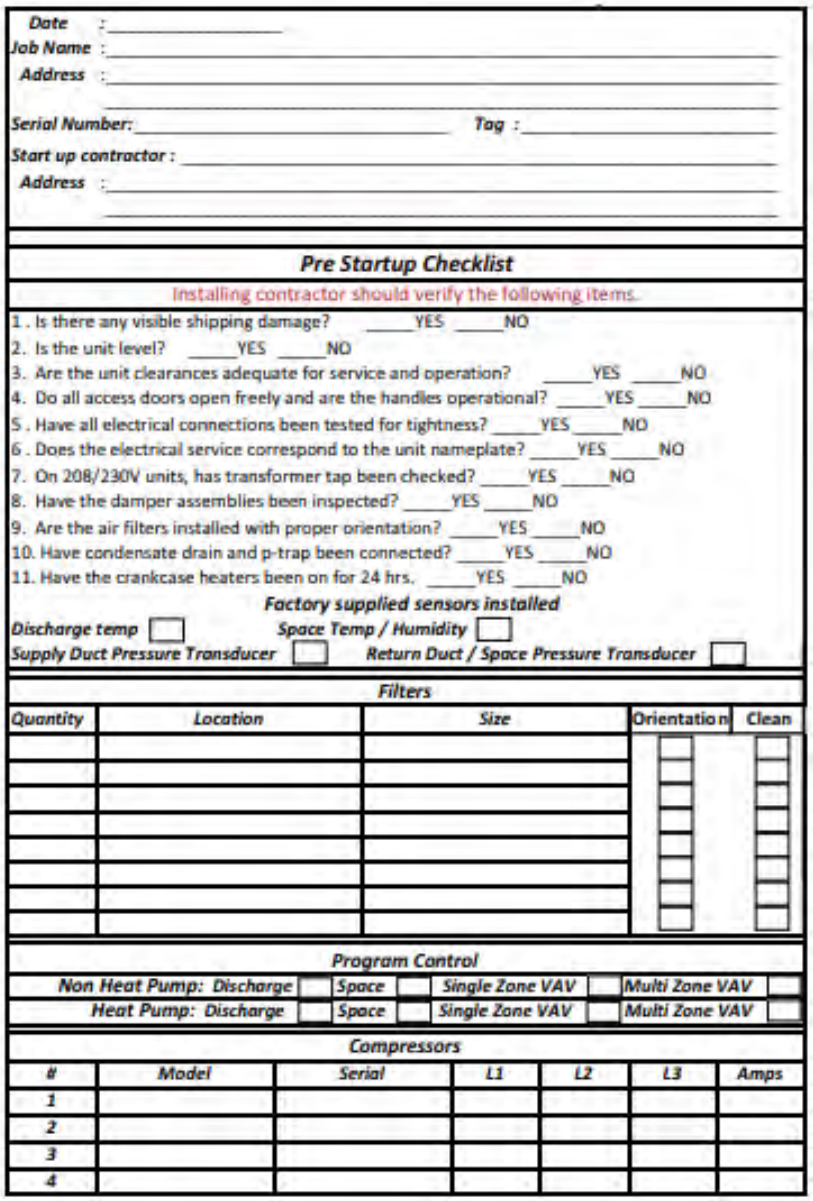
Controls and Sequences of Operations per Mechanical Plans

APPENDIX 4- START UP CHECKLISTS

Contractor shall complete and submit to the CxP the manufacturer's startup checklists for all commissionable HVAC equipment and controls, as provided in the IOM manuals.

DOAS1

DOAS 1 has Start Up checklists starting on pages 65-67 of its IOM manual, publication number OAU-SVX006C-EN dated November 2019. Excerpts are shown below:



Date :_____
Job Name :_____
Address :_____
_____
Serial Number:_____ Tag :_____
Start up contractor : _____
Address :_____
_____

Pre Startup Checklist

Installing contractor should verify the following items.

1. Is there any visible shipping damage? _____YES _____NO
2. Is the unit level? _____YES _____NO
3. Are the unit clearances adequate for service and operation? _____YES _____NO
4. Do all access doors open freely and are the handles operational? _____YES _____NO
5. Have all electrical connections been tested for tightness? _____YES _____NO
6. Does the electrical service correspond to the unit nameplate? _____YES _____NO
7. On 208/230V units, has transformer tap been checked? _____YES _____NO
8. Have the damper assemblies been inspected? _____YES _____NO
9. Are the air filters installed with proper orientation? _____YES _____NO
10. Have condensate drain and p-trap been connected? _____YES _____NO
11. Have the crankcase heaters been on for 24 hrs. _____YES _____NO

Factory supplied sensors installed

Discharge temp ☐ Space Temp / Humidity ☐
Supply Duct Pressure Transducer ☐ Return Duct / Space Pressure Transducer ☐

Filters

Quantity	Location	Size	Orientation	Clean
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐

Program Control

Non Heat Pump: Discharge	☐	Space	☐	Single Zone VAV	☐	Multi Zone VAV	☐
Heat Pump: Discharge	☐	Space	☐	Single Zone VAV	☐	Multi Zone VAV	☐

Compressors

#	Model	Serial	L1	L2	L3	Amps
1						
2						
3						
4						

Figure 1-Start Up Checklist for DOAS-1 (1)

Commissioning Plan

Supply Fan Assembly								
Fan 2 - Alignment		Name plate amps:		Actual Amps:		Rotation		Hrtz:
Fan 2 - Alignment		Name plate amps:		Actual Amps:		Rotation		Hrtz:

Energy Recover Wheel							
Wheel Spins freely		Check Rotation		FLA:			
Voltage	L1:	L2:	L3:		Amps:		HP:

Power Exhaust Fan Assembly								
Fan 2 - Alignment		Name plate amps:		Actual Amps:		Rotation		Hrtz:
Fan 2 - Alignment		Name plate amps:		Actual Amps:		Rotation		Hrtz:

Dampers					
Damper set up	Modulating		Two Position		Operation check

Ambient Temperature	
Ambient Dry Bulb Temperature_____°F	Ambient Wet Bulb Temperature_____°F

Condenser Configuration						
Water Cooled						
No water leaks		Water Flow :_____ GPM				
Water Inlet Temp :_____ °F		Water Outlet Temp: _____ °F				
Air Cooled		L1	L2	L3	Amps	HP
	Fan 1					
	Fan 2					
	Fan 3					
	Fan 4					

Refrigeration System --Circuit 1					
	Pressure	Sat Temperature	Line Temperature	Subcooling	Super Heat
Discharge					
Suction					
Liquid					

Refrigeration System --Circuit 2					
	Pressure	Sat Temperature	Line Temperature	Subcooling	Super Heat
Discharge					
Suction					
Liquid					

HEATING -- Refrigeration System (Heat Pump Only) --Circuit 1					
	Pressure	Sat Temperature	Line Temperature	Subcooling	Super Heat
Discharge					
Suction					
Liquid					

HEATING -- Refrigeration System (Heat Pump Only) --Circuit 2					
	Pressure	Sat Temperature	Line Temperature	Subcooling	Super Heat
Discharge					
Suction					
Liquid					

Figure 2-Start Up Checklist for DOAS-1 (2)

Commissioning Plan

Electric Heat				
Pre Heat:	Amps	L1:	L2:	L3:
Primary:	Amps	L1:	L2:	L3:

Figure 3-Start Up Checklist for DOAS-1 (3)

RTU2

RTU2 has Pre-Start, Unit Start Up and Sequence of Operations checks on pages 46-65 of IOM publication OAU-SVX006C-EN dated April 2020. Owner's Representative will provide a more abbreviated checklists corresponding to the final unit configuration.

Split System 1 (AHU1 & CU1)

AHU1 has per-start, general, fan, coil and electrical checks that begin on page 65 of IOM publication BCX-SVX001A-EN dated October 2013. CU1 has start up and checkout procedures in the installer guide is publication 18-AC51D1-9-EN. Excerpt of Checkout procedure is shown below:

Final phases of this installation are the unit Operational and Checkout Procedures. To obtain proper performance, all units must be operated and charge adjustments made.

Important: *Perform a final unit inspection to be sure that factory tubing has not shifted during shipment. Adjust tubing if necessary so tubes do not rub against each other when the unit runs. Also be sure that wiring connections are tight and properly secured.*

CHECKOUT PROCEDURE

After installation has been completed, it is recommended that the entire system be checked against the following list:

1. Leak check refrigerant lines. ..... [ ]
2. Properly insulate suction lines and fittings..... [ ]
3. Properly secure and isolate all refrigerant lines..... [ ]
4. Seal passages through masonry. If mortar is used, prevent mortar from coming into direct contact with copper tubing. ..... [ ]
5. Verify that all electrical connections are tight..... [ ]
6. Observe outdoor fan during on cycle for clearance and smooth operation..... [ ]
7. Be sure that indoor coil drain line drains freely. Pour water into drain pan..... [ ]
8. Be sure that supply registers and return grilles are open and unobstructed..... [ ]
9. Be sure that a return air filter is installed..... [ ]
10. Be sure that the correct airflow setting is used. (Indoor blower motor) ..... [ ]
11. Operate complete system in each mode to ensure safe operation..... [ ]

Figure 4- Checkout Procedures for CU1

Commissioning Plan

Mini Split System (AHU2 & CU2)

IOM for TPLA is unavailable for now. Owner's Representative will provide an update or custom checklists.

VAV Systems

VAV models VCEF have installation and unit setup checks beginning on page 32 of publication VAV-SVN01E-EN date June 2006.

APPENDIX 5- FUNCTIONAL PERFORMANCE TESTS

Functional Performance Tests (FPT) will be performed on commissionable HVAC equipment and controls after start-up checks are verified. FPTs will test all sequences of operations listed on the mechanical plans and verify proper systems setpoints, safeties, interlocks, and integration. Owner's Representative will create the required checklists after equipment is ordered and RFIs are satisfied. Contractors will provide personnel to operate the equipment and Owner's Representative will witness and verify that operation. Issues identified during testing will be recorded by Owner's Representative in the Issues and Resolutions Log, to be corrected by the appropriate contractor.

APPENDIX 6- ISSUES AND RESOLUTIONS LOG

The Issues and Resolutions Log template is shown below with project samples. Contractor shall resolve all Issues identified and recorded during Cx and FPTs.

Statu	Reference	Issue Type	Issue Description	Proposed Resolution	Assigned
Complete	1900000000	HVAC	Mech reported that RTU-1 freeze stat was reported faulty	Verify repair or adjustment	Mech/Trane
Complete	1900000000	HVAC	Mech reported that RTU1 was going into heat mode due to low temperature setpoints; reported as corrected	Verify correction	Trane/Mech
Complete	2109280000R	Humidity	Terracon reported RH>60% in both September and December reports	Confirm with data loggers deployed	WLC
Complete	2112031004E	Humidity	City reported RH>70% in bunk rooms with temperatures between 62-67F db after OAD closed. Exhaust status is unknown, therefore building pressurization status is unknown	Confirm the status	City
Complete	2112131530I	Controls	Multiple tstats (3) observed in corridors; unknown which control units and which are for monitoring	Verify stat status following retrofit; completed	Trane
Complete	B&I	Drawings	Please send the original building drawings so we have the roof pitch and drop ceiling info.	Whiskey Lima to add original building drawings to One Drive shared Project Documents	WLC

Table 2-Sample Issues and Resolutions Log

APPENDIX 7- SYSTEMS MANUAL

Owner's Representative shall assemble a digital Systems Manual to guide building staff and occupants in the operation and maintenance of the HVAC equipment and controls. Contractor shall provide new documents and updates to existing project documents as requested by Owner's Representative.

APPENDIX 8- SYSTEMS TRAINING

Owner's Representative shall develop and perform 8 hours of HVAC systems operation and maintenance training for building maintenance staff, after development of the Systems Manual. Contractor shall provide one certified technician to assist in the training.

APPENDIX 9- WARRANTY AND SEASONAL REVIEW

Owner's Representative will propose seasonal and warranty review and testing of equipment, as dictated by conditions of the original commissioning for this project. Priority will be to test during peak cooling load conditions that are expected to be from July- September.

Contact Information for the Contractors that Constructed Fire Station 54

Architect
PGAL
Contact: David Wallace
Phone: (561) 988-4002
E-Mail: DWallace@pgal.com
791 Park of Commerce Blvd #400, Boca Raton, FL 33487

General Contractor
Burke Construction Group
Contact: David Martinez
Phone: (305) 468-6654
E-Mail: DMartinez@bcginc.net
10145 NW 19th Street, Doral, FL 33172

Roof Subcontractor
Precision Roofing Corporation
Contact: Maria Cadenas
Phone: (305) 822-9969
E-Mail: Maria@precision-roofing.com
2646 W 77th Pl, Hialeah, FL 33016

Fire Sprinkler System
Cardell Fire Protection
Contact: Jorge Caballo
Phone: (305) 418-4880
E-Mail: info@cardelfire.com
1430 N.W. 108th Avenue, Suite 101, Miami, FL 33166

FM200 Fire Suppression System
United Fire Protection, Inc.
Contact: Donnie Delgado
Phone: (954) 572-0119
E-Mail: ddelgado@united-fire.com
10260 NW 47th Street, Sunrise, FL 33351

DRAWING INDEX

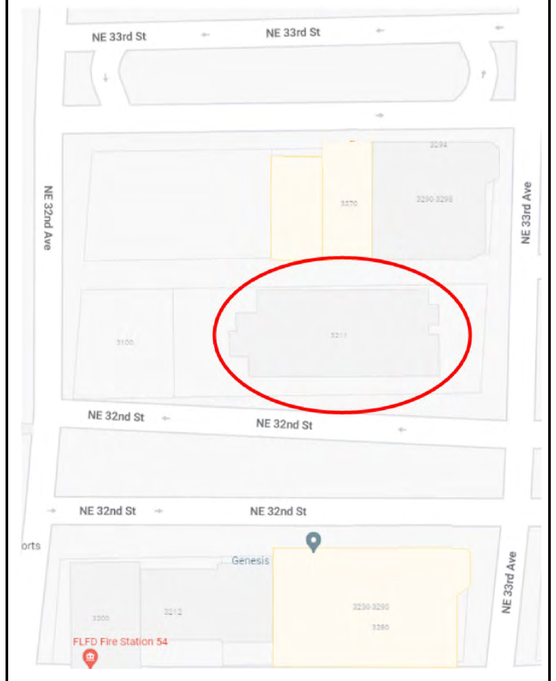
XX	SHEET DESCRIPTION
M-000	MECHANICAL ABBREVIATIONS, SYMBOLS AND NOTES
MD-101	MECHANICAL DEMOLITION PLAN FIRST FLOOR
MD-102	MECHANICAL DEMOLITION PLAN SECOND FLOOR
MD-103	MECHANICAL DEMOLITION PLAN ROOF FLOOR
M-101	MECHANICAL PLAN FIRST FLOOR
M-102	MECHANICAL PLAN SECOND FLOOR
M-103	MECHANICAL PLAN ROOF FLOOR
M-104	HVAC CONTROLS PLANS FIRST FLOOR
M-105	HVAC CONTROLS PLANS SECOND FLOOR
M-500	MECHANICAL DETAILS
M-600	MECHANICAL SCHEDULES
M-700	HVAC CONTROLS DIAGRAMS
M-701	HVAC CONTROLS DIAGRAMS
E-000	ELECTRICAL SPECIFICATIONS, ABBREVIATIONS, SYMBOLS AND NOTES
ED-101	HVAC CONTROLS PLANS SECOND FLOOR
ED-102	MECHANICAL DETAILS
ED-103	MECHANICAL SCHEDULES
E-101	ELECTRICAL PLAN FIRST FLOOR
E-102	ELECTRICAL PLAN SECOND FLOOR
E-103	ELECTRICAL PLAN - ROOF
E-500	ELECTRICAL SCHEDULES & PARTIAL ELECTRICAL RISER DIAGRAM

CITY OF FORT LAUDERDALE

PROJECT #12735
FIRE STATION 54 HVAC SYSTEM
HVAC UPGRADES

3211 NORTH EAST 32ND STREET

FORT LAUDERDALE, FLORIDA



NORTH

LOCATION SKETCH

PROJECT #12735
FIRE STATION 54 HVAC SYSTEM
HVAC UPGRADES
3211 NORTH EAST 32ND STREET, FORT LAUDERDALE, FLORIDA 33308

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

FORT LAUDERDALE CITY COMMISSION

DEAN J. TRANTALIS	MAYOR
HEATHER MORAITIS	COMMISSIONER - DISTRICT I
STEVEN GLASSMAN	COMMISSIONER - DISTRICT II
ROBERT McKINZIE	COMMISSIONER - DISTRICT III
BEN SORENSEN	COMMISSIONER - DISTRICT IV

PROJECT MANAGER	JOB TITLE	PHONE NO.

DATE: 03/04/22

CAD FILE:

DRAWING FILE No.:

FOR PERMIT

MECHANICAL NOTES

1. PROVIDE ASSISTANCE, DOCUMENTATION, AND COORDINATION WITH 3RD PARTY COMMISSIONING AGENT. COMMISSIONING SPECIFICATIONS TO BE PROVIDED BY COMMISSIONING AGENT.
2. REFER TO M-600 FOR HVAC EQUIPMENT SCHEDULES INCLUDING BUT NOT LIMITED TO ROOFTOP UNITS, SPLIT AC UNITS, EXHAUST FANS AND AIR DISTRIBUTION DEVICES.
3. PROVIDE FIRE DAMPERS, SMOKE DAMPERS, COMBINATION FIRE SMOKE DAMPERS, FIRE STOPPING AND SMOKE BARRIER SEALING OF ALL PENETRATIONS THROUGH FIRE WALLS AND FLOORS AS REQUIRED. REFER TO ARCHITECTURAL FLOOR PLANS AND CODE SHEETS FOR ADDITIONAL INFORMATION. COORDINATE ELECTRICAL AND FIRE ALARM CONNECTION WITH DIVISION 26.
4. NO PIPING, ETC, SHALL BE INSTALLED IN STAIRWELLS UNLESS THAT PIPING OR EQUIPMENT SERVES THE STAIRS.
5. PROVIDE VOLUME DAMPERS ON ALL DUCTWORK, BRANCH DUCTWORK, SERVING DIFFUSERS, GRILLES ETC.
6. THE CONTRACTOR SHALL PROVIDE PIPE EXPANSION JOINTS ON PIPING PASSING THRU ALL BUILDING EXPANSION JOINT LOCATIONS AS REQUIRED PER BUILDING CODES WHETHER OR NOT SHOWN ON DRAWINGS. REVIEW ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR EXACT BUILDING EXPANSION JOINT LOCATIONS AND EXPANSION DIMENSIONS.
7. HOUSEKEEPING PADS: REINFORCED CONCRETE WITH APPROXIMATELY 1" CHAMFERED EDGES, MINIMUM CLEARANCE OF 6" FROM EQUIPMENT BASE TO EDGE OF PAD. PAD SHALL BE MINIMUM 6" THICK, BUT THICKER WHERE REQUIRED FOR PROPER INSTALLATION OF EQUIPMENT.
8. COORDINATE ALL ELECTRICAL REQUIREMENTS WITH DIVISION 26.
9. COORDINATE ALL AIR INTAKES WITH EXHAUST. GENERAL EXHAUSTS SHALL BE MINIMUM 10'-0" AWAY FROM ANY INTAKES OR OPENINGS.
10. TEMPERATURE SENSORS SHALL BE LOCATED ON WALL 5'-0"AFF.
11. WALL MOUNTED HUMIDITY AND CO2 SENSORS SHALL BE PROVIDED
12. MOTORS: ALL MOTORS ARE TO BE PREMIUM EFFICIENCY TYPE
13. PROVIDE ACCESS PANELS FOR ALL EQUIPMENT CONCEALED ABOVE NON-REMOVEABLE CEILINGS.

MECHANICAL SPECIFICATIONS

1. PROVIDE ALL MATERIALS, EQUIPMENT AND LABOR NECESSARY TO COMPLETE THE WORK OUTLINED ON THESE CONTRACT DOCUMENTS. THE CONTRACTOR IS TO NOTE THAT THESE DOCUMENTS ARE DIAGRAMMATIC ONLY AND THAT FINAL PLACEMENT OF EQUIPMENT OR DEVICES IN THE FIELD MAY NOT DIRECTLY CORRESPOND TO THAT WHICH IS SHOWN ON THE DRAWINGS. IF A CONFLICT IN POSITIONING OCCURS THE CONTRACTOR IS TO NOTIFY THE ENGINEER IMMEDIATELY TO ASCERTAIN WHAT THE INTENT WAS BY THE DESIGN PROFESSIONAL.

2. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE LATEST CODES.
   - A. FBC 7TH EDITION 2020
   - B. NFPA 101 EDITION 2018, LIFE SAFETY CODE

3. PROVIDE ALL NECESSARY ELECTRICAL WORK, MATERIALS, EQUIPMENT AND LABOR TO PROVIDE POWER AND CONTROL WIRING TO ALL ITEMS OF MECHANICAL EQUIPMENT INDICATED ON THESE CONTRACT DOCUMENTS. PROVIDE ALL NECESSARY JUNCTION BOXES, PULL BOXES, PULL WIRES, COVER PLATES AND OTHER MISCELLANEOUS EQUIPMENT WHICH ARE NOT SHOWN ON THE CONTRACT DOCUMENTS BUT NECESSARY TO COMPLETE THE WORK.

4. ALL ELECTRICAL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE LATEST STATE OF FLORIDA ACCEPTED REVISION OF THE NATIONAL ELECTRIC CODE (NEC), NFPA 70, BOCA AND THE NFPA 101 LIFE SAFETY CODE.

5. THE FOLLOWING DEFINITIONS APPLY TO THIS CONTRACT:
   - A. FURNISH: THE TERM "FURNISH" MEANS TO "SUPPLY AND DELIVER TO THE PROJECT SITE, READY FOR UNLOADING, UNPACKING, ASSEMBLY, INSTALLATION, AND SIMILAR OPERATIONS."
   - B. INSTALL: THE TERM "INSTALL" IS USED TO DESCRIBE OPERATIONS AT PROJECT SITE INCLUDING THE ACTUAL "UNLOADING, UNPACKING, ASSEMBLY, ERECTION, PLACING, ANCHORING, APPLYING, WORKING TO DIMENSION, FINISHING, CURING, PROTECTING, CLEANING, AND SIMILAR OPERATIONS."
   - C. PROVIDE: THE TERM "PROVIDE" MEANS "TO FURNISH AND INSTALL, COMPLETE AND READY FOR THE INTENDED USE."
   - D. REMOVE: THE TERM "REMOVE" MEANS " TO DISCONNECT FROM ITS PRESENT POSITION, REMOVE FROM THE PREMISES AND TO DISPOSE OF IN A LEGAL MANNER."
   - E SUBSTITUTIONS: "SUBSTITUTIONS" ARE REQUESTS FOR CHANGES IN PRODUCTS, MATERIALS AND METHODS OF CONSTRUCTION AS PROPOSED BY THE CONTRACTOR AFTER AWARD OF THE CONTRACT.

6 INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS

7. THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL PERMITS REQUIRED BY THE AUTHORITIES HAVING JURISDICTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ARRANGING FOR INSPECTIONS AND BEING AVAILABLE FOR INSPECTIONS BY THE AUTHORITY HAVING JURISDICTION.

8. SUBMIT TO THE OWNER AN OFFICIAL CERTIFICATE OF INSURANCE FOR THEIR RECORDS.

9. DO NOT BURY DEBRIS OR EXCESS MATERIALS ON THE OWNER'S PROPERTY. DO NOT DISCHARGE VOLATILE, HARMFUL OR DANGEROUS MATERIALS INTO DRAINAGE SYSTEMS. REMOVE AND DISPOSE OF ALL WASTE MATERIALS, PACKAGING MATERIAL, SKIDS ETC. FROM THE SITE AND DISPOSE OF IN A LAWFUL MANNER IN ACCORDANCE WITH MUNICIPAL, STATE AND FEDERAL REGULATIONS.

10. PROVIDE FIRESTOPPING AROUND ALL MECHANICAL PENETRATIONS THROUGH FIRE RATED PARTITIONS. PROVIDE ASBESTOS FREE FIRESTOPPING SYSTEM CAPABLE OF MAINTAINING AN EFFECTIVE BARRIER AGAINST FLAME AND GASES. SYSTEM SHALL BE UL LISTED AND COMPLY WITH ASTM E 814.

11 PRIOR TO ORDERING ANY MATERIALS AND EQUIPMENT, THOROUGHLY REVIEW THE SITE CONDITIONS TO DETERMINE IF ADEQUATE CLEARANCES AND ACCESS IS ALLOWED TO INSTALL THE COMPONENTS. ORDER EQUIPMENT BROKEN DOWN AS NECESSARY TO ALLOW FOR PROPER RIGGING THROUGH THE PROJECT AREA. PROVIDE ALL NECESSARY ALTERATIONS TO THE STRUCTURE OF THE BUILDING AS NECESSARY TO RIG THE EQUIPMENT IN PLACE.

12 CAREFULLY INSPECT ALL BUILDING ELEMENTS PRIOR TO CUTTING OR DRILLING INTO WALL, FLOORS OR CEILINGS. PATCH AND PAINT SURFACES DISTURBED BY WORK UNDER THIS CONTRACT AS REQUIRED TO RESTORE THEM TO THEIR ORIGINAL CONDITION.

13. THE CONTRACTOR SHALL BE REQUIRED TO PROPERLY STORE MATERIALS AND EQUIPMENT SO AS TO AVOID THEFT OR VANDALISM. IF THEFT OR VANDALISM OCCURS, THE CONTRACTOR SHALL REPAIR OR REPLACE SUCH ITEMS AT THE DIRECTION OF THE ENGINEER.

14. THE CONTRACTOR SHALL COORDINATE ALL INTERRUPTIONS OF SERVICES AND LIMITATIONS OF ACCESS WITH THE OWNER NO LESS THAN 5 DAYS PRIOR TO THE INTERRUPTION.

15. ACCESS DOORS SHALL BE PROVIDED IN CEILINGS, WALLS AND FLOORS AT ALL DAMPERS, VALVES, CONTROL DEVICES, AND OTHER APPARATUS AND EQUIPMENT REQUIRING PERIODIC SERVICE AND INSPECTION. COORDINATE TYPE AND LOCATION WITH ARCHITECTURAL PLANS.

16. DUCTWORK AND ACCESSORIES
   - A. ALL DUCTWORK AND ACCESSORIES AS ITEMIZED HERE-IN SHALL BE GALVANIZED STEEL CONSTRUCTION, INCLUDING ALL FITTINGS AND FASTENERS AND SHALL COMPLY WITH THE LATEST EDITION OF SMACNA STANDARDS FOR 1" PRESSURE CLASS. ALL DUCTWORK DIMENSIONS SHOWN ARE INSIDE CLEAR DIMENSIONS. ALL SQUARE DUCT ELBOWS ARE TO BE INSTALLED WITH TURNING VANES. ALL RADIUSED DUCT ELBOWS SHALL HAVE MINIMUM CENTER LINE RADIUS EQUAL TO 1-1/2 TIMES THE DUCT WIDTH.
   - B. FLEXIBLE DUCT RUNOUTS SHALL NOT EXCEED 8 FEET IN LENGTH, SHALL BE PREINSULATED WITH VAPOR BARRIER, CPE INNER LINER, FACTORY FABRICATED, AND SHALL COMPLY WITH NFPA 90A AND UL 181. THE INSULATION MATERIAL SURFACE SHALL NOT BE EXPOSED TO THE AIR STREAM. FLEXIBLE DUCT RUNOUTS SHALL BE INSTALLED FULLY EXTENDED AND SUPPORTED TO MINIMIZE BENDS. FLEXIBLE DUCT SHALL BE AS MANUFACTURERD BY THERMAFLEX, TUTTLE AND BAILEY OR APPROVED EQUAL. FLEXIBLE DUCT CONNECTORS APPROXIMATELY 6 INCHES IN LENGTH SHALL BE PROVIDED WHERE SHEET METAL CONNECTIONS ARE MADE TO AIR HANDLING EQUIPMENT.
   - C. DUCT ACCESS DOORS SHALL BE PROVIDED IN DUCTWORK AT ALL AUTOMATIC DAMPERS, COILS, CONTROL DEVICES, AND OTHER APPARATUS REQUIRING SERVICE AND INSPECTION.
   - D. MANUAL BALANCING DAMPERS SHALL BE PROVIDED FOR EACH DIFFUSER, GRILLE AND REGISTER, EACH BRANCH OF THE MAIN TRUNK DUCT AND AS INDICATED ON THE DRAWINGS.
   - E. INSTALLATION OF DIFFUSERS GRILLES AND REGISTERS SHALL BE COORDINATED WITH AND SUITABLE FOR INSTALLATION IN, ON, OR FROM CEILING, WALL OR FLOORS SPECIFIED ON THE ARCHITECTURAL PLANS. THE CONTRACTOR MUST VERIFY THE CEILING OR WALL TYPES PRIOR TO ORDERING.
   - F. FIRE DAMPERS SHALL BE 1-1/2 HR FIRE RATED UNLESS OTHERWISE INDICATED AND SHALL CONFORM TO THE REQUIREMENTS OF NFPA 90A UL 105 AND UL 555. FIRE DAMPERS SHALL BE AUTOMATIC OPERATING TYPE, SHALL BE APPROVED FOR THE SPECIFIC APPLICATION, AND SHALL BE INSTALLED IN ACCORDANCE WITH THEIR LISTING. FIRE DAMPERS SHALL BE CURTAIN TYPE 'B' WITH DAMPER BLADES OUT OF THE AIR STREAM. FIRE DAMPERS SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF SMACNA STANDARDS AND THE MANUFACTURER'S INSTRUCTIONS AS REQUIRED TO MAINTAIN THE DAMPER'S LISTING. FIRE DAMPERS SHALL BE RUSKIN TYPE IBD OR APPROVED EQUAL AS MANUFACTURED BY GREENHECK OR AIR BALANCE.

17. PIPING AND FITTINGS
   - A. REFRIGERANT PIPING SHALL BE TYPE ACR COPPER TUBING
   - B. CONDENSATE PIPING SHALL BE SCHEDULE 40 PVC
   - C. PIPING INSTALLATIONS
     1. INSTALL UNIONS OR FLANGES IN PIPES ADJACENT TO EACH VALVE, CONTROL DEVICE AND AT FINAL CONNECTIONS EACH PIECE OF EQUIPMENT.
     2. INSTALL DIELECTRIC UNIONS TO JOIN DISSIMILAR METALS.
     3. INSTALL AND ANCHOR PIPING TO ENSURE PROPER EXPANSION AND CONTRACTION.
     4. PIPE HANGERS AND SUPPORTS SHALL MEET THE REQUIREMENTS OF MSS SP-69 AND SP-89 DEVELOPED BY THE MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVES AND FITTINGS INDUSTRY INC.

18. INSULATION
   - A. INSULATION THICKNESS SHALL BE IN ACCORDANCE WITH LATEST EDITION OF ASHRAE 90.1 EXCEPT THAT PIPE INSULATION SHALL NOT BE LESS THAN 1" THICK AND, FLEXIBLE DUCTWORK INSULATION SHALL NOT BE LESS THAN 1-1/2" THICK. ALL INSULATION MATERIALS, ADHESIVES, COATINGS, AND OTHER ACCESSORIES SHALL HAVE FLAME SPREAD RATINGS OF 25 OR LESS, AND SMOKE DEVELOPED RATINGS OF 50 OR LESS AS TESTED BY ASTM E-84 (NFPA 255) METHOD. ALL INSULATION MATERIALS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND IN ACCORDANCE WITH THE LATEST EDITION OF SMACNA AND ASHRAE STANDARDS.
   - B. PIPE INSULATION SHALL BE FIBERGLASS WITH VAPOR BARRIER JACKET. PROVIDE INSULATION FOR THE FOLLOWING PIPING SYSTEMS:
     1. REFRIGERANT PIPING.
   - C. DUCT INSULATION MATERIALS SHALL BE FLEXIBLE FIBERGLASS R-6 DUCTWORK INSULATION WITH VAPOR BARRIER JACKET. DUCT INSULATION INSTALLED WITHIN MECHANICAL ROOMS SHALL BE RIGID, BOARD TYPE, MINIMUM 1" THICK. DUCTWORK ACOUSTIC LINING SHALL BE CELLULAR GLASS WITH FACE BONDED TO PROVIDE A SMOOTH DAMAGE RESISTANT FINISH. PROVIDE INSULATION FOR THE FOLLOWING DUCTWORK SYSTEMS:
     1. SUPPLY AIR DUCTWORK
     2. RETURN AIR DUCTWORK
     3. OUTSIDE AIR INTAKE DUCTWORK

19. MECHANICAL IDENTIFICATION
   - A. MECHANICAL IDENTIFICATION WORK SHALL COMPLY WITH ANSI A13.1. NAMES, ABBREVIATIONS AND OTHER DESIGNATIONS USED IN MECHANICAL IDENTIFICATION WORK, SHALL CORRESPOND WITH ANSI A13.1 OR OWNER'S STANDARDS.
   - B. WHERE IDENTIFICATION IS TO BE APPLIED TO SURFACES WHICH REQUIRE INSULATION, PAINTING OR OTHER COVERING OR FINISH, INSTALL IDENTIFICATION AFTER COMPLETION OF COVERING AND PAINTING. INSTALL IDENTIFICATION PRIOR TO INSTALLATION OF ACOUSTICAL CEILINGS AND SIMILAR REMOVABLE CONCEALMENT.
   - C. DUCTWORK IDENTIFICATION:
     1. DUCTWORK IDENTIFICATION SHALL BE EITHER LAMINATED PLASTIC DUCT MARKERS; OR STENCILED SIGNS. DUCTWORK IDENTIFICATION SHALL INDICATE DUCTWORK SERVICE AND DIRECTION OF FLOW.
     2. WHERE DUCTWORK IS EXPOSED (OR CONCEALED ONLY BY REMOVABLE CEILING), LOCATE DUCT MARKERS OR SIGNS NEAR POINTS WHERE DUCTWORK ORIGINATES OR CONTINUES INTO CONCEALED ENCLOSURES (SHAFT, UNDERGROUND OR SIMILAR CONCEALMENT), AND AT 50' SPACINGS ALONG EXPOSED RUNS.
   - D. PIPING SYSTEM IDENTIFICATION:
     1. PIPE MARKERS SHALL BE EITHER PRE-PRINTED, SEMI-RIGID SNAP-ON, COLOR-CODED PLASTIC PIPE MARKERS, OR PRE-PRINTED, PERMANENT ADHESIVE, COLOR-CODED, PRESSURE-SENSITIVE VINYL PIPE MARKERS. INCLUDE ARROWS TO SHOW NORMAL DIRECTION OF FLOW.
     2. LOCATE PIPE MARKERS AND COLOR BANDS ON EXPOSED PIPING (OR CONCEALED BY REMOVABLE CEILING)AS FOLLOWS:
        - A. SPACE MARKERS A MAXIMUM OF 50' ALONG EACH PIPING RUN, OR 25' IN CONGESTED AREAS.
        - B. NEAR EACH MAJOR EQUIPMENT ITEM, VALVE AND CONTROL DEVICE.
        - C. NEAR EACH BRANCH, EXCLUDING SHORT TAKE-OFFS.
        - D. NEAR LOCATIONS WHERE PIPES PASS THROUGH WALLS OR FLOORS/CEILINGS, OR ENTER NON-ACCESSIBLE ENCLOSURES.
        - E. AT ACCESS DOORS, MANHOLES AND SIMILAR ACCESS POINTS WHICH PERMIT VIEW OF CONCEALED PIPING.
   - E. MECHANICAL EQUIPMENT IDENTIFICATION: PROVIDE LAMINATED PLASTIC NAMEPLATES FOR ALL EQUIPMENT. NAMEPLATES SHALL BE MELAMINE PLASTIC, 0.125-INCH THICK, WHITE WITH BLACK CENTER CORE. SURFACE SHALL BE MATTE FINISH. MINIMUM SIZE OF NAMEPLATES SHALL BE 1 BY 2.5 INCHES. LETTERING SHALL BE A MINIMUM OF 0.25-INCH HIGH.

20. SHOP DRAWINGS:
   - A. SUBMIT NEWLY PREPARED INFORMATION, DRAWN TO ACCURATE SCALE OF 1/4"=1'0". HIGHLIGHT, ENCIRCLE, OR OTHERWISE INDICATE DEVIATIONS FROM THE CONTRACT DOCUMENTS. DO NOT REPRODUCE CONTRACT DOCUMENTS OR COPY STANDARD INFORMATION AS THE BASIS OF SHOP DRAWINGS. STANDARD INFORMATION PREPARED WITHOUT SPECIFIC REFERENCE TO THE PROJECT IS NOT CONSIDERED SHOP DRAWINGS.
   - B. SHOP DRAWINGS INCLUDE EQUIPMENT SUBMITTALS, FABRICATION AND INSTALLATION DRAWINGS, SETTING DIAGRAMS, SCHEDULES, PATTERNS, TEMPLATES AND SIMILAR DRAWINGS. INCLUDE THE FOLLOWING INFORMATION:
     1. DIMENSIONS.
     2. IDENTIFICATION OF PRODUCTS AND MATERIALS INCLUDED.
     3. COMPLIANCE WITH SPECIFIED STANDARDS AND PERFORMANCE DATA AS INDICATED.
     4. NOTATION OF COORDINATION REQUIREMENTS.
     5. NOTATION OF DIMENSIONS ESTABLISHED BY FIELD MEASUREMENT.
   - C. SUBMIT 3 BLACK-LINE PRINTS AND 2 ADDITIONAL PRINTS WHERE REQUIRED FOR MAINTENANCE MANUALS, PLUS THE NUMBER OF PRINTS NEEDED BY THE ENGINEER FOR DISTRIBUTION. ONE PRINT WILL BE RETAINED; THE REMAINDER RETURNED. ONE OF THE PRINTS RETURNED SHALL BE MARKED-UP AND MAINTAINED AS A "RECORD DOCUMENT".
   - D. DO NOT USE SHOP DRAWINGS WITHOUT AN APPROPRIATE FINAL STAMP INDICATING ACTION TAKEN IN CONNECTION WITH CONSTRUCTION.
   - E. DO NOT ORDER ANY MATERIALS OR EQUIPMENT PRIOR TO RECEIVING FINAL APPROVED SHOP DRAWINGS.

21. TESTING , ADJUSTING AND BALANCING
   - A. THE MECHANICAL CONTRACTOR SHALL PROVIDE THE SERVICES OF AN INDEPENDENT TESTING, ADJUSTING, AND BALANCING (TAB) AGENCY TO PROVIDE TAB SERVICES FOR THE MECHANICAL SYSTEMS. THE TAB AGENCY SHALL BE CERTIFIED BY NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB) OR THE ASSOCIATED AIR BALANCE COUNCIL (AABC) IN THOSE TESTING AND BALANCING DISCIPLINES REQUIRED FOR THIS PROJECT. THE TAB AGENCY SHALL HAVE AT LEAST ONE PROFESSIONAL ENGINEER REGISTERED IN THE STATE IN WHICH THE SERVICES ARE TO BE PERFORMED AND CERTIFIED BY NEBB OR AABC AS A TEST AND BALANCE ENGINEER.
   - B. PRIOR TO TESTING, ADJUSTING, AND BALANCING, THE MECHANICAL CONTRACTOR SHALL VERIFY THAT THE SYSTEMS HAVE BEEN INSTALLED AND ARE OPERATING AS SPECIFIED. APPROVED SHOP DRAWINGS, AS BUILT DRAWINGS, AND ALL OTHER DATA REQUIRED FOR EACH SYSTEM AND/OR COMPONENT TO BE TESTED SHALL BE MADE AVAILABLE AT THE JOB SITE DURING THE ENTIRE TAB EFFORT. THE OWNER SHALL BE NOTIFIED IN WRITING OF ALL EQUIPMENT, COMPONENTS, OR BALANCING DEVICES, THAT ARE DAMAGED, INCORRECTLY INSTALLED, OR MISSING, AS WELL AS ANY DESIGN DEFICIENCIES THAT WILL PREVENT PROPER TESTING, ADJUSTING, AND BALANCING. TESTING, ADJUSTING, AND BALANCING SHALL NOT COMMENCE UNTIL APPROVED BY THE OWNER.
   - C. PERFORM TESTING AND BALANCING PROCEDURES ON EACH SYSTEM IDENTIFIED, IN ACCORDANCE WITH THE DETAILED PROCEDURES OUTLINED IN EITHER NEBB: "PROCEDURAL STANDARDS FOR TESTING, ADJUSTING, AND BALANCING OF ENVIRONMENTAL SYSTEMS" OR AABC: "NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE." THE TAB AGENCY SHALL TEST, ADJUST, AND BALANCE THE FOLLOWING MECHANICAL SYSTEMS:
     1. ALL AIR HANDLING EQUIPMENT
     3. ALL SUPPLY AIR SYSTEMS
     4. ALL RETURN AIR SYSTEMS
     5. ALL EXHAUST AIR SYSTEMS
     8. VERIFY OPERATION OF ALL TEMPERATURE CONTROL SYSTEMS
     9. TEST SYSTEMS FOR PROPER SOUND AND VIBRATION LEVELS
   - D. SUBMIT TESTING, ADJUSTING, AND BALANCING REPORTS BEARING THE SEAL AND SIGNATURE OF THE TAB PROFESSIONAL ENGINEER. PREPARE A REPORT OF RECOMMENDATIONS FOR CORRECTING UNSATISFACTORY MECHANICAL PERFORMANCES WHEN A SYSTEM CANNOT BE SUCCESSFULLY BALANCED.
   - E. ALL REFRIGERANT PIPING SYSTEM INSTALLED UNDER THIS CONTRACT SHALL BE PRESSURE TESTED. PRESSURE TEST PIPE AT 200 PSIG WITH NITROGEN.

22. AS-BUILT DRAWINGS
   - A. PREPARE AS-BUILT DRAWINGS TO A SCALE OF 1/4"=1'-0" OR LARGER; DETAILING THE ACTUAL INSTALLATION OF MAJOR ELEMENTS, COMPONENTS, AND SYSTEMS OF MECHANICAL EQUIPMENT AND MATERIALS. WHERE SHOP DRAWINGS ARE USED, RECORD A CROSS-REFERENCE AT THE CORRESPONDING LOCATION ON THE AS-BUILT DRAWINGS. GIVE PARTICULAR ATTENTION TO CONCEALED ELEMENTS THAT WOULD BE DIFFICULT TO MEASURE AND RECORD AT A LATER DATE.
   - B. MARK NEW INFORMATION THAT IS IMPORTANT TO THE OWNER, BUT WAS NOT SHOWN ON CONTRACT DRAWINGS OR SHOP DRAWINGS.
   - C. NOTE RELATED CHANGE ORDER NUMBERS WHERE APPLICABLE.
   - D. ORGANIZE AS-BUILT DRAWINGS INTO MANAGEABLE SETS, BIND WITH DURABLE PAPER COVER SHEETS, AND PRINT SUITABLE TITLES, DATES AND OTHER IDENTIFICATION ON THE COVER OF EACH SET.

23. CLEAN, PRIME AND PAINT MECHANICAL EQUIPMENT AND THE EXPOSED PORTION OF THE DUCTWORK AND PIPING SYSTEMS TO MATCH THE FINISH OF THE ADJACENT SURFACES OR TO MEET THE INDICATED OR SPECIFIED SAFETY CRITERIA OR TO MEET THE COLOR SCHEME SET BY THE ARCHITECT.

24. SUBSTITUTIONS
   - A. SUBSTITUTION REQUEST SUBMITTAL: REQUESTS FOR SUBSTITUTION WILL BE CONSIDERED IF RECEIVED WITHIN 45 DAYS AFTER COMMENCEMENT OF THE WORK. REQUESTS RECEIVED MORE THAN 45 DAYS AFTER COMMENCEMENT OF THE WORK MAY BE CONSIDERED OR REJECTED AT THE DISCRETION OF THE ENGINEER.
   - B SUBMIT 3 COPIES OF EACH REQUEST FOR SUBSTITUTION FOR CONSIDERATION.
   - C. IDENTIFY THE PRODUCT, OR THE FABRICATION OR INSTALLATION METHOD TO BE REPLACED IN EACH REQUEST. INCLUDE RELATED DRAWING NUMBERS. PROVIDE COMPLETE DOCUMENTATION SHOWING COMPLIANCE WITH THE REQUIREMENTS FOR SUBSTITUTIONS, AND THE FOLLOWING INFORMATION, AS APPROPRIATE.
     1. PRODUCT DATA, INCLUDING DRAWINGS AND DESCRIPTIONS OF PRODUCTS, FABRICATION AND INSTALLATION PROCEDURES.
     2. SAMPLES, WHERE APPLICABLE OR REQUESTED.
     3. A DETAILED COMPARISON OF SIGNIFICANT QUALITIES OF THE PROPOSED SUBSTITUTION WITH THOSE OF THE WORK SPECIFIED. SIGNIFICANT QUALITIES MAY INCLUDE ELEMENTS SUCH AS SIZE, WEIGHT, DURABILITY, PERFORMANCE AND VISUAL EFFECT.
     4. COORDINATION INFORMATION, INCLUDING A LIST OF CHANGES OR MODIFICATIONS NEEDED TO OTHER PARTS OF THE WORK AND TO CONSTRUCTION PERFORMED BY THE OWNER AND SEPARATE CONTRACTORS, THAT WILL BECOME NECESSARY TO ACCOMMODATE THE PROPOSED SUBSTITUTION.
     5. A STATEMENT INDICATING THE SUBSTITUTION'S EFFECT ON THE CONTRACTOR'S CONSTRUCTION SCHEDULE COMPARED TO THE SCHEDULE WITHOUT APPROVAL OF THE SUBSTITUTION. INDICATE THE EFFECT OF THE PROPOSED SUBSTITUTION ON OVERALL CONTRACT TIME.
     6. COST INFORMATION, INCLUDING A PROPOSAL OF THE NET CHANGE, IF ANY IN THE CONTRACT SUM.
     7. CERTIFICATION BY THE CONTRACTOR THAT THE SUBSTITUTION PROPOSED IS EQUAL TO OR BETTER IN EVERY SIGNIFICANT RESPECT TO THAT REQUIRED BY THE CONTRACT DOCUMENTS AND THAT IT WILL PERFORM ADEQUATELY IN THE APPLICATION INDICATED. INCLUDE THE CONTRACTOR'S WAIVER OF RIGHTS TO ADDITIONAL PAYMENT OR TIME, THAT MAY SUBSEQUENTLY BECOME NECESSARY BECAUSE OF THE FAILURE OF THE SUBSTITUTION TO PERFORM ADEQUATELY.
   - D. ENGINEER'S ACTION: WITHIN ONE WEEK OF RECEIPT OF THE REQUEST FOR SUBSTITUTION, THE ENGINEER WILL REQUEST ADDITIONAL INFORMATION OR DOCUMENTATION NECESSARY FOR EVALUATION OF THE REQUEST. WITHIN 2 WEEKS OF RECEIPT OF THE REQUEST, OR ONE WEEK OF RECEIPT OF THE ADDITIONAL INFORMATION OR DOCUMENTATION, WHICHEVER IS LATER, THE ENGINEER WILL NOTIFY THE CONTRACTOR OF ACCEPTANCE OR REJECTION OF THE PROPOSED SUBSTITUTION. IF A DECISION ON USE OF A PROPOSED SUBSTITUTE CANNOT BE MADE OR OBTAINED WITH THE TIME ALLOCATED, USE THE PRODUCT SPECIFIED BY NAME. ACCEPTANCE OF A PRODUCT SUBSTITUTION WILL BE IN THE FORM OF A CHANGE ORDER.
   - E. OTHER CONDITIONS: THE CONTRACTOR'S SUBSTITUTION REQUEST WILL BE RECEIVED AND CONSIDERED BY THE ENGINEER WHEN ONE OR MORE OF THE FOLLOWING CONDITIONS ARE SATISFIED, AS DETERMINED BY THE ENGINEER; OTHERWISE REQUESTS WILL BE RETURNED WITHOUT ACTION EXCEPT TO RECORD NONCOMPLIANCE WITH THESE REQUIREMENTS.
     1. THE REQUEST IS DIRECTLY RELATED TO AN "OR EQUAL" CLAUSE OR SIMILAR LANGUAGE IN THE CONTRACT DOCUMENTS.
     2. THE SPECIFIED PRODUCT OR METHOD OF CONSTRUCTION CANNOT BE PROVIDED WITHIN THE CONTRACT TIME. THE REQUEST WILL NOT BE CONSIDERED IF THE PRODUCT OR METHOD CANNOT BE PROVIDED AS A RESULT OF FAILURE TO PURSUE THE WORK PROMPTLY OR COORDINATE ACTIVITIES PROPERLY.
     3. A SUBSTANTIAL ADVANTAGE IS OFFERED THE OWNER, IN TERMS OF COST, TIME, ENERGY CONSERVATION OR OTHER CONSIDERATIONS OF MERIT, AFTER DEDUCTING OFFSETTING RESPONSIBILITIES THE OWNER MAY BE REQUIRED TO BEAR. ADDITIONAL RESPONSIBILITIES FOR THE OWNER MAY INCLUDE ADDITIONAL COMPENSATION TO THE ENGINEER FOR REDESIGN AND EVALUATION SERVICES, INCREASED COST OF OTHER CONSTRUCTION BY THE OWNER OR SEPARATE CONTRACTORS, AND SIMILAR CONSIDERATIONS.

25. PROVIDE ALL NECESSARY CONTROL DEVICES, EQUIPMENT, MATERIALS, LABOR, WIRE AND CONDUIT TO PERFORM THE SEQUENCES OF OPERATION AS INDICATED. WIRING AND CONDUIT SHALL BE INSTALLED IN ACCORDANCE WITH DIVISION 16. ALL CONTROL WIRING INSTALLED WITHIN AIR PLENUM SPACES TO BE TEFLON COATED RATED FOR PLENUM CEILINGS.

HVAC DUCTWORK LEGEND

SYMBOL	DESCRIPTION
	FLEXIBLE DUCTWORK
	NEW DUCTWORK
	EXISTING DUCTWORK
	DEMOLITION HATCH. (DUCT, EQUIPMENT, DEVICE,ETC.)
	VOLUME DAMPER
BD	BACKDRAFT DAMPER
	MOTORIZED DAMPER
S	DUCT MOUNTED SMOKE DETECTOR
UD	UNDERCUT DOOR
	RETURN/EXHAUST/OUTSIDE AIR ARROW
	SUPPLY ARROW
	CONNECTION TO EXISTING
	SUPPLY DIFFUSER
	RETURN REGISTER
	CEILING MOUNTED EXHAUST FAN
OR	VAV BOX

MECHANICAL ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AFF	ABOVE FINISHED FLOOR
AHU-#	AIR HANDLING UNIT
APPROX	APPROXIMATE
BC	BRANCH CONTROLLER
BHP	BREAK HORSE POWER
BTU	BRITISH THERMAL UNIT
CAP	CAPACITY
CD	CONDENSATE DRAIN
CFM	CUBIC FEET PER MINUTE
CU-#	CONDENSING UNIT
ETR	EXISTING TO REMAIN
EAT	ENTERING AIR TEMPERATURE
EF-#	EXHAUST FAN
ENT	ENTERING
ESP	EXTERNAL STATIC PRESSURE
EXG	EXISTING
EXH	EXHAUST
°F	DEGREES FAHRENHEIT
FD	FIRE DAMPER
FLEX	FLEXIBLE
FPM	FEET PER MINUTE
FT	FEET
HP	HORSE POWER
HR	HOUR
HVAC	HEATING, VENTILATION & AIR CONDITIONING
IN.	INCH
IN.W.G	INCHES WATER GAUGE
KW	KILOWATT
MAX	MAXIMUM
MBH	BTU PER HOUR (THOUSAND)
MIN	MINIMUM
N.T.S.	NOT TO SCALE
N/A	NOT APPLICABLE
NC	NOISE CRITERIA
NIC	NOT IN CONTRACT
NO.	NUMBER
NOM	NOMINAL
OA	OUTSIDE AIR
PH	PHASE
PSIG	POUNDS PER SQUARE INCH GAUGE
RA	RETURN AIR
RH	RELATIVE HUMIDITY
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
RTU-#	ROOFTOP PACKAGED UNIT
SENS.	SENSIBLE
SP	STATIC PRESSURE
SPEC	SPECIFICATION
SQ.FT.	SQUARE FEET
SS	STAINLESS STEEL
STD	STANDARD
TEMP	TEMPERATURE
T-STAT	THERMOSTAT
TYP	TYPICAL
VAR	VARIABLE
VEL	VELOCITY
W	WATT

TEMPERATURE CONTROL SYMBOLS

SYMBOLS	DESCRIPTION
AI	ANALOG INPUT
AO	ANALOG OUTPUT
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
BMS	BUILDING MANAGEMENT SYSTEM
CO2 C	CARBON DIOXIDE SENSOR
CSR	CURRENT SENSING RELAY
DP	DIFFERENTIAL PRESSURE GAUGE WITH CONTACT SWITCH
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
FM	FLOW METER
FS	FLOW SWITCH
H	HUMIDITY SENSOR
MD	MOTORIZED DAMPER
SP	STATIC PRESSURE SENSOR
S	SMOKE DETECTOR
S_D	SMOKE DUCT DETECTOR
T	THERMOSTAT
T	TEMPERATURE SENSOR
VFD	VARIABLE FREQUENCY DRIVE
AFMS	AIR FLOW MEASURING STATION
	STARTER/DISCONNECT

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

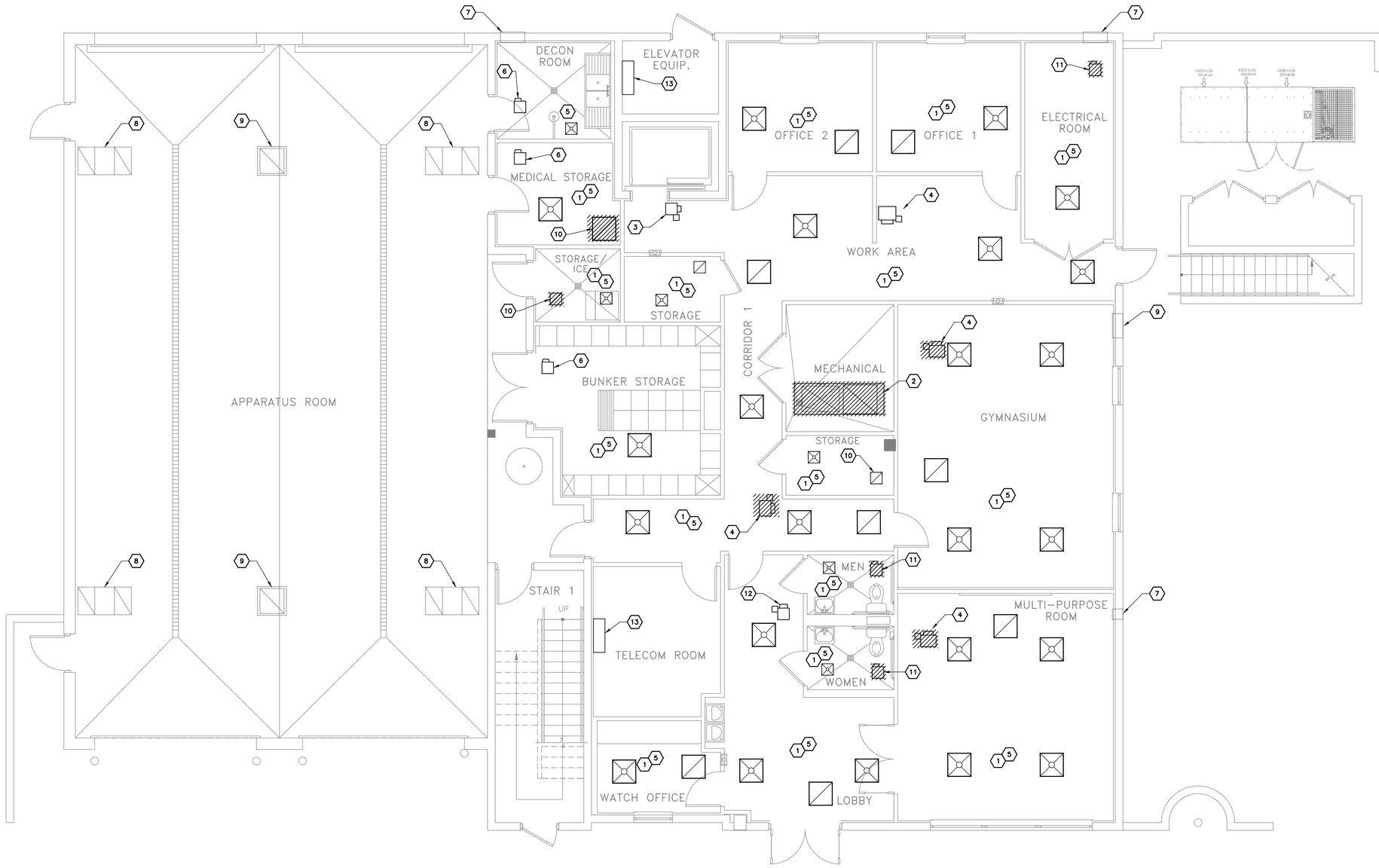
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANICAL ABBREVIATIONS, SYMBOLS AND NOTES

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

M-000



1 **MECHANICAL DEMOLITION PLAN - FIRST FLOOR**
SCALE: 1/4"=1'0"

MECHANICAL NOTES

1. REFER TO M-000 SHEET FOR LEGEND AND SYMBOLS.
2. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF MECHANICAL DEMOLITION. ADDITIONAL DEMOLITION AND MODIFICATION WORK NOT SHOWN SHOULD BE ANTICIPATED.
3. PRIOR TO SUBMITTING BID, VISIT SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY IDENTIFIED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.
4. CAPTURE AND DISPOSE OF ALL REFRIGERANT IN ACCORDANCE WITH ALL CODES AND REGULATIONS.

MECHANICAL KEYNOTES

1. REMOVE EXISTING SUPPLY AND RETURN DUCTWORK IN ITS ENTIRETY. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS AND FITTINGS. REFER TO M-101 FOR NEW WORK.
2. REMOVE EXISTING AIR HANDLING UNIT AND ALL ASSOCIATED REFRIGERANT PIPING, DUCTWORK AND ACCESSORIES IN ITS ENTIRETY. REFER TO M-101 FOR NEW WORK.
3. REMOVE EXISTING VAV BOX FOR RELOCATION. VAV TO SERVE LOBBY AREA. REFER TO M-101 FOR NEW LOCATION.
4. REMOVE EXISTING VAV BOX AND ALL ASSOCIATED ACCESSORIES IN ITS ENTIRETY.
5. EXISTING SUPPLY/RETURN DIFFUSER TO REMAIN.
6. EXISTING CEILING MOUNTED EXHAUST FAN TO REMAIN.
7. EXISTING EXHAUST LOUVER TO REMAIN.
8. EXISTING EXHAUST DUCTWORK TO REMAIN.
9. EXISTING OUTSIDE AIR INTAKE WALL LOUVER OR ROOF HOOD TO REMAIN.
10. REMOVE EXISTING RETURN AIR DIFFUSER IN ITS ENTIRETY.
11. REMOVE EXISTING CEILING MOUNTED EXHAUST FAN IN ITS ENTIRETY. REMOVE ASSOCIATED DUCTWORK, CAP AND SEAL AS NEEDED.
12. REMOVE EXISTING VAV BOX FOR RELOCATION. VAV TO SERVE GYMNASIUM. REFER TO M-101 FOR NEW LOCATION.
13. EXISTING WALL MOUNTED MINI SPLIT UNIT TO REMAIN.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL 33309
954.990.0556
Proj.#2021673.00

REVISIONS

NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

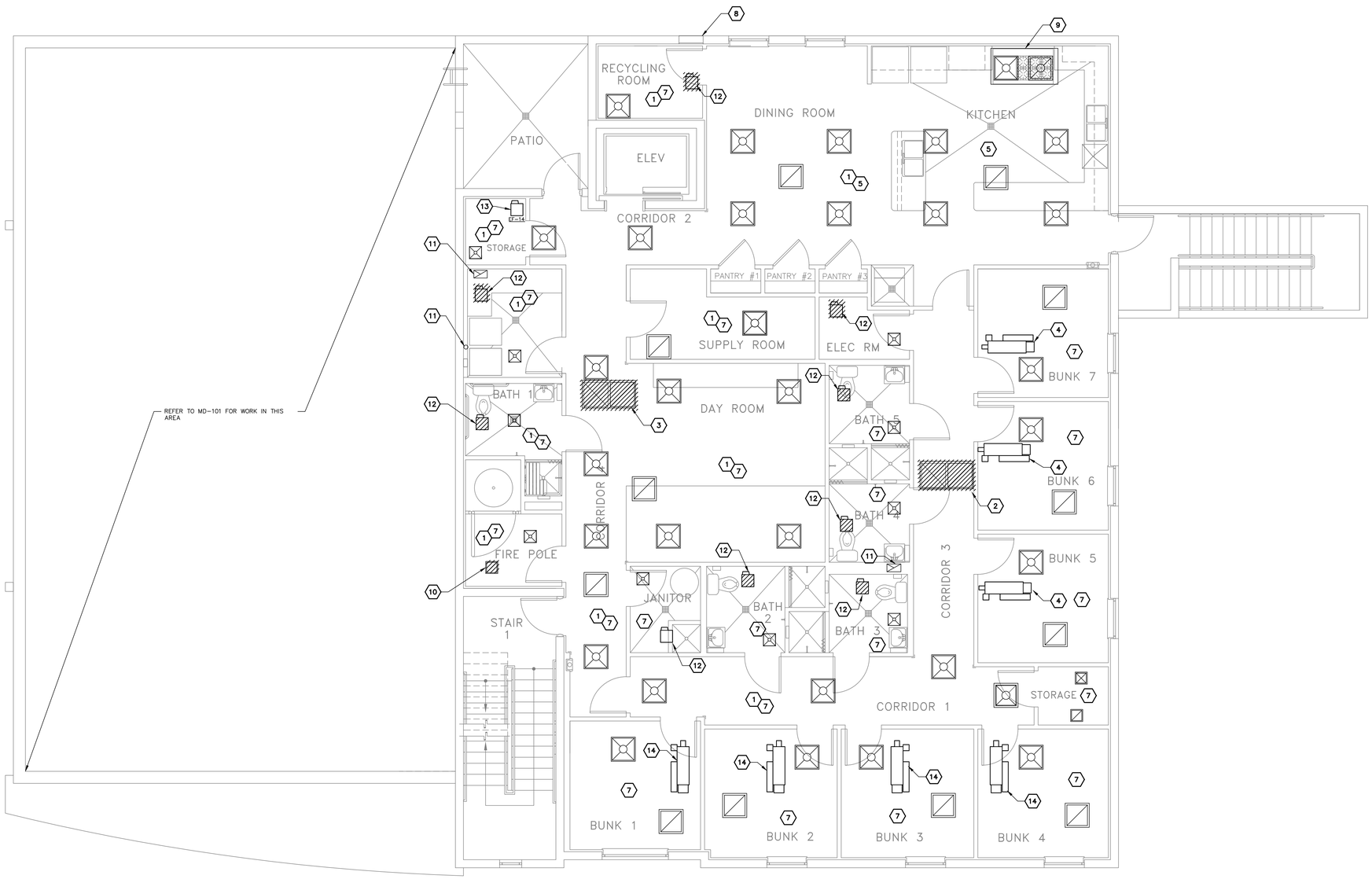
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANICAL DEMOLITION PLAN FIRST FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

MD-101



1 **MECHANICAL DEMOLITION PLAN - SECOND FLOOR**
SCALE: 1/4"=1'0"

MECHANICAL NOTES

1. REFER TO M-000 SHEET FOR LEGEND AND SYMBOLS.
2. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF MECHANICAL DEMOLITION. ADDITIONAL DEMOLITION AND MODIFICATION WORK NOT SHOWN SHOULD BE ANTICIPATED.
3. PRIOR TO SUBMITTING BID, VISIT SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY IDENTIFIED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.
4. CAPTURE AND DISPOSE OF ALL REFRIGERANT IN ACCORDANCE WITH ALL CODES AND REGULATIONS.

MECHANICAL KEYNOTES

1. REMOVE EXISTING SUPPLY AND RETURN DUCTWORK IN ITS ENTIRETY. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS AND FITTINGS.
2. REMOVE EXISTING DUCT DROPS FROM ROOFTOP UNIT FOR REPLACEMENT. RE-USE EXISTING ROOF OPENING FOR FUTURE UNIT. REFER TO M-102 FOR NEW WORK.
3. REMOVE EXISTING DUCT DROPS FROM RTU-2 IN ITS ENTIRETY. RE-USE EXISTING ROOF OPENING FOR FUTURE DEDICATED OUTSIDE AIR SYSTEM. REFER TO M-102 FOR NEW WORK.
4. EXISTING VAV BOX AND DUCTWORK TO SUPPLY DIFFUSER TO REMAIN. REFER TO M-102 FOR DUCT LAYOUT.
5. REMOVE EXISTING SUPPLY AND RETURN DIFFUSERS IN THIS AREA FOR REPLACEMENT. REFER TO M-120 FOR NEW WORK.
6. EXISTING CEILING MOUNTED EXHAUST FAN TO REMAIN.
7. EXISTING SUPPLY/RETURN DIFFUSER TO REMAIN.
8. EXISTING EXHAUST LOUVER TO REMAIN.
9. EXISTING KITCHEN EXHAUST FAN TO REMAIN. REMOVE KITCHEN SUPPLY FAN IN ITS ENTIRETY. REFER TO M-102 FOR NEW WORK.
10. REMOVE EXISTING RETURN AIR DIFFUSER IN ITS ENTIRETY.
11. EXISTING EXHAUST DUCT UP TO ROOF TO REMAIN.
12. REMOVE EXISTING CEILING MOUNTED EXHAUST FAN IN ITS ENTIRETY. TRUNCATE AND PERMANENTLY CAP/SEAL THE EXISTING EXHAUST DUCTWORK UP TO THE POINT SHOWN ON SHEET M-102.
13. REMOVE EXISTING CEILING MOUNTED EXHAUST FAN FOR RELOCATION. EXHAUST FAN TO SERVE FIRE POLE CLOSET. REFER TO M-102 FOR NEW WORK. TRUNCATE AND PERMANENTLY CAP/SEAL THE EXISTING EXHAUST DUCTWORK UP TO THE POINT SHOWN ON SHEET M-102.
14. REMOVE EXISTING VAV BOX AND ALL ASSOCIATED ACCESSORIES IN ITS ENTIRETY FOR REPLACEMENT. REFER TO M-102 FOR NEW WORK.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

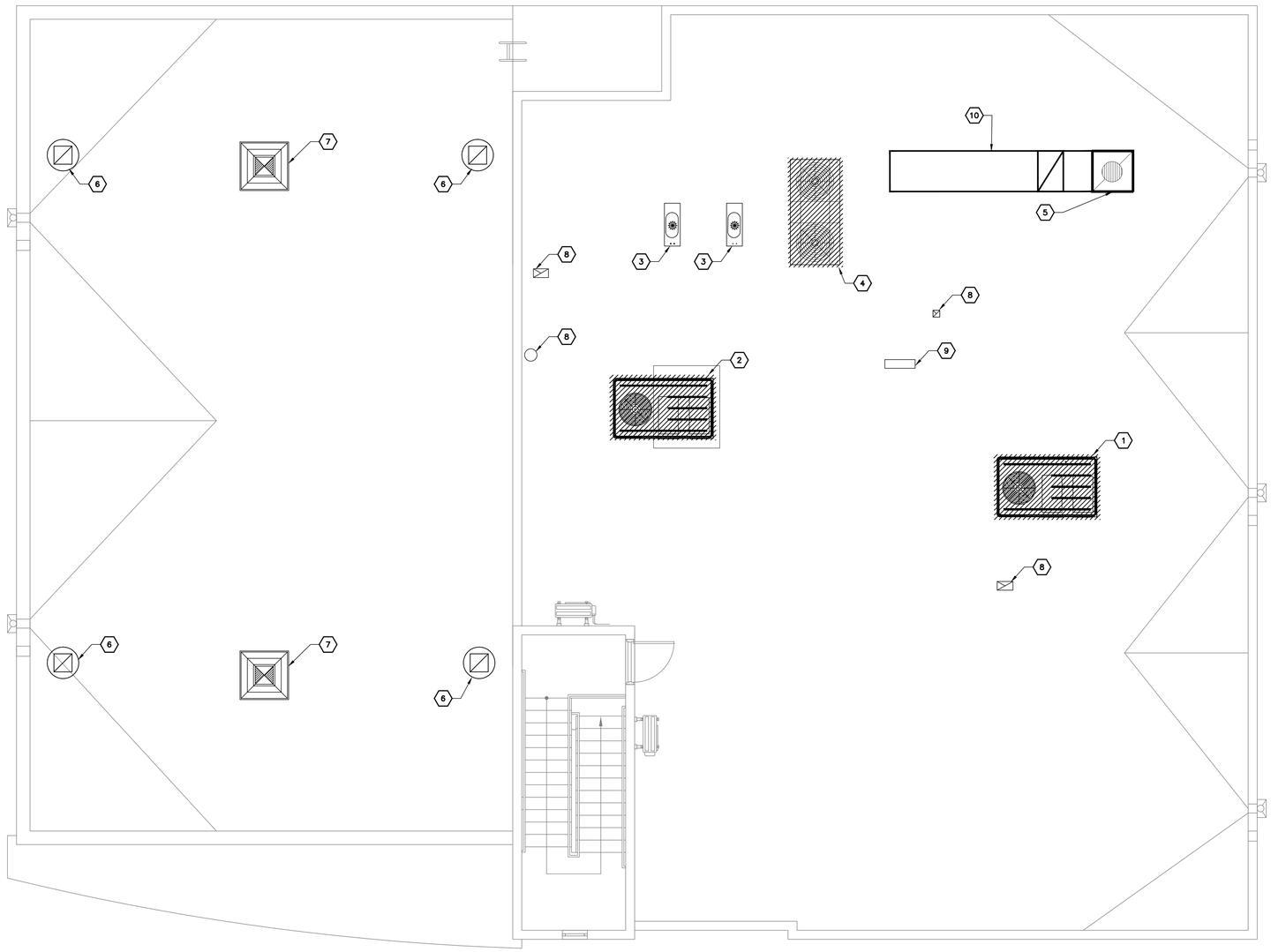
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANICAL DEMOLITION PLAN SECOND FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

MD-102



1 **MECHANICAL DEMOLITION PLAN - ROOF**
SCALE: 1/4"=1'0"

MECHANICAL NOTES

1. REFER TO M-000 SHEET FOR LEGEND AND SYMBOLS.
2. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF MECHANICAL DEMOLITION. ADDITIONAL DEMOLITION AND MODIFICATION WORK NOT SHOWN SHOULD BE ANTICIPATED.
3. PRIOR TO SUBMITTING BID, VISIT SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY IDENTIFIED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.
4. CAPTURE AND DISPOSE OF ALL REFRIGERANT IN ACCORDANCE WITH ALL CODES AND REGULATIONS.

MECHANICAL KEYNOTES

1. REMOVE EXISTING ROOFTOP PACKAGED UNIT FOR REPLACEMENT. RE-USE ROOF CURB IF POSSIBLE. REFER TO M-103 FOR NEW WORK.
2. REMOVE EXISTING RTU AND ROOF CURB IN ITS ENTIRETY. RE-USE EXISTING ROOF OPENING FOR NEW DOAS. REFER TO M-103 FOR NEW WORK.
3. EXISTING CONDENSING UNIT TO REMAIN,
4. REMOVE EXISTING CONDENSING UNIT AND ALL ASSOCIATED REFRIGERANT PIPING IN ITS ENTIRETY. EXISTING CONDENSER STAND TO REMAIN FOR NEW UNIT. REFER TO M-103 FOR NEW WORK.
5. EXISTING KITCHEN HOOD EXHAUST FAN TO REMAIN.
6. EXISTING APPARATUS BAY EXHAUST FAN TO REMAIN. REFER TO M-103 FOR NEW WORK.
7. EXISTING OUTDOOR AIR INTAKE HOODS TO REMAIN.
8. EXISTING EXHAUST ROOF TERMINATION TO REMAIN.
9. EXISTING REFRIGERANT LINE SET ROOF JACK TO REMAIN.
10. REMOVE EXISTING KITCHEN HOOD MAKE UP AIR UNIT IN ITS ENTIRETY. CLOSE AND SEAL ROOF OPENING.

CES
Engineering
Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54
HVAC SYSTEM

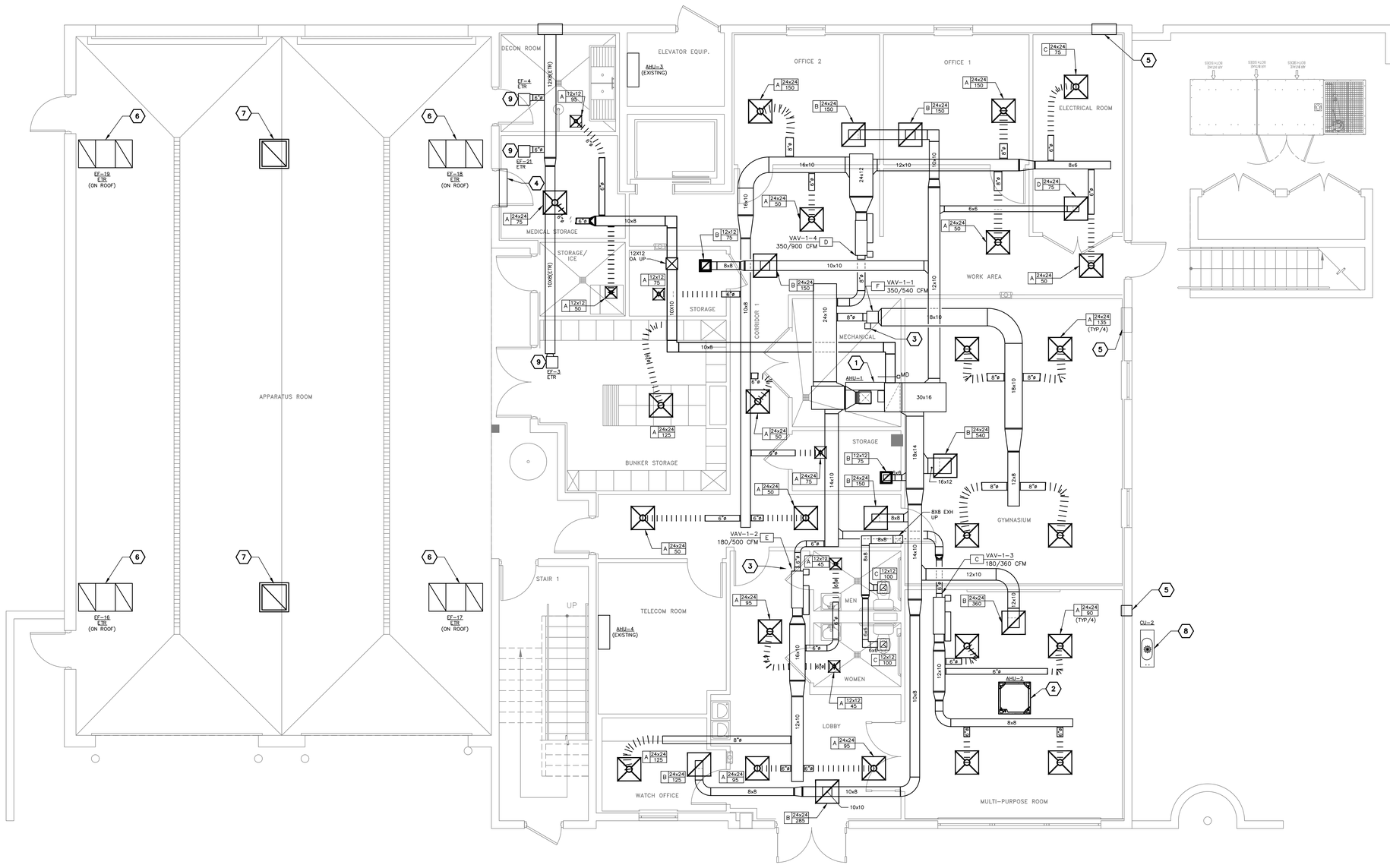
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANICAL DEMOLITION PLAN ROOF

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

MD-103



1 MECHANICAL PLAN - FIRST FLOOR

SCALE: 1/4"=1'0"

MECHANICAL NOTES

1. REFER TO SHEET M-000 FOR LEGEND, ABBREVIATIONS AND SPECIFICATIONS. REFER TO M-600 FOR EQUIPMENT SCHEDULES.
2. PROVIDE FIRE STOPPING AND SMOKE BARRIER SEALING OF ALL PENETRATIONS THROUGH FIRE WALLS OR SMOKE BARRIERS AS REQUIRED.
3. PROVIDE VOLUME DAMPERS ON ALL DUCTWORK, BRANCH DUCTWORK, SERVING DIFFUSERS, GRILLES ETC.
4. COORDINATE ALL AIR INTAKES WITH EXHAUST. GENERAL EXHAUSTS SHALL BE MINIMUM 10'-0" AWAY FROM ANY INTAKES OR OPENINGS.
5. REFER TO SHEETS M-104 AND M-105 FOR HVAC CONTROLS FLOOR PLANS, AND M-700 AND M-701 FOR CONTROLS DIAGRAMS.

MECHANICAL KEYNOTES

1. PROVIDE NEW VERTICAL AIR HANDLING UNIT VARIABLE AIR VOLUME SYSTEM. REFER TO DETAIL 1/M-500. PROVIDE NEW REFRIGERANT LINES TO NEW CONDENSING UNIT ON THE ROOF. REFER TO M-600 FOR MECHANICAL SCHEDULES.
2. PROVIDE A SUPPLEMENTAL SPLIT DX SYSTEM TO SERVE THE MULTIPURPOSE ROOM ONLY FOR SPECIAL EVENTS. REFER TO M-600 FOR MECHANICAL SCHEDULES.
3. RELOCATED EXISTING VAV BOX. REFER TO MD-101 FOR PREVIOUS LOCATION.
4. PROVIDE NEW AIR CURTAIN ON TOP OF THE DOOR. AIR CURTAIN SHALL BE INTERLOCKED TO DOOR. USE MARS MODEL #LPV236-1UA-OB.
5. CAP AND SEAL METAL PLENUM BOX ATTACHED TO EXISTING LOUVER.
6. EXISTING EXHAUST DUCTWORK SHALL BE THOROUGHLY CLEANED.
7. EXISTING OUTSIDE AIR INTAKE ROOF HOOD TO REMAIN.
8. PROVIDE NEW CONDENSING UNIT AND CONNECT TO NEW AHU-2 SERVING MULTI-PURPOSE ROOM AT FIRST FLOOR. PROVIDE NEW CONCRETE PAD AND TIE 1" STEEL TIE DOWN CLIPS. USE MIAMI TECH ICN FL APPROVED PRODUCT FL#19731.2.
9. REBALANCE EXISTING EXHAUST FAN TO MAINTAIN NEUTRAL PRESSURE. REFER TO FAN SCHEDULE ON SHEET M-600.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

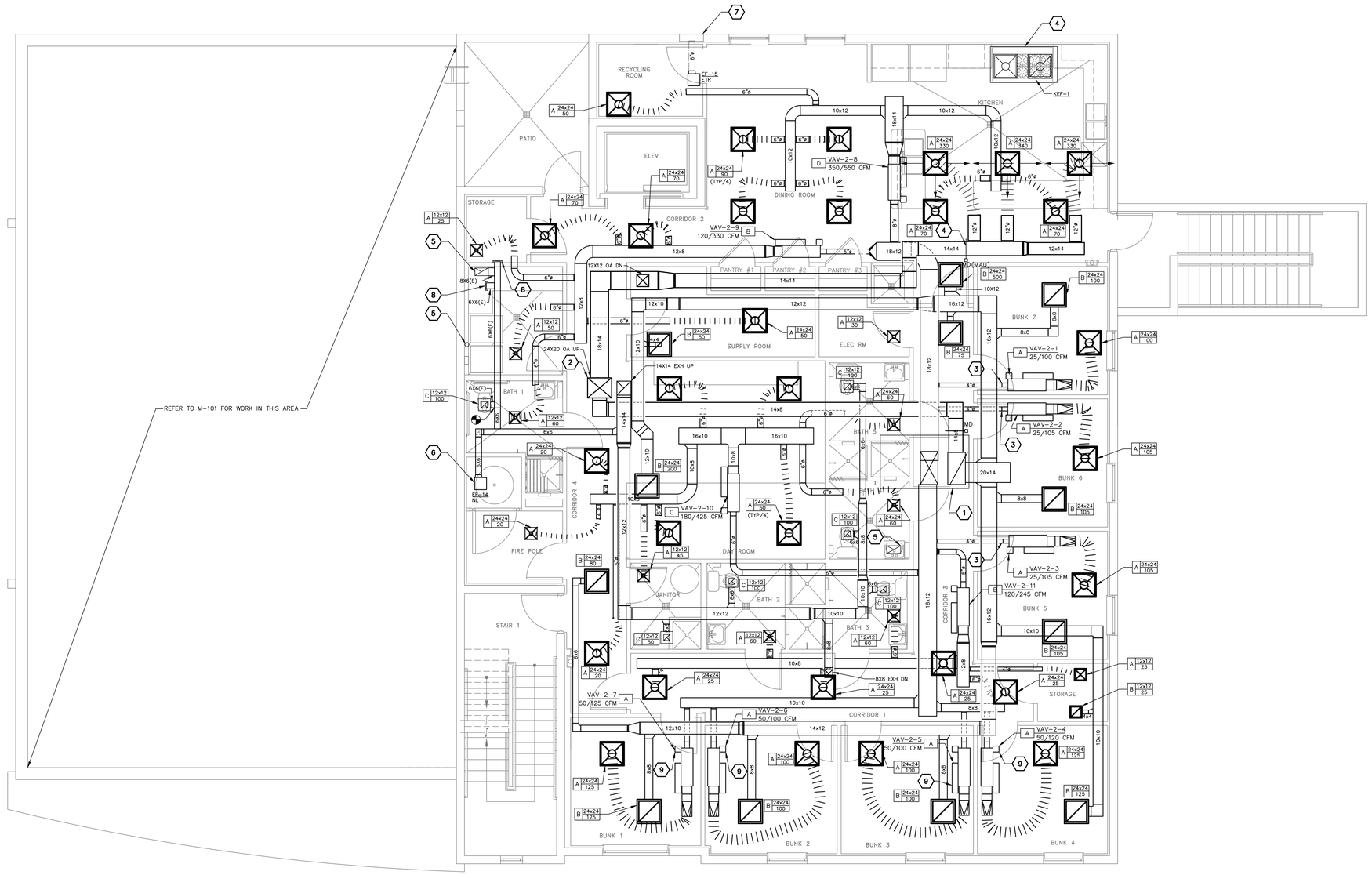
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANICAL PLAN
FIRST FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

M-101



1 MECHANICAL PLAN - SECOND FLOOR

SCALE: 1/4"=1'0"

MECHANICAL NOTES

1. REFER TO SHEET M-000 FOR LEGEND, ABBREVIATIONS AND SPECIFICATIONS. REFER TO M-600 FOR EQUIPMENT SCHEDULES.
2. PROVIDE FIRE STOPPING AND SMOKE BARRIER SEALING OF ALL PENETRATIONS THROUGH FIRE WALLS OR SMOKE BARRIERS AS REQUIRED.
3. PROVIDE VOLUME DAMPERS ON ALL DUCTWORK, BRANCH DUCTWORK, SERVING DIFFUSERS, GRILLES ETC.
4. COORDINATE ALL AIR INTAKES WITH EXHAUST. GENERAL EXHAUSTS SHALL BE MINIMUM 10'-0" AWAY FROM ANY INTAKES OR OPENINGS.
5. REFER TO SHEETS M-104 AND M-105 FOR HVAC CONTROLS PLANS.

MECHANICAL KEYNOTES

1. SUPPLY AND RETURN DUCTWORK UP TO RTU-2. REFER TO M-103 FOR MECHANICAL ROOF PLAN.
2. OUTDOOR AIR AND EXHAUST AIR DUCTWORK UP TO DOAS-1 ON ROOF. REFER TO M-103 FOR MECHANICAL ROOF PLAN.
3. EXISTING VAV BOX TO REMAIN.
4. PROVIDE NEW MAKE UP AIR DUCT FROM NEW DOAS-1 TO SERVE THE KITCHEN AREA. PROVIDE MOTORIZED DAMPER AND INTERLOCK WITH KEF-1. DOAS-1 SHALL RAMP UP.
5. EXISTING EXHAUST DUCT UP TO ROOF TO REMAIN. REFER TO M-103 FOR MECHANICAL ROOF PLAN.
6. RELOCATED EXISTING EXHAUST FAN. PROVIDE NEW 6x6 DUCT AND CONNECT TO EXISTING EXHAUST DUCT UP TO ROOF.
7. EXISTING EXHAUST LOUVER TO REMAIN.
8. PERMANENTLY CAPPED AND SEALED EXHAUST DUCT.
9. NEW VAV BOX. REFER TO SCHEDULE SHEET M-600 FOR MORE INFORMATION.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

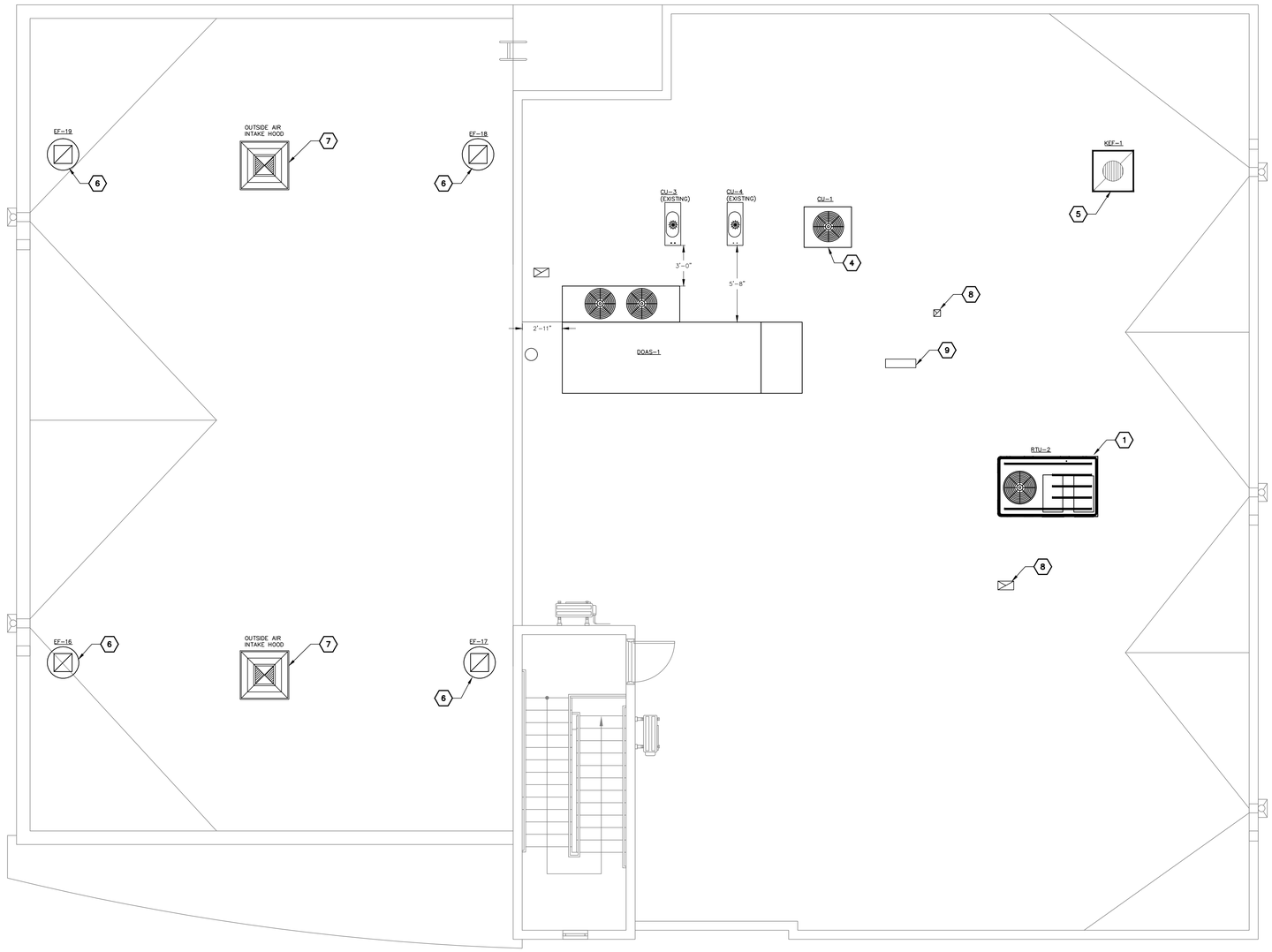
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANIC PLAN
SECOND FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

M-102



1 **MECHANICAL PLAN - ROOF**
SCALE: 1/4"=1'0"

MECHANICAL NOTES

1. REFER TO M-0 SHEET FOR LEGEND AND SYMBOLS.
2. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF MECHANICAL DEMOLITION. ADDITIONAL DEMOLITION AND MODIFICATION WORK NOT SHOWN SHOULD BE ANTICIPATED.
3. PRIOR TO SUBMITTING BID, VISIT SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY IDENTIFIED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.
4. CAPTURE AND DISPOSE OF ALL REFRIGERANT IN ACCORDANCE WITH ALL CODES AND REGULATIONS.

MECHANICAL KEYNOTES

1. PROVIDE NEW ROOFTOP PACKAGED UNIT VARIABLE AIR VOLUME SYSTEM. INSTALL ON EXISTING ROOF OPENING. RE-USE ROOF CURB IF POSSIBLE. REFER TO DETAIL 3/M-500. REFER TO M-600 FOR MECHANICAL SCHEDULES.
2. PROVIDE A NEW DEDICATED OUTSIDE AIR SYSTEM. INSTALL ON EXISTING ROOF OPENING AND MODIFY AS NEEDED. PROVIDE NEW ROOF CURB. REFER TO M-600 FOR MECHANICAL SCHEDULES. PROVIDE STRUCTURAL ENGINEERING DRAWINGS FOR ROOF AND WIND LOADING SIGNED AND SEALED BY A LICENSED FLORIDA PE.
3. EXISTING CONDENSING UNIT TO REMAIN.
4. PROVIDE NEW CONDENSING UNIT. MOUNT UNIT ON EXISTING CONDENSER METAL STAND. PROVIDE NEW REFRIGERANT LINE SET AND CONNECT TO NEW AHU-1 AT FIRST FLOOR.
5. EXISTING KITCHEN EXHAUST SHALL BE THOROUGHLY CLEANED.
6. EXISTING EXHAUST FAN TO REMAIN. FAN SHALL BE ADJUSTED TO PROVIDE 1,650 CFM OF EXHAUST AIR AND SHALL BE CONTROLLED VIA NEW OCCUPANCY SENSOR. PROVIDE NEW CO/NO2 CONTROL SYSTEM AND CONNECT TO FANS FOR EMERGENCY OPERATION. REFER TO M-701.
7. EXISTING OUTDOOR AIR INTAKE HOODS TO REMAIN. EQUIPMENT PERFORMANCE SHALL BE ADEQUATE TO SUPPLY 3,300 CFM OF MAKE UP AIR FOR THE APPARATUS BAY.
8. EXISTING EXHAUST ROOF TERMINATION TO REMAIN.
9. ROUTE NEW REFRIGERANT LINES THROUGH THE EXISTING REFRIGERANT LINE SET ROOF JACK.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

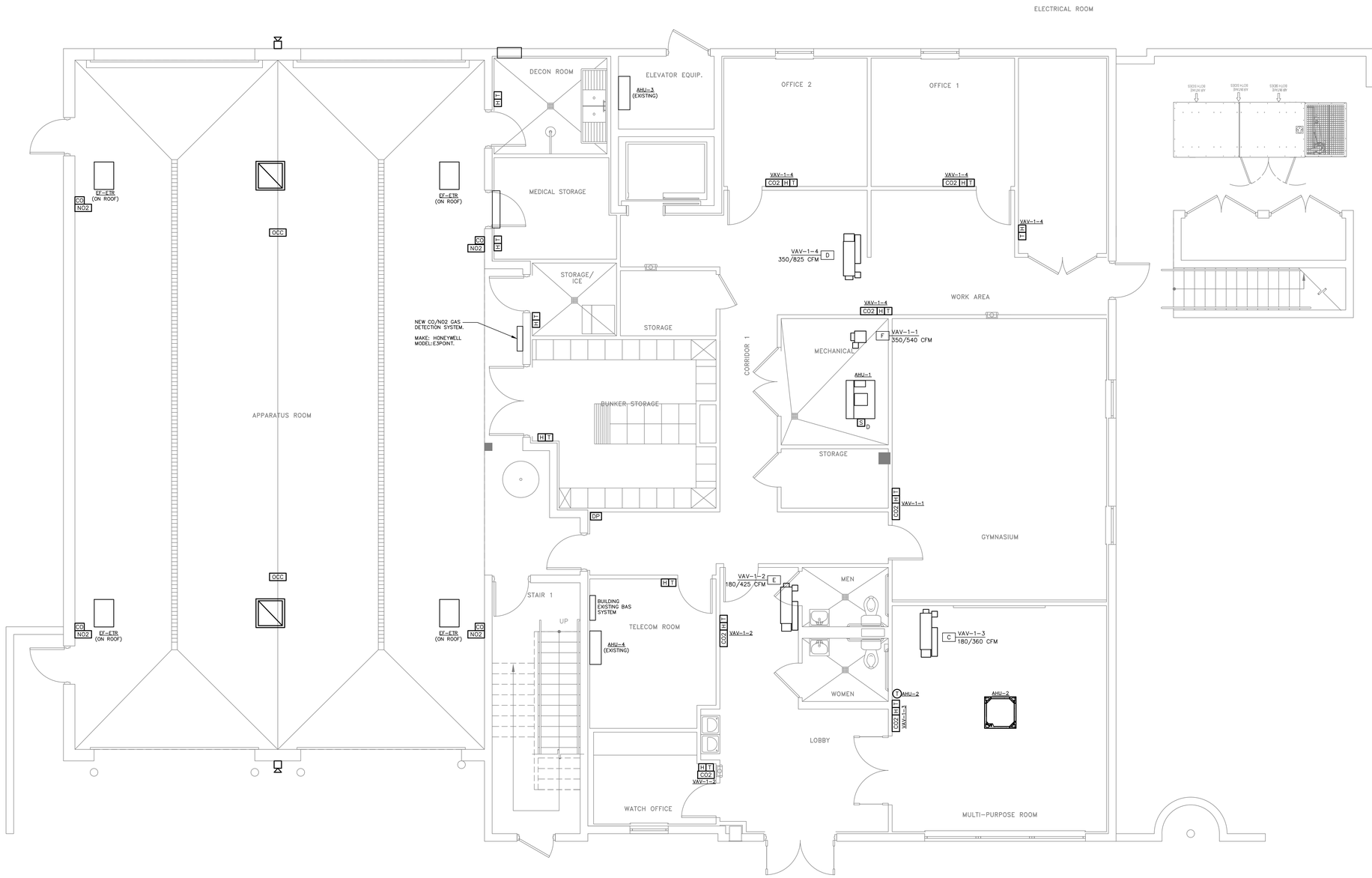
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANICAL PLAN ROOF

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

M-103



1 HVAC CONTROLS PLAN - FIRST FLOOR

SCALE: 1/4"=1'0"

MECHANICAL NOTES

1. REFER TO M-700 AND M-701 FOR HVAC CONTROLS DIAGRAMS AND SEQUENCE OF OPERATIONS.
2. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF THE WORK. BUILDING AUTOMATION SYSTEM IS EXISTING TO REMAIN.

TEMPERATURE CONTROL SYMBOLS

SYMBOLS	DESCRIPTION
BMS	BUILDING MANAGEMENT SYSTEM
CO2 C	CARBON DIOXIDE SENSOR
CO	CARBON MONOXIDE SENSOR
CSR	CURRENT SENSING RELAY
MD	MOTORIZED DAMPER
DP	DIFFERENTIAL PRESSURE SENSOR
S	SMOKE DETECTOR
S_D	SMOKE DUCT DETECTOR
T	THERMOSTAT
T	TEMPERATURE SENSOR
NO2	NITROGEN DIOXIDE SENSOR
	AUDIBLE AND VISUAL ALARM
OCC	OCCUPANCY SENSOR

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

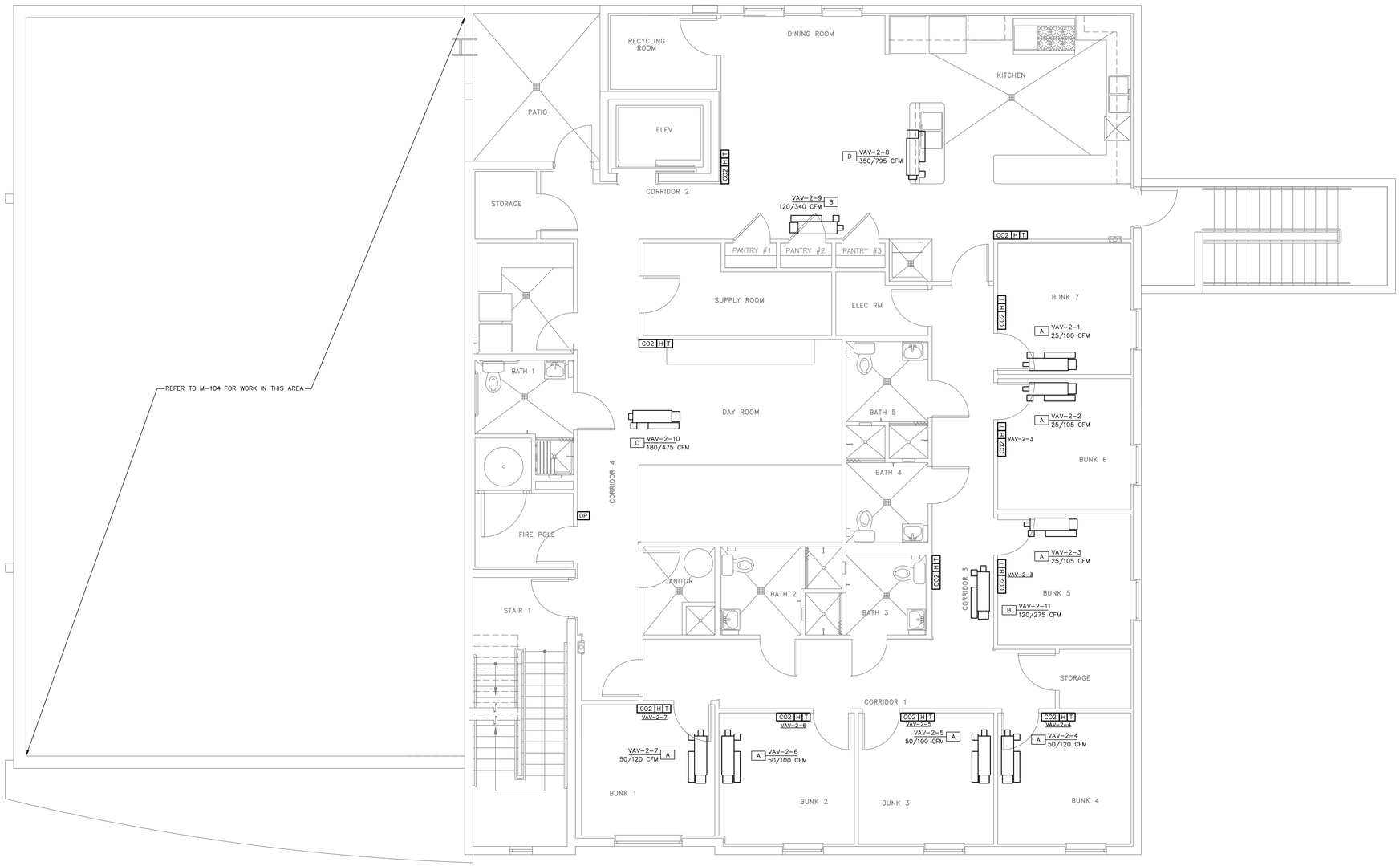
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

HVAC CONTROLS PLAN FIRST FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

M-104



1 **HVAC CONTROLS PLAN - SECOND FLOOR**
SCALE: 1/4"=1'0"

MECHANICAL NOTES

1. REFER TO M-700 AND M-701 FOR HVAC CONTROLS DIAGRAMS AND SEQUENCE OF OPERATIONS.
2. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF THE WORK. BUILDING AUTOMATION SYSTEM IS EXISTING TO REMAIN.

TEMPERATURE CONTROL SYMBOLS

SYMBOLS	DESCRIPTION
BMS	BUILDING MANAGEMENT SYSTEM
CO2 C	CARBON DIOXIDE SENSOR
CO	CARBON MONOXIDE SENSOR
CSR	CURRENT SENSING RELAY
MD	MOTORIZED DAMPER
DP	DIFFERENTIAL STATIC PRESSURE SENSOR
S	SMOKE DETECTOR
S D	SMOKE DUCT DETECTOR
T	THERMOSTAT
T	TEMPERATURE SENSOR
NO2	NITROGEN DIOXIDE SENSOR

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS

NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

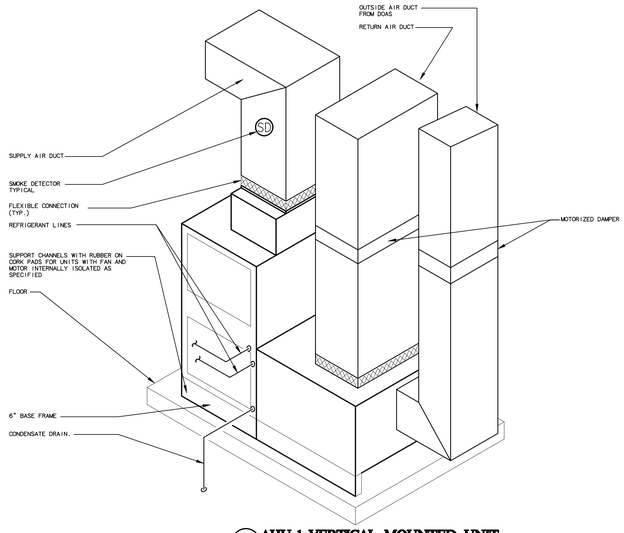
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

HVAC CONTROLS PLANS 2ND FLOOR

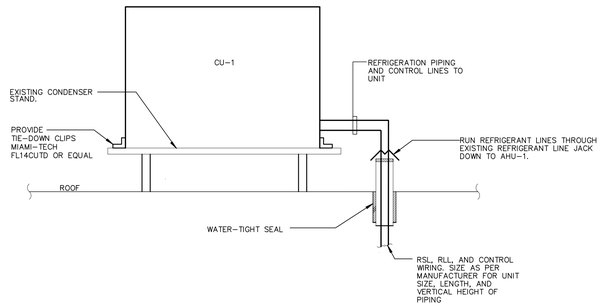
DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

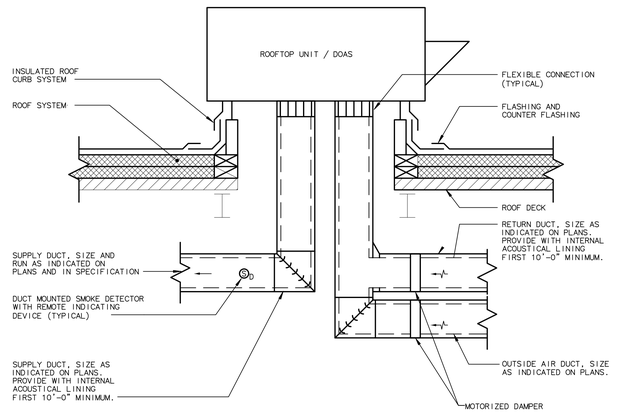
M-105



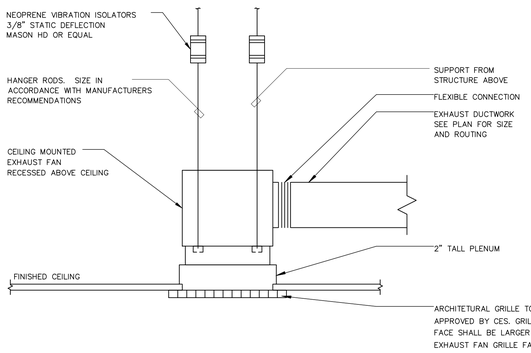
1 AHU-1 VERTICAL MOUNTED UNIT
SCALE: N.T.S.



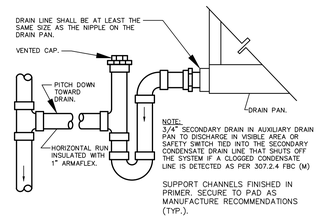
2 CONDENSING UNIT CU-1 DETAIL
SCALE: N.T.S.



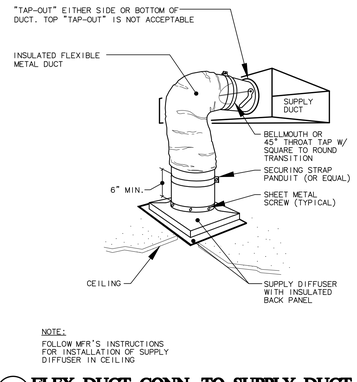
3 RTU-2 ROOFTOP UNIT DETAIL
SCALE: N.T.S.



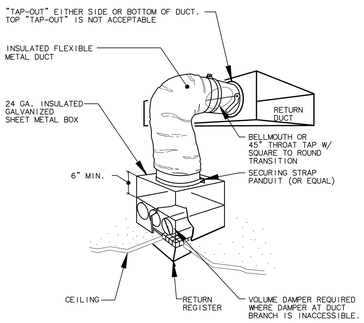
4 CEILING MOUNTED EXHAUST FAN DETAIL
SCALE: N.T.S.



5 CONDENSATE DRAIN DETAIL
SCALE: N.T.S.

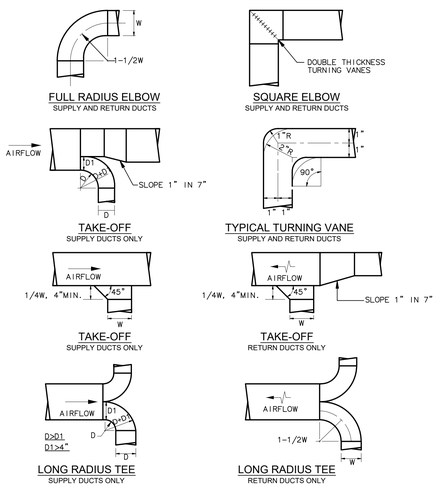


6 FLEX DUCT CONN. TO SUPPLY DUCT DETAIL
SCALE: N.T.S.

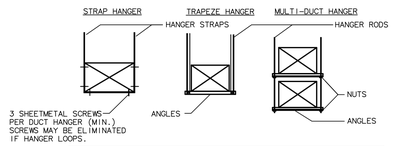


NOTE: INSULATE RETURN DUCTWORK PER SPECS.

7 FLEX DUCT CONN. TO RETURN DUCT DETAIL
SCALE: N.T.S.



8 DUCT CONSTRUCTION DETAIL
N.T.S.



MINIMUM RECTANGULAR DUCT HANGER SIZES

MAXIMUM DUCT WIDTH	MAXIMUM SPACING	WIRE SIZE	ROD SIZE	STRAP SIZE	TRAPEZE SIZE
24	10'-0"	10 GAUGE	----	1"x22 GAUGE	1x1x16 GAUGE
58	10'-0"	----	3/8"	1"x18 GAUGE	1x1x1/8
77	10'-0"	----	3/8"	1"x16 GAUGE	1.5x1.5x1/8
96	10'-0"	----	1/2"	1-1/2"x16 GAUGE	1.5x1.5x1/4
134	10'-0"	----	1/2"	1-1/2"x16 GAUGE	2.5x2.5x1/8
154	8'-0"	----	1/2"	1-1/2"x16 GAUGE	2.5x2.5x3/16
155	----	----	----	----	----

NOTES:
1. STRAPS ARE GALVANIZED STEEL; RODS ARE UNOATED OR GALVANIZED STEEL;WIRE IS BLACK ANNEALED, BRIGHT BASIC OR GALVANIZED STEEL. ALL ARE ALTERNATIVES.
2. TABLE ALLOWS FOR CONVENTIONAL WALL THICKNESS, AND JOINT SYSTEMS PLUS ONE LB/SF OF INSULATION 2. WEIGHT. IF HEAVIER DUCTS ARE TO BE INSTALLED, ADJUST HANGER SIZES TO BE WITHIN THEIR LOAD LIMITS.
3. WHEN STRAP HANGERS ARE LAP JOINED USE THES MINIMUM FASTENERS:
   1"x 18, 20, 2GUAGE 2-#10 OR OR 1-1/4" BOLT
   1"x 16 GUAGE 2-1/4" BOLTS
   1"x 14 GUAGE 2-3/8" BOLTS
4. REFER TO SMACNA HVAC CONSTRUCTION STANDARDS FOR ADDITIONAL INFORMATION.

9 DUCT HANGER DETAIL
N.T.S.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANICAL DETAILS

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

M-500

DEDICATED OUTSIDE AIR UNIT SCHEDULE

GENERAL				PHYSICAL				PERFORMANCE								ELECTRICAL				REMARKS		
SYMBOL	MANUFACTURER	MODEL	LOCATION	WEIGHT (LBS)	DIMENSIONS			SUPPLY FAN				EXHAUST FAN				VOLTS	PHASE	MCA	MOCP	FEATURES	INSTALL	TYPE
					LENGTH (IN)	WIDTH (IN)	HEIGHT (IN)	POWER	CFM (MIN/MAX)	ESP (IN H20)	RPM	POWER	CFM	ESP (IN WG)	RPM							
DOAS-1	TRANE	0ADG015C1-DAB10JD00	ROOF	4,129	176.5	96.0	69.0	2.0 HP	1,292/2,300	1.5	2207	1.5 HP	947	1.0	1575	208	3	86.8	100	1-14	1-9	1

NOTES:
AF = AIR FOIL
FC = FORWARD CURVE
PL = PLENUM FAN

REMARKS - FEATURES:

1. PROVIDE SINGLE POINT OF CONNECTION. PROVIDE NON-FUSED DISCONNECT.
2. 2" DOUBLE WALL CONSTRUCTION.
3. UNIT WITH VERTICAL DISCHARGE AND VERTICAL RETURN AIRFLOWS.
4. MODULATING LOW LEAKAGE RECIRCULATION AIR DAMPER WITH ACTUATORS.
5. DX COOLING COIL WITH STAINLESS STEEL DRAIN PAN.
6. PROVIDE UNIT CONDENSATE OVERFLOW SWITCH.
7. COMPRESSOR WITH SOUND BLANKETS FOR SOUND ATTENUATION.
8. PROVIDE COIL COATING FOR SEACOAST APPLICATION.
9. PROVIDE UNIT WITH HOT GAS REHEAT. PROVIDE FIN & TUBE COATING FOR SEACOAST APPLICATION.
10. PROVIDE UNIT WITH SRC MODULATING PRIMARY ELECTRIC HEAT 20KW.
11. PROVIDE UNIT WITH ENERGY RECOVERY WHEEL.
12. PREMIUM EFFICIENCY MOTORS, DIRECT DRIVE SUPPLY FAN WITH VARIABLE FREQUENCY (PROVIDED BY UNIT MANUFACTURER).
13. PREMIUM EFFICIENCY MOTORS, DIRECT DRIVE EXHAUST FAN WITH VARIABLE FREQUENCY (PROVIDED BY UNIT MANUFACTURER).
14. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

REMARKS - INSTALL:

1. PROVIDE 18" ROOF CURB.
2. END DEVICES AND UNIT CONTROLLER SHALL BE SUPPLIED BY THE MANUFACTURER AND INSTALLED BY THE MECHANICAL AND AUTOMATION CONTROLS CONTRACTOR.
3. AUTOMATIC TEMPERATURE CONTROLS CONTRACTOR SHALL PROVIDE AND INSTALL AIRFLOW MONITORING STATION TO MEASURE OUTSIDE AIR PER UNIT, OUTSIDE AIRFLOW MEASUREMENTS SHALL BE DISPLAYED AT BUILDING AUTOMATION SYSTEM.
4. 2" THICK PLEATED DISPOSABLE MERV 13 OUTSIDE AIR AND EXHAUST AIR FILTERS AND MERV 13 SUPPLY AIR DISPOSABLE CARTRIDGE FILTERS.
5. PROVIDE SINGLE POINT POWER CONNECTION.
6. COOLING COIL SECTION SHALL BE PROVIDED WITH STAINLESS STEEL DRAIN PANS.
7. PROVIDE UNIT WITH RELIATEL COOLING CONTROL AND BACNET BUILDING INTERFACE.
8. REFER TO M-701 FOR CONTROLS DIAGRAMS AND SEQUENCE OF OPERATIONS.
9. PROVIDE UNIT CONTROL TRANE UC-600.

REMARKS - TYPE:

1. 100% OUTSIDE AIR UNIT WITH ROTARY TYPE TOTAL ENERGY RECOVERY WHEEL. SINGLE WHEEL UNIT. SEE ENERGEY RECOVERY WHEEL SCHEDULE.

DEDICATED OUTSIDE AIR UNIT DX COIL SCHEDULE

GENERAL	PHYSICAL	PERFORMANCE												REMARKS
AIR HANDLER	ROWS	COOLING AIR SIDE								HEATING AIR SIDE				
		MBH TOTAL	MBH SENS.	CFM	FPM	APD (IN WG)	EDB (°F)	EWB (°F)	LDB (°F)	LWB (°F)	CFM	HEAT (KW)	EDB (°F)	LDB (°F)	
DOAS-1	6	182.8	90.6	2,300	220	0.28	83.9	73.3	61.8	53.9	2,300	20	54.5	82.0	1-3

REMARKS:
1. OUTDOOR COIL AIR COOLED FIN & TUBE.
2. COMPRESSOR DIGITAL/VARIABLE SCROLL 1ST CIRCUIT ONLY. 2ND CIRCUIT STANDARD SCROLL COMPRESSOR.
3. 5 YEAR WARRANTY ON SCROLL COMPRESSOR, 25 YEAR HEAT EXCHANGER.
4. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

ENERGY RECOVERY WHEEL SCHEDULE

GENERAL	PERFORMANCE - GENERAL					
UNIT	SUPPLY AIR		EXHAUST AIR		EFFECTIVENESS	
	CFM	APD (IN H2O)	CFM	APD (IN H2O)	WINTER (%)	SUMMER (%)
DOAS-1	2,300	1.00	800	0.37	94%	94%

PERFORMANCE - WINTER

UNIT	SUPPLY AIR				EXHAUST AIR			
	EDB (°F)	EWB (°F)	LDB (°F)	LWB (°F)	EDB (°F)	EWB (°F)	LDB (°F)	LWB (°F)
DOAS-1	46.0	45.0	54.5	48.4	70.0	54.0	46.2	45.0

PERFORMANCE - SUMMER

UNIT	SUPPLY AIR				EXHAUST AIR			
	EDB (°F)	EWB (°F)	LDB (°F)	LWB (°F)	EDB (°F)	EWB (°F)	LDB (°F)	LWB (°F)
DOAS-1	91.0	79.0	83.9	73.3	72.0	61.0	90.8	78.4

VENTILATION SCHEDULE

Room Number	Room Name	Outside Air Area Component CFM per sq.ft.	Outside Air People Component CFM per Person	Total CFM
	WATCH OFFICE	0.06	5.0	10
	LOBBY	0.06	5.0	15
	MULTI-PURPOSE ROOM	0.06	5.0	45
	TELECOM ROOM	0.06	5.0	15
	CORRIDOR 1 / WORK AREA	0.06		35
	WOMEN			45
	MEN			45
	GYMNASIUM	0.06	20.0	110
	BUNKER STORAGE	0.12		30
	STORAGE	0.12		10
	STORAGE	0.12		10
	STORAGE/ICE	0.12		10
	MEDICAL STORAGE	0.12		15
	DECON ROOM	0.12		10
	OFFICE 2	0.06	5	15
	OFFICE 1	0.06	5	15
	ELECTRICAL ROOM			
Summary - 1st Floor				435
	BUNK 1	0.06	5	15
	BUNK 2	0.06	5	15
	BUNK 3	0.06	5	15
	BUNK 4	0.06	5	15
	CORRIDOR 1	0.06		15
	STORAGE	0.12		5
	CORRIDOR 4	0.06		15
	FIRE POLE	0.12		10
	JANITOR	0.12		10
	BATH 2			25
	BATH 3			25
	BUNK 5	0.06	5	15
	CORRIDOR 3	0.06		10
	DAY ROOM	0.06	5	25
	BATH 4			25
	BUNK 6	0.06	5	15
	BATH 5			25
	BATH 1 ACCESSIBLE			25
	LAUNDRY	0.06	5	10
	SUPPLY ROOM	0.12		15
	ELEC CL			
	BUNK 7	0.06	5	20
	STORAGE	0.12		5
	CORRIDOR 2	0.06		20
	RECYCLING ROOM	0.12		10
	DINING ROOM	0.18	8	50

AIR BALANCE SCHEDULE

ZONE	ROOM	OA SUPPLY (MIN)	OA SUPPLY (MAX)	EXHAUST	NET MIN	NET MAX
1	APPARATUS BAY	0	6572	6,572	0	0
2	DECON ROOM	95	95	95	0	0
	MEDICAL STORAGE	75	75	75	0	0
	ICE STORAGE	50	50	0	50	50
	BUNKER STORAGE	125	125	125	0	0
3	1ST FLOOR	193	330	100	93	230
4	2ND FLOOR	690	700	690	0	10
	KITCHEN	0	925	1200	0	-275
TOTAL	DEDICATED OUTSIDE AIR SYSTEM	1,228		1,085	1,343	
			2,300	2,285		15

CONDENSING UNIT SCHEDULE

SYMBOL	MANUFACTURER	MODEL	LOCATION	AREAS SERVED	NOMINAL CAPACITY (TON)	TOTAL COOLING CAP.(MBH)	SENSIBLE CAP.(MBH)	SEER	ELECTRICAL DATA					PHYSICAL DATA				REMARKS
									VOLTAGE	PHASE	FLA(AMPS)	MCA(AMPS)	MOCP(AMPS)	LENGTH	WIDTH	HEIGHT	WEIGHT	
CU-1	TRANE	4TTR4042L1000A	ROOF	FIRST FLOOR	3.5	42	35	14	230 V	1	17.75	22	35	2'-10"	3'-1"	2'-6"	184	1-4

REMARKS:
1. PROVIDE WITH LOCAL UNIT-MOUNTED FUSED DISCONNECT.
2. INSTALL UNIT AND PIPING PER MANUFACTURERS RECOMMENDATIONS.
3. UNIT TO BE INSTALLED ON EXISTING CONDENSER STAND. REFER TO DETAIL 2/M-500 FOR MORE INFORMATION.
4. PROVIDE UNIT COATING FOR SEACOAST APPLICATION.
5. UNIT TO BE VARIABLE AIR VOLUME(VAV).
6. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

AIR HANDLING UNIT SCHEDULE

SYMBOL	MANUFACTURER	MODEL	LOCATION	AREAS SERVED	SUPPLY FAN			ELECTRICAL					PHYSICAL DATA				REMARKS
					TOTAL CFM	OA CFM	ESP	VOLTAGE	PHASE	HP	FLA (AMPS)	MCA (AMPS)	MOCP (AMPS)	LENGTH	WIDTH	HEIGHT	WEIGHT	
AHU-1	TRANE	BCVD054	FIRST FLOOR MECHANICAL RM	FIRST FLOOR	2300	330	1.50 in-wg	208 V	3	1.5	7.6	9.5	15	1'-10"	3'-4"	5'-4"	276.4	1-7

REMARKS:
1. PROVIDE UNIT WITH BUILT-IN CIRCUIT BREAKER OR DISCONNECT.
2. PROVIDE CONDENSATE DRAIN AND ROUTE TO EXISTING CONDENSATE DRAIN LINE.
3. PROVIDE SECONDARY DRAIN PAN WITH OVERFLOW SWITCH TO SHUT DOWN UNIT UPON ACTIVATION.
4. UNIT TO BE VERTICAL MOUNTED. REFER TO DETAIL 1/M-500.
5. PROVIDE 2" MERV 11 THROWAWAY FILTERS.
6. PROVIDE REFRIGERANT LINES FROM CU-1 AS PER MANUFACTURER'S INSTALLATION INSTRUCTIONS
7. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

REMARKS (CONT):
7. PROVIDE UNIT WITH VARIABLE SPEED FAN.
8. PROVIDE VAV CONTROLLER WITH BACNET INTERFACE. CONNECT TO EXISTING BAS.
9. PROVIDE ULTRAVIOLET GERMICIDAL LIGHT AT THE COIL. PROVIDE URV1.3 KILL RATES FOR COMPLETE AIRSTREAM, PURE LIGHT CLEAN AIR MODEL PLCA-195-ADPL. COORDINATE WITH DIVISION 26.

ROOF TOP UNIT SCHEDULE

SYMBOL	MANUFACTURER/ MODEL	NOMINAL TONS	AREA SERVED	SUPPLY FAN DATA				COOLING CAPACITY			EFFICIENCY	ELECTRICAL					MAX. OPERATING WEIGHT (LBS)	REMARKS
				TOTAL CFM	OA CFM	ESP (IN WG)	HP	TOTAL CAP (MBH)	SENS CAP (MBH)	EAT (°F) DB/WB	EER/SEER	FLA	MCA	MOCP	VOLTS	PHASE		
RTU-2	TRANE THC067E3R0A	5.0	SECOND FLOOR	2000	665	1.00	1.0	52.5	35.4	68.6/60.8	13.0/17.20	28.1	33	45	208	3	953	1-11

REMARKS:
1. PROVIDE UNITS WITH CORROSION RESISTANT OUTDOOR COIL.
2. SUPPLY DUCT SMOKE DETECTOR.
3. PROVIDE BAROMETRIC RELIEF.
4. UNIT WITH 2-STAGE COMPRESSOR.
5. PROVIDE 2" MERV 13 FILTERS.
6. PROVIDE UNIT WITH CONDENSATE OVERFLOW CONTROL SYSTEM.
7. RE-USE EXISTING ROOF CURB. PROVIDE CURB ADAPTER. ADAPTER SHALL BE CERTIFIED TO WITHSTAND HURRICANE WIND ZONE BY A FLORIDA LICENSED PROFESSIONAL ENGINEER.
8. PROVIDE ELECTRICAL SINGLE POINT OF CONNECTION.
9. PROVIDE UNIT WITH VAV STANDARD MOTOR.
10. UNIT SHALL BE VARIABLE AIR VOLUME(VAV).
11. PROVIDE ULTRAVIOLET GERMICIDAL LIGHT AT THE COIL. PROVIDE URV1.3 KILL RATES FOR COMPLETE AIRSTREAM, PURE LIGHT CLEAN AIR MODEL PLCA-195-PRU. COORDINATE WITH DIVISION 26.
12. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

VARIABLE AIR VOLUME BOX SCHEDULE

SYMBOL	MANUFACTURER/ MODEL NUMBER	UNIT AND INLET SIZE	AIR CFM		MAXIMUM APD @ IN H2O	MAXIMUM RADIATED NC	ELECTRIC HEAT							REMARKS
			MIN CFM	MAX CFM			CAPACITY KW	STAGES	VOLTS	PHASE	FLA (AMPS)	MCA (AMPS)	MOCP (AMPS)	
A	TRANE VCEF04	4"	50	225	0.03	24	1	1	208	1	3.6	4.5	15	1-6
B	TRANE VCEF05	5"	120	350	0.03	24	1	1	208	1	3.6	4.5	15	1-6
C	TRANE VCEF06	6"	180	500	0.23	29	2	1	208	1	14.4	18.2	20	1-6
D	TRANE VCEF08	8"	350	900	0.11	32	3	1	208	1	10.8	13.5	15	1-6
E	TRANE VCCF06	6"	180	500	0.23	29	-	-	208	-	-	-	-	1-7
F	TRANE VCCF08	8"	350	900	0.11	32	-	-	208	-	-	-	-	1-7

NOTES:
1. PROVIDE 24V STEP DOWN TRANSFORMER IN VAV BOX FROM MANUFACTURER
2. CONTROLS SHALL BE NATIVE BACNET. PROVIDE CONTROLS DISCONNECT.
3. (-) DASHES INDICATED NC RATING LESS THAN 20.
4. PROVIDE OUTLET CONNECTION AND SIZE AS REQUIRED
5. PROVIDE INLET CONNECTION TRANSITION AS REQUIRED
6. PROVIDE UNIT MOUNTED FUSED DISCONNECT SWITCH.
7. COOLING ONLY.
8. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

INDICATES VAV SYMBOL: A | VAV 1-1 (INDICATES UNIT & VAV NUMBER) / 50/2000 (INDICATES MIN./MAX CFM SETTING)

DIFFUSER/REGISTER SCHEDULE

SYMBOL	MANUFACTURER / MODEL NO.	DUTY	TYPE	CONSTRUCTION			REMARKS
				MATERIAL	BORDER TYPE	VOLUME DAMPER TYPE	
A	PRICE / AMD	SUPPLY	LF	ALUMINUM	LAY IN	MANUAL	4
B	PRICE / 630	RETURN	LF	ALUMINUM	LAY IN	MANUAL	4
C	PRICE / 85	EXHAUST	EC	-	-	-	1-3

TYPES:
LF-LOUVERED FACE
EC-EGGCRATE

INDICATES UNIT TYPE: A | 12X12 (INDICATES FACE SIZE) / 350 (INDICATES UNIT CFM CAPACITY)

REMARKS:
1. DIFFUSER FINISH COLOR SHALL BE WHITE.
2. BALANCE DEVICE TO AIRFLOW SHOWN ON THE DRAWINGS.
3. PRICE IS BASIS OF DESIGN.
4. RE-USE EXISTING DIFFUSER IF IN GOOD CONDITION.
5. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.
6. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

MINI SPLIT SYSTEM SCHEDULE

SYMBOL	MANUFACTURER	MODEL	LOCATION	NOMINAL TONS	COOLING (BTUH)	ELECTRICAL					SOUND PRESSURE (DBA)	WEIGHT (LBS)	DIMENSIONS (WxLxH) INCHES	REMARKS
						FLA	MCA	MOCP	VOLTS	PHASE				
CU-2	TRANE	TRUZA0361KA70NA	ROOF	3.0	35,202	17.25	25.0	35	208	1	47	151	42x14x53	1-4,7,8
AHU-2		TPLA0A0361EA70A	MULTIPURPOSE ROOM			0.36	2.0	15	208	1	32	56	37x37x14	5-7,8

REMARKS:
1. R410A REFRIGERANT. CAPACITY RATINGS AT ARI CONDITIONS. COOLING - 80°F EDB, 67°F EWB, 95°F ODB. HEATING - 70°F EDB, 47°F ODB, 43°F OWB.
2. ROUTE REFRIGERANT PIPING FROM CONDENSING UNIT TO ASSOCIATED EVAPORATOR UNIT. COORDINATE EXACT ROUTING IN FIELD. REFRIGERANT PIPE SIZE BY EQUIPMENT MANUFACTURER
3. PROVIDE CONCRETE PAD FOR FLOOR MOUNTED UNIT. USE MIAMI TECH INC 1" STEEL TIE DOWN CLIPS AND INSTALLED PER FL APPROVED PRODUCT #19731.2.
4. PROVIDE ELECTRICAL DISCONNECT.
5. PROVIDE CEILING CASSETTE MOUNTING KIT.
6. ROUTE CONDENSATE DRAIN TO EXISTING CONDENSATE DRAIN IN MECHANICAL ROOM. USE CONDENSATE DRAIN PUMP HARTELL MODEL #KL-1DG-115.
7. PROVIDE CORROSION PROTECTION COATING ON CONDENSER COILS.
8. WARRANTY 5 YEARS PARTS AND LABOR.
9. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

FAN SCHEDULE

LABEL	AREA SERVED	MANUFACTURER / MODEL NO.	CFM	SP	LOCATION	WATTS (HP)	RPM	VOLTAGE	NOTES
EF-3	BUNKER/STORAGE	GREENHECK SP-A290	125	0.25	CEILING	80	1050	115	3
EF-4	DECON ROOM	GREENHECK SP-A90	95	0.1	CEILING	17.6	900	115	1
KEF-1	KITCHEN HOOD	GREENHECK CUBE 140-4	1125		ROOF	.25 HP	1040	208	1
EF-14	FIRE POLE ROOM	GREENHECK SP-A50	40	0.1	ROOF	18.3	700	208	3
EF-15	RECYCLING ROOM	GREENHECK SP-A125	100	0.1	CEILING	22.5	1100	115	3
EF-16	APPARATUS BAY	ACME PDURFH	1650	0.25	ROOF	.5 HP	1250	115	2
EF-17	APPARATUS BAY	ACME PDURFH	1650	0.25	ROOF	.5 HP	1250	115	2
EF-18	APPARATUS BAY	ACME PDURFH	1650	0.25	ROOF	.5 HP	1250	115	2
EF-19	APPARATUS BAY	ACME PDURFH	1650	0.25	ROOF	.5 HP	1250	115	2
EF-20	TRASH	GREENHECK CW-060	150	0.125	WALL	1/5 HP	1550	115	1
EF-21	STORAGE	GREENHECK SP-A190	75	0.25	CEILING	54.4	1400	115	3

REMARKS:
1. EXISTING EXHAUST FAN TO REMAIN.
2. EXISTING EXHAUST FAN TO BE RE-BALANCED TO CFM VALUE SHOWN.
3. EXISTING FAN RELOCATED TO AREA NOTED.
4. SPECIFIED MANUFACTURER IS BASIS OF DESIGN, APPROVED EQUAL SHALL BE ALLOWED.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS

NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

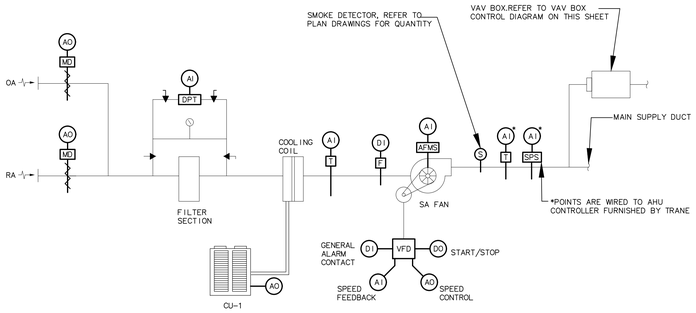
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

MECHANICAL SCHEDULES

DATE: 03/04/2022
PROJECT NO: 12735
CES PROJECT NO: 2021673.00
DRAWN: SMP
CHECKED: GJN
ISSUED FOR: PERMIT SET
REVISIONS:

SHEET NO.

M-600



1 AIR HANDLING UNIT CONTROL DIAGRAM VARIABLE AIR VOLUME (VAV) - AHU-1

SCALE: 1/4"=1'0"

SEQUENCE OF OPERATION:

THE AHU SUPPLY FAN IS STARTED BY:
- A.PLACING THE HAND-OFF-AUTO (HOA) SWITCH IN HAND
- B.OR WHEN THE HOA IS IN AUTO:
- A.BY THE BAS BASED UPON A TIME OF DAY SCHEDULE OR
- B.BY THE BAS WHEN THE SPACE CONDITIONS EXCEED THE UNOCCUPIED SETUP/SETBACK TEMPERATURES.
- C.BY THE BAS WHEN THE TIMED OVERRIDE ON THE SPACE TEMPERATURE SENSOR OF AN ASSOCIATED VAV BOX IS PRESSED.

FROM THE BAS THE SPACE TEMPERATURE, HUMIDITY AND CO2 SETPOINTS MAY BE ADJUSTED, THE OCCUPIED/UNOCCUPIED SCHEDULES MAY BE SET AND MANUAL OVERRIDE OF THE SCHEDULE MAY BE SELECTED.

IN ADDITION, FROM THE VAV BOX SPACE TEMPERATURE SENSORS, THE SPACE TEMPERATURE SETPOINTS MAY BE ADJUSTED TO IN A 5 DEGREE RANGE (SETPOINT RANGE LIMIT IS ADJUSTABLE AT THE OPERATOR WORKSTATION) AND A 2 HOUR TIMED LOCAL OVERRIDE (ADJUSTABLE AT THE OPERATOR WORKSTATION) MAY BE ENABLED VIA THE PUSHBUTTON ON THE SPACE SENSOR. RELATIVE HUMIDITY SETPOINTS SHALL NOT BE ADJUSTABLE AT THE SENSORS.

SPACE TEMPERATURE SETPOINT SHALL NOT BE LESS THAN 68F

THE AHU SHALL BE INDEXED BETWEEN OCCUPIED AND UNOCCUPIED MODE FROM THE BAS.

OCCUPIED MODE

THE AHU SUPPLY FAN SHALL RUN CONTINUOUSLY. THE OA DAMPER SHALL MODULATE OPEN TO MINIMUM POSITION TO PROVIDE MINIMUM OA CFM. MINIMUM DAMPER POSITION SHALL BE SET DURING TESTING AND BALANCING. RETURN AIR DAMPER SHALL MODULATE TO BALANCE AHU OVERALL SUPPLY. DOAS SUPPLY FAN SHALL RAMP UP TO PROVIDE OUTSIDE AIR TO AHU-1.

COOLING COIL CONTROL

WHEN THE FAN IS RUNNING, THE CONDENSING UNIT SHALL CYCLE ON/OFF TO MAINTAIN THE LEAVING AIR TEMPERATURE SETPOINT TO 54F (ADJUSTABLE FROM THE OPERATOR WORKSTATION). WHEN THE FAN IS OFF, THE CONDENSING UNIT CU-1 SHALL BE OFF.

COOLING COIL RESET OPTION AND HUMIDITY CONTROL

THE BAS SHALL INCLUDE A SELECTABLE OPTION FOR A COOLING COIL RESET OPTION BASED ON INDOOR RELATIVE HUMIDITY. WHEN ALL VAV BOXES ARE OPERATING AT LESS THAN THEIR FULL CAPACITY AND THE SPACE RH FALLS BELOW 45% (ADJUSTABLE) FOR 20 MINUTES THE LEAVING AIR COOLING COIL TEMPERATURE SETPOINT SHALL BE RESET UPWARDS IN 1 DEGREE INCREMENTS (ADJUSTABLE), UP TO A MAXIMUM OF 4°F (ADJUSTABLE) HIGHER THAN THE INITIAL SETPOINT.

WHEN ANY ONE VAV BOX IS AT FULL CAPACITY OR IF THE SPACE RELATIVE HUMIDITY IS ABOVE 55% (ADJUSTABLE) THE SETPOINT WILL BE SLOWLY RESET DOWNWARD UNTIL IT REACHES THE SCHEDULED COOLING COIL DISCHARGE SETPOINT.

ANYTIME THE SPACE RH RISES ABOVE 60% (ADJUSTABLE), THE RESET ROUTINE SHALL BE SUSPENDED AND THE SETPOINT RETURNED TO ITS NORMALLY SCHEDULED VALUE UNTIL THE SPACE RH FALLS BELOW 45% (ADJUSTABLE).

FAN SPEED CONTROL

A DUCT MOUNTED STATIC PRESSURE SENSOR LOCATED 2/3 DOWN THE SUPPLY AIR DUCT SHALL PROVIDE THE INPUT SIGNAL FOR THE CONTROL OF THE FAN SPEED. THE AHU STATIC PRESSURE SETPOINT SHALL BE ADJUSTABLE FROM THE OPERATOR WORKSTATION.

OPTIMUM FAN STATIC PRESSURE RESET

THE STATIC PRESSURE SETPOINT MAY BE RESET BETWEEN 0.7 AND 1.5 IN WC (ADJUSTABLE). THE BAS SHALL MONITOR THE ACTUAL AIRFLOW FOR ALL OF THE VAV BOXES SERVED BY THE AHU.

WHEN ALL OF THE AIRFLOWS AT THE VAV BOXES ARE AT 85% OPEN (ADJUSTABLE) OR LESS FOR 10 MINUTES (ADJUSTABLE) THE FAN STATIC PRESSURE SHALL BE REDUCED IN INCREMENTS OF 0.05'(ADJUSTABLE) AT 10-MINUTE INTERVALS (ADJUSTABLE). WHEN ANY VAV BOX IS AT 95% OPEN (ADJUSTABLE) FOR MORE THAN 3 MINUTES (ADJUSTABLE) THE FAN STATIC PRESSURE SHALL BE INCREASED IN INCREMENTS OF 0.05'(ADJUSTABLE) AT 10-MINUTE INTERVALS (ADJUSTABLE) UP TO THE MAXIMUM SETPOINT VALUE.

THE OA CONTROL SEQUENCE SHALL OVERRIDE THE STATIC PRESSURE RESET ROUTINE AS REQUIRED.

DEMAND CONTROL VENTILATION

THE OA DAMPER SHALL MODULATE BASED ON THE SPACE CO2 LEVEL. EACH ZONE SHALL BE PROVIDED WITH A CO2 SENSOR. WHEN THE CO2 LEVELS OF ALL THE ZONES ARE BELOW THE CO2 SETPOINT (700 PPM, ADJUSTABLE) THE OA DAMPER SHALL MODULATE DOWNWARD TOWARDS ITS MINIMUM SETPOINT. UPON A RISE IN CO2 IN ANY ZONE THE OA DAMPER SHALL MODULATE OPEN TOWARDS IT MAXIMUM SETPOINT UNTIL THE CO2 LEVELS IN ALL THE ZONES DROP BELOW THE CO2 SETPOINT.

UNOCCUPIED MODE

THE AHU SUPPLY FAN SHALL BE OFF, THE OA DAMPER SHALL BE CLOSED AND THE ASSOCIATED EXHAUST FANS SHALL BE OFF.

COOLING

WHEN A SUFFICIENT NUMBER (ADJUSTABLE) OF ZONE TEMPERATURE SENSORS SENSE A RISE ABOVE THE UNOCCUPIED COOLING SETPOINT THE VAV TERMINAL UNITS SHALL BE INDEXED TO THE OCCUPIED MODE AND THE AHU SUPPLY FAN SHALL RUN UNTIL THE ALL OF THE SPACE TEMPERATURES FALLS BELOW THEIR UNOCCUPIED COOLING SETPOINTS, BUT NOT FOR LESS THAN 15 MINUTES (ADJUSTABLE).

HUMIDITY CONTROL

THE BAS MONITORS THE SPACE HUMIDITY SIGNALS. IF ANY SPACE HUMIDITY RISES ABOVE 65% (ADJUSTABLE) FOR MORE THAN 10 MINUTES (ADJUSTABLE) THE SYSTEM WILL INITIATE A DEHUMIDIFICATION CYCLE. THE AHU FAN SHALL RUN AT MINIMUM SPEED, THE COMPRESSORS SHALL START, THE OA DAMPER SHALL REMAIN CLOSED, THE RA DAMPER SHALL BE OPEN 100%, THE VAV BOX UNOCCUPIED COOLING SETPOINTS SHALL BE RESET TO 75°F AND THE AHU SHALL RUN UNTIL THE SPACE HUMIDITY FALLS BELOW 50% (ADJUSTABLE) BUT NOT FOR LESS THAN 30 MINUTES (ADJUSTABLE)

THE BAS MONITORS THE HUMIDITY SIGNALS FROM ALL OF THE SPACE SENSORS. IF ANY SPACE SENSOR INDICATES A HIGH HUMIDITY CONDITION AND IT HAS BEEN AT LEAST 2 HOURS (ADJUSTABLE) SINCE THE SYSTEM HAS TURNED OFF, THE SYSTEM WILL INITIATE A DEHUMIDIFICATION CYCLE. DURING THE DEHUMIDIFICATION CYCLE, THE AHU SHALL BE ENABLED. THE DEHUMIDIFICATION CYCLE WILL RUN FOR A MINIMUM OF 1 HOUR AND A MAXIMUM OF 2 HOURS EVERY 12 HOURS. IF ALL HIGH HUMIDITY SIGNALS HAVE NOT RETURNED TO NORMAL AFTER 2 HOURS THE DEHUMIDIFICATION CYCLE WILL BE STOPPED AND AN ALARM WILL BE GENERATED.

FIRE/SMOKE CONTROL

THE FIRE ALARM SYSTEM IS FURNISHED AND INSTALLED UNDER DIVISION 26. WHEN IN ALARM THE FAS SHALL ACTIVATE FIRE ALARM SHUT DOWN RELAYS WHICH SHALL SHUT DOWN THE AHU SUPPLY FAN.

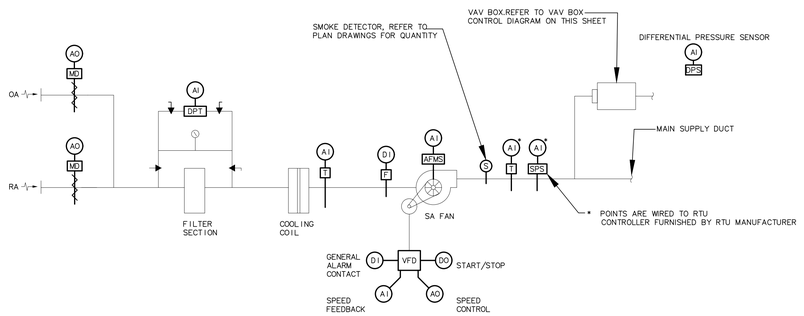
GRAPHIC DISPLAYS

THE FOLLOWING REAL TIME INFORMATION SHALL BE DISPLAYED ON THE GRAPHICAL DISPLAY FOR THE EQUIPMENT:

- •AHU STATE (OCCUPIED/UNOCCUPIED/OVERRIDE)
- •STATIC PRESSURE RESET MODE
- •STATIC PRESSURE VALUE AND SETPOINT
- •COOLING COIL RESET MODE
- •COOLING DISCHARGE TEMPERATURE, DEWPOINT AND SETPOINT
- •DEHUMIDIFICATION MODE
- •RELATIVE HUMIDITY AND RH SETPOINT FOR EACH SPACE
- •DAMPER POSITION
- •OA AIR DAMPER POSITION AND SETPOINT
- •AHU SUPPLY FAN STATUS
- •AHU SUPPLY FAN VFD STATUS
- •AHU SUPPLY FAN VFD PERCENT SPEED
- •HIGH STATIC PRESSURE SAFETY SWITCHES

ALARMS

- •IF THE AHU FAN IS COMMANDED ON BUT THE STATUS IS OFF AFTER A DELAY OF 60 SECONDS (ADJUSTABLE).
- •IF THE AHU FAN IS COMMANDED OFF BUT THE STATUS IS ON AFTER A DELAY OF 60 SECONDS (ADJUSTABLE).
- •IF THE STATIC PRESSURE DEVIATES BY MORE THAN 0.5 IN WC (ADJUSTABLE) FROM SETPOINT.
- •IF THE AHU FAN VFD GOES INTO AN OFF-NORMAL CONDITION, THE VFD WILL PROVIDE A SIGNAL TO THE BAS.
- •IF THE RH LEVEL EXCEEDS THE RH SETPOINT (OCCUPIED AND UNOCCUPIED SETPOINTS) PLUS 5% (ADJUSTABLE).
- •IF THE TEMPERATURE LEVELS EXCEED THE TEMPERATURE SETPOINT PLUS 5F (ADJUSTABLE)
- •IF THE OA FLOW RATE DEVIATES FROM SETPOINT BY MORE THAN 15% (ADJUSTABLE) FOR LONGER THAN 2 MINUTES (ADJUSTABLE).
- •IF THE HIGH STATIC PRESSURE SAFETY SWITCH TRIPS.



2 ROOF TOP UNIT CONTROL DIAGRAM VARIABLE AIR VOLUME(VAV)

SCALE: NTS

SEQUENCE OF OPERATION:

A.THE RTU SUPPLY FAN RUNS CONTINUOSLY UNLESS PLACED IN THE MANUAL OFF POSITION. RTU IS IN OCCUPIED MODE AT ALL TIMES.

IN ADDITION, FROM THE VAV BOX SPACE TEMPERATURE SENSORS, THE SPACE TEMPERATURE SETPOINTS MAY BE ADJUSTED (SETPOINT RANGE LIMIT IS ADJUSTABLE AT THE OPERATOR WORKSTATION) AND A 2 HOUR TIMED LOCAL OVERRIDE (ADJUSTABLE AT THE OPERATOR WORKSTATION) MAY BE ENABLED VIA THE PUSHBUTTON ON THE SPACE SENSOR. RELATIVE HUMIDITY SETPOINTS SHALL NOT BE ADJUSTABLE AT THE SENSORS.

THE RTU SHALL RUN IN OCCUPIED CONTINUOSLY.

OCCUPIED MODE

THE RTU SUPPLY FAN SHALL RUN CONTINUOUSLY. THE OA DAMPER SHALL MODULATE OPEN. RETURN AIR DAMPER SHALL MODULATE TO BALANCE RTU OVERALL SUPPLY. DOAS SUPPLY FAN SHALL RAMP UP TO PROVIDE OUTSIDE AIR TO THE RTU.

COOLING COIL CONTROL

WHEN THE FAN IS RUNNING, THE COMPRESSORS SHALL CYCLE ON/OFF TO MAINTAIN THE LEAVING AIR TEMPERATURE SETPOINT 54F (ADJUSTABLE FROM THE OPERATOR WORKSTATION). WHEN THE FAN IS OFF THE COMPRESSORS SHALL TURN OFF.

COOLING COIL RESET OPTION AND HUMIDITY CONTROL

THE BAS SHALL INCLUDE A SELECTABLE OPTION FOR A COOLING COIL RESET OPTION BASED ON INDOOR RELATIVE HUMIDITY. WHEN ALL VAV BOXES ARE OPERATING AT LESS THAN THEIR FULL CAPACITY AND THE SPACE RH FALLS BELOW 45% (ADJUSTABLE) FOR 20 MINUTES THE LEAVING AIR COOLING COIL TEMPERATURE SETPOINT SHALL BE RESET UPWARDS IN 1 DEGREE INCREMENTS (ADJUSTABLE), UP TO A MAXIMUM OF 4°F (ADJUSTABLE) HIGHER THAN THE INITIAL SETPOINT.

WHEN ANY ONE VAV BOX IS AT FULL CAPACITY OR IF THE SPACE RELATIVE HUMIDITY IS ABOVE 55% (ADJUSTABLE) THE SETPOINT WILL BE SLOWLY RESET DOWNWARD UNTIL IT REACHES THE SCHEDULED COOLING COIL DISCHARGE SETPOINT.

ANYTIME THE SPACE RH RISES ABOVE 60% (ADJUSTABLE), THE RESET ROUTINE SHALL BE SUSPENDED AND THE SETPOINT RETURNED TO ITS NORMALLY SCHEDULED VALUE UNTIL THE SPACE RH FALLS BELOW 45% (ADJUSTABLE).

FAN SPEED CONTROL

A DUCT MOUNTED STATIC PRESSURE SENSOR LOCATED 2/3 DOWN THE SUPPLY AIR DUCT SHALL PROVIDE THE INPUT SIGNAL FOR THE CONTROL OF THE FAN SPEED. THE RTU STATIC PRESSURE SETPOINT SHALL BE ADJUSTABLE FROM THE OPERATOR WORKSTATION.

OPTIMUM FAN STATIC PRESSURE RESET

THE STATIC PRESSURE SETPOINT MAY BE RESET BETWEEN 0.4 AND 1.0 IN WC (ADJUSTABLE). THE BAS SHALL MONITOR THE ACTUAL AIRFLOW FOR ALL OF THE VAV BOXES SERVED BY THE RTU.

WHEN ALL OF THE AIRFLOWS AT THE VAV BOXES ARE AT 85% OPEN (ADJUSTABLE) OR LESS FOR 10 MINUTES (ADJUSTABLE) THE FAN STATIC PRESSURE SHALL BE REDUCED IN INCREMENTS OF 0.05'(ADJUSTABLE) AT 10-MINUTE INTERVALS (ADJUSTABLE). WHEN ANY VAV BOX IS AT 95% OPEN (ADJUSTABLE) FOR MORE THAN 3 MINUTES (ADJUSTABLE) THE FAN STATIC PRESSURE SHALL BE INCREASED IN INCREMENTS OF 0.05' (ADJUSTABLE) AT 10-MINUTE INTERVALS (ADJUSTABLE) UP TO THE MAXIMUM SETPOINT VALUE.

THE OA CONTROL SEQUENCE SHALL OVERRIDE THE STATIC PRESSURE RESET ROUTINE AS REQUIRED.

OUTSIDE AIR CONTROL

THE OUTSIDE AIR DAMPER MINIMUM POSITION SHALL BE SET DURING TESTING AND BALANCING TO PROVIDE THE MINIMUM OUTSIDE AIR REQUIRED. OA DAMPER SHALL MODULATE BETWEEN MINIMUM AND MAXIMUM POSITIONS IN RESPONSE TO CO2 AND SPACE PRESSURE.

DEMAND CONTROL VENTILATION

THE OA DAMPER SHALL MODULATE BASED ON THE SPACE CO2 LEVEL. EACH ZONE SHALL BE PROVIDED WITH A CO2 SENSOR. WHEN THE CO2 LEVELS OF ALL THE ZONES ARE BELOW THE CO2 SETPOINT (700 PPM, ADJUSTABLE) THE OA DAMPER SHALL MODULATE DOWNWARD TOWARDS ITS MINIMUM SETPOINT, UPON A RISE IN CO2 IN ANY ZONE THE OA DAMPER SHALL MODULATE OPEN TOWARDS IT MAXIMUM SETPOINT UNTIL THE CO2 LEVELS IN ALL THE ZONES DROP BELOW THE CO2 SETPOINT.

COOLING

WHEN A SUFFICIENT NUMBER (ADJUSTABLE) OF ZONE TEMPERATURE SENSORS SENSE A RISE ABOVE THE COOLING SETPOINT THE VAV TERMINAL UNITS SHALL BE INDEXED AND THE RTU SUPPLY FAN SHALL MODULATE UP. THE RTU SHALL RUN UNTIL ALL OF THE SPACE TEMPERATURES FALLS BELOW THEIR COOLING SETPOINTS, BUT NOT FOR LESS THAN 15 MINUTES (ADJUSTABLE).

HUMIDITY CONTROL

THE BAS MONITORS THE SPACE HUMIDITY SIGNALS. IF ANY SPACE HUMIDITY RISES ABOVE 60% (ADJUSTABLE) FOR MORE THAN 10 MINUTES (ADJUSTABLE) THE SYSTEM WILL INITIATE A DEHUMIDIFICATION CYCLE. THE RTU FAN SHALL RUN AT MINIMUM SPEED, THE COMPRESSORS SHALL START, THE OA DAMPER SHALL REMAIN CLOSED, THE RA DAMPER SHALL BE OPEN 100%, THE VAV BOX COOLING SETPOINTS SHALL BE RESET TO 75°F AND THE RTU SHALL RUN UNTIL THE SPACE HUMIDITY FALLS BELOW 55% (ADJUSTABLE) BUT NOT FOR LESS THAN 30 MINUTES (ADJUSTABLE)

THE OA DAMPER SHALL BE OVERRIDEN BY THE PRESSURE SENSOR.

FIRE/SMOKE CONTROL

THE FIRE ALARM SYSTEM IS FURNISHED AND INSTALLED UNDER DIVISION 26. WHEN IN ALARM THE FAS SHALL ACTIVATE FIRE ALARM SHUT DOWN RELAYS WHICH SHALL SHUT DOWN THE AHU SUPPLY FAN.

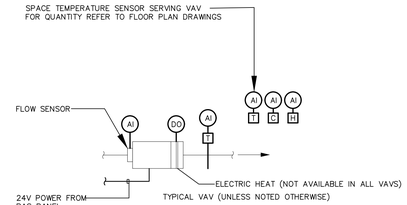
GRAPHIC DISPLAYS

THE FOLLOWING REAL TIME INFORMATION SHALL BE DISPLAYED ON THE GRAPHICAL DISPLAY FOR THE EQUIPMENT:

- •RTU STATE (ON/OFF)
- •STATIC PRESSURE RESET MODE
- •STATIC PRESSURE VALUE AND SETPOINT
- •COOLING COIL RESET MODE
- •COOLING DISCHARGE TEMPERATURE, DEWPOINT AND SETPOINT
- •DEHUMIDIFICATION MODE
- •SPACE RELATIVE HUMIDITY AND RH SETPOINT
- •DAMPER POSITION
- •OA AIR DAMPER POSITION AND SETPOINT
- •RTU SUPPLY FAN STATUS
- •RTU SUPPLY FAN VFD STATUS
- •RTU SUPPLY FAN VFD PERCENT SPEED
- •HIGH STATIC PRESSURE SAFETY SWITCHES

ALARMS

- •IF THE RTU FAN IS COMMANDED ON BUT THE STATUS IS OFF AFTER A DELAY OF 60 SECONDS (ADJUSTABLE).
- •IF THE RTU FAN IS COMMANDED OFF BUT THE STATUS IS ON AFTER A DELAY OF 60 SECONDS (ADJUSTABLE).
- •IF THE STATIC PRESSURE DEVIATES BY MORE THAN 0.5 IN WC (ADJUSTABLE) FROM SETPOINT.
- •IF THE RTU FAN VFD GOES INTO AN OFF-NORMAL CONDITION, THE VFD WILL PROVIDE A SIGNAL TO THE BAS.
- •IF THE RH LEVEL EXCEEDS THE RH SETPOINT PLUS 5% (ADJUSTABLE).
- •IF THE OA FLOW RATE DEVIATES FROM SETPOINT BY MORE THAN 15% (ADJUSTABLE) FOR LONGER THAN 2 MINUTES (ADJUSTABLE).
- •IF THE HIGH STATIC PRESSURE SAFETY SWITCH TRIPS.



3 VAV BOX CONTROL DIAGRAM

SCALE: NTS

SEQUENCE OF OPERATION:

THE VAV TERMINAL UNITS SHALL BE INDEXED BETWEEN OCCUPIED AND UNOCCUPIED MODES VIA TIME SCHEDULES PROGRAMMED FOR THE ASSOCIATED AHU OR RTU. RTU-2 SHALL REMAIN OCCUPIED AT ALL TIMES.

ZONE SETPOINT ADJUST

THE OCCUPANT SHALL BE ABLE TO ADJUST THE ZONE TEMPERATURE HEATING AND COOLING SETPOINTS AT THE ZONE SENSOR. THE AMOUNT OF ADJUSTMENT SHALL BE A RANGE OF 5 DEGREES (ADJUSTABLE) AS DEFINED FROM THE BAS OPERATOR WORKSTATION, BUT AT NO TIME SHALL THE COOLING SETPOINT BE LESS THAN 68F..

ZONE UNOCCUPIED OVERRIDE (AHU-1)

A TIMED LOCAL OVERRIDE CONTROL SHALL ALLOW AN OCCUPANT TO OVERRIDE THE SCHEDULE AND PLACE THE UNIT INTO THE OCCUPIED MODE FOR 2 HOURS (ADJUSTABLE AT THE OPERATOR WORKSTATION). AT THE EXPIRATION OF THIS TIME, CONTROL OF THE UNIT SHALL AUTOMATICALLY RETURN TO THE SCHEDULE.

OCCUPIED MODE

THE OCCUPIED SETPOINTS ARE AS FOLLOWS:

COOLING SETPOINT: 72°F (ADJUSTABLE)
HEATING SETPOINT: 68°F (ADJUSTABLE)

AT NO TIME SHALL THE HEATING SETPOINT BE GREATER THAN 5°F LESS THAN THE COOLING SETPOINT.

COOLING

WHEN THE ZONE TEMPERATURE IS GREATER THAN ITS OCCUPIED COOLING SETPOINT, THE VAV SHALL MODULATE BETWEEN THE MINIMUM OCCUPIED AIRFLOW (ADJUSTABLE) AND THE MAXIMUM COOLING AIRFLOW (ADJUSTABLE) UNTIL THE ZONE IS SATISFIED.

WHEN THE ZONE TEMPERATURE IS LESS THAN THE OCCUPIED COOLING SETPOINT, THE VAV SHALL MAINTAIN THE MINIMUM REQUIRED ZONE VENTILATION (ADJUSTABLE)

HEATING

ON A DROP IN ZONE TEMPERATURE BELOW THE OCCUPIED HEATING SETPOINT THE VAV AIRFLOW SHALL BE INDEXED TO THE MINIMUM HEATING CFM AND THE ELECTRIC REHEAT COIL SHALL BE MODULATED TO MAINTAIN THE HEATING SETPOINT.

UNOCCUPIED MODE (APPLICABLE ONLY FOR VAV BOXES SERVED BY AHU-1)

THE UNOCCUPIED SETPOINTS ARE AS FOLLOWS:

COOLING SETPOINT: 80°F (ADJUSTABLE)
HEATING SETPOINT: 60°F (ADJUSTABLE)

WHEN ALL OF THE VAV TERMINAL UNIT ZONE TEMPERATURES ARE BETWEEN THE UNOCCUPIED COOLING AND HEATING SETPOINTS THE VAV BOX DAMPERS SHALL REMAIN OPEN AND THE AHU SHALL REMAIN OFF.

COOLING/HEATING

WHEN A SUFFICIENT NUMBER (ADJUSTABLE) OF ZONE TEMPERATURE SENSORS SENSE A RISE ABOVE THE UNOCCUPIED COOLING SETPOINT OR DROP BELOW THE UNOCCUPIED HEAT SETPOINT THE VAV TERMINAL UNITS SHALL BE INDEXED TO THE OCCUPIED MODE AND THE AHU SUPPLY FAN SHALL BE STARTED. THE AHU SHALL RUN UNTIL THE ALL OF THE SPACE TEMPERATURES FALLS WITHIN THE DEAD BAND BETWEEN THE UNOCCUPIED COOLING AND HEATING SETPOINTS, BUT NOT FOR LESS THAN 15 MINUTES (ADJUSTABLE).

GRAPHIC DISPLAYS

THE FOLLOWING REAL TIME INFORMATION SHALL BE DISPLAYED ON THE GRAPHICAL DISPLAY FOR THE EQUIPMENT:

- •SPACE TEMPERATURE AND SETPOINTS
- •SPACE HUMIDITY AND SETPOINTS
- •SPACE CO2 AND SEPOINTS
- •DISCHARGE AIR TEMPERATURE
- •AIR FLOW CFM AND SETPOINTS
- •DAMPER POSITION
- •HEAT OPERATION

ALARMS

- •HIGH ZONE TEMP: IF THE ZONE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY 5°F (ADJUSTABLE).
- •LOW ZONE TEMP: IF THE ZONE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A 5°F (ADJUSTABLE).
- •HIGH ZONE HUMIDITY: IF THE ZONE TEMPERATURE IS GREATER THAN THE HUMIDITY SETPOINT BY 5% RH(ADJUSTABLE)
- •HIGH CO2: IF THE ZONE CO2 LEVEL EXCEEDS 1200 PPM (ADJUSTABLE)

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS

NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

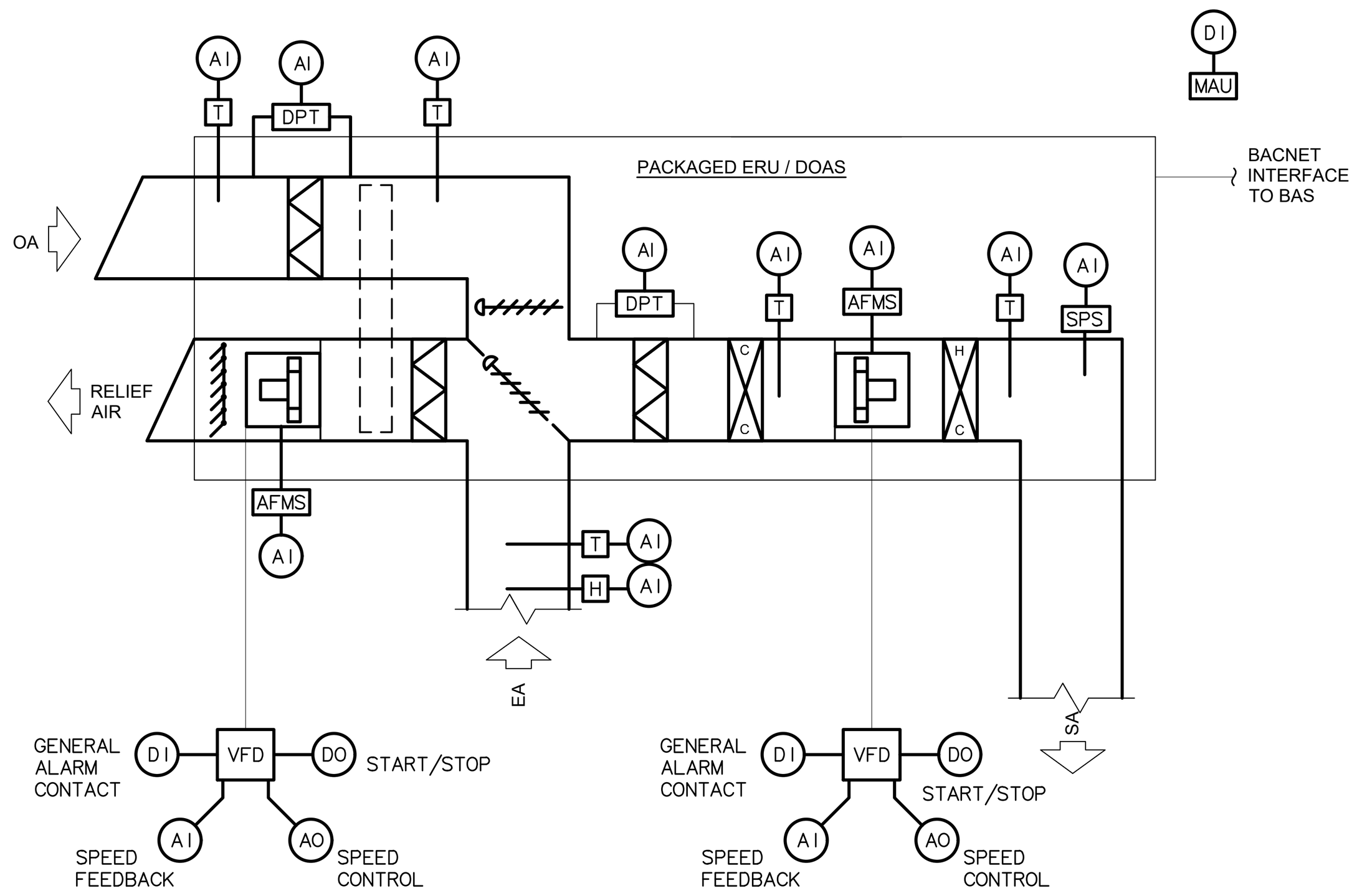
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

HVAC CONTROLS DIAGRAMS

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

M-700



1 DEDICATED OUTSIDE AIR UNIT CONTROL DIAGRAM

SCALE: NTS

SEQUENCE OF OPERATION

SAFETIES

1. UNIT SHALL INCORPORATE A LOCKOUT CIRCUIT WHICH PROVIDES RESET CAPABILITY AT THE SPACE THERMOSTAT OR BASE UNIT, SHOULD ANY OF THE FOLLOWING STANDARD SAFETY DEVICES TRIP AND SHUT OFF COMPRESSOR.
   A. LOSS-OF-CHARGE/LOW-PRESSURE SWITCH.
   B. HIGH-PRESSURE SWITCH.
   C. FREEZE CONDITION SENSOR ON EVAPORATOR COIL.
2. IF ANY OF THESE SAFETY DEVICES TRIP, THE BAS WILL DISPLAY THE ALARM MESSAGE.
3. UNIT SHALL INCORPORATE "AUTO RESET" COMPRESSOR OVER TEMPERATURE, OVER CURRENT PROTECTION.
4. UNIT CONTROL BOARD SHALL HAVE ON-BOARD DIAGNOSTICS AND FAULT MESSAGE DISPLAY.
5. STANDARD CONTROLS SHALL INCLUDE ANTI-SHORT CYCLE AND LOW VOLTAGE PROTECTION, AND PERMIT COOLING OPERATION DOWN TO A SELECTABLE VALUE AS LOW AS 40 °F.
6. CONTROL BOARD SHALL MONITOR EACH REFRIGERANT SAFETY SWITCH INDEPENDENTLY.

A. THE ELECTRIC HEATING SECTION SHALL HAVE A PRIMARY LIMIT CONTROL(S) (AUTOMATIC RESET) TO PREVENT THE HEATING ELEMENT SYSTEM FROM OPERATING AT AN EXCESSIVE TEMPERATURE

BUILDING AUTOMATION SYSTEM INTERFACE

1. THE BUILDING AUTOMATION SYSTEM (BAS) SHALL SEND THE CONTROLLER TEMPERATURE DISCHARGE SETPOINT. IF COMMUNICATION IS LOST WITH THE BAS THE CONTROLLER SHALL OPERATE USING DEFAULT MODES AND SETPOINTS.

OPERATIONAL MODE - UNIT SHALL RUN IN OCCUPIED MODE AT ALL TIMES.

1. DURING OCCUPIED PERIODS, THE SUPPLY FAN SHALL RUN CONTINUOUSLY AND THE OUTSIDE AIR DAMPER SHALL OPEN TO MAINTAIN MINIMUM VENTILATION REQUIREMENTS.
2. THE UNIT CONTROLLER SHALL CONTROL THE SUPPLY FAN SPEED TO MAINTAIN THE DUCT STATIC PRESSURE SETPOINT (ADJ.)
3. THE DX COOLING AND ELECTRIC HEAT SHALL MAINTAIN SETPOINTS AS DESCRIBED BELOW.
4. IF ECONOMIZING IS ENABLED THE OUTSIDE AIR DAMPER SHALL MODULATE TO MAINTAIN THE OCCUPIED SPACE TEMPERATURE SETPOINT.

COOLING MODE:

1. DISCHARGE AIR SETPOINT SHALL BE MAINTAINED BY MODULATING THE ECONOMIZER OR STAGING THE DX COOLING AS REQUIRED TO MAINTAIN THE DISCHARGE AIR SETPOINT. ONCE ALL ECONOMIZING REQUIREMENTS HAVE BEEN MET, COMPRESSOR OPERATION WILL BE ENABLED IF THE ECONOMIZER ALONE CANNOT MEET THE DEMAND. COMPRESSORS SHALL STAGE UP AND DOWN AS REQUIRED TO MAINTAIN DISCHARGE AIR SETPOINT.

HEATING MODE

1. THE UNIT CONTROLLER SHALL USE THE SPACE TEMPERATURE AND SPACE TEMPERATURE HEATING SETPOINT TO DETERMINE WHEN TO INITIATE REQUESTS FOR HEAT. WHEN THE SPACE TEMPERATURE DROPS BELOW THE SPACE TEMPERATURE HEATING SETPOINT, THE CONTROLLER SHALL ENABLE THE MODULATING HEAT BANK AT HIGH FIRE FOR 60 SECONDS, THEN THE CONTROLLER SHALL MODULATE THE HEAT BANK TO THE NECESSARY RATE TO SATISFY THE SPACE TEMPERATURE HEATING SETPOINT. THE SUPPLY FAN SPEED SHALL VARY TO MEET ZONE HEATING REQUIREMENTS IN CONJUNCTION WITH THE HEAT BANK OUTPUT. ONCE THE SPACE TEMPERATURE RISES ABOVE THE SETPOINT, THE HEATING CYCLE SHALL BE DISABLED.

DEHUMIDIFICATION

1. FACTORY INSTALLED HOT GAS REHEAT AND ELECTRIC HEATING COIL SHALL ALLOW APPLICATION OF DEHUMIDIFICATION.
2. ON A CALL FOR DEHUMIDIFICATION, THE REHEAT VALVE SHALL ENERGIZE AND THE COMPRESSOR SHALL ENABLE. WHEN THE HUMIDITY CONTROL SETPOINT IS SATISFIED, THE VALVE SHALL BE DE-ENERGIZED AND THE COMPRESSOR SHALL BE DISABLED.

   DISCHARGE AIR SHALL BE SET TO 50%RH (ADJ)

ECONOMIZER:

1. THE UNIT SHALL MEASURE THE DRY BULB SUPPLY AIR TEMPERATURE AND DRY BULB OUTDOOR AIR TEMPERATURE AND ECONOMIZER SHALL BE ENABLED WHEN THE OUTDOOR AIR TEMPERATURE IS BELOW THE DRY BULB CHANGE OVER SETPOINT. WHEN ECONOMIZING IS ENABLED AND THE UNIT IS OPERATING IN THE COOLING MODE, THE ECONOMIZER DAMPER SHALL BE MODULATED BETWEEN ITS MINIMUM POSITION AND 100% TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SETPOINT. THE ECONOMIZER DAMPER SHALL MODULATE TOWARD MINIMUM POSITION IN THE EVENT THE DISCHARGE AIR TEMPERATURE FALLS BELOW THE DISCHARGE LOW LIMIT TEMPERATURE SETPOINT. COMPRESSORS SHALL BE DELAYED FROM OPERATING UNTIL THE ECONOMIZER HAS OPENED TO 100%.

SUPPLY FAN

1. THE SUPPLY FAN SHALL BE ENABLED WHILE IN THE OCCUPIED MODE. A DIFFERENTIAL PRESSURE SWITCH SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE FAN. IF THE SWITCH DOES NOT OPEN WITHIN 40 SECONDS AFTER A REQUEST FOR FAN OPERATION A FAN FAILURE ALARM SHALL BE ANNUNCIATED AT THE BAS, THE UNIT SHALL STOP, REQUIRING A MANUAL RESET.

KITCHEN HOOD MAKEUP AIR:

1. WHEN THE KITCHEN EXHAUST FAN IS ENABLED, THE MAKE UP AIR (MAU) DAMPER SHALL OPEN AND THE SUPPLY FAN SHALL RAMP UP TO MAINTAIN DUCT STATIC PRESSURE.

SUPPLY DUCT STATIC PRESSURE CONTROL

1. THE UNIT CONTROLLER SHALL MODULATE THE SUPPLY FAN OUTPUT AS REQUIRED TO MAINTAIN THE DUCT STATIC PRESSURE SETPOINT. IF THE DUCT STATIC PRESSURE FALLS BELOW THE SUPPLY AIR STATIC SETPOINT + DEADBAND, THE UNIT CONTROLLER SHALL INCREASE THE OUTPUT TO THE SUPPLY FAN TO MAINTAIN SETPOINT. IF THE DUCT STATIC PRESSURE RISES ABOVE THE SUPPLY AIR STATIC SETPOINT + DEADBAND, THE UNIT CONTROLLER SHALL DECREASE THE OUTPUT TO THE SUPPLY FAN TO MAINTAIN SETPOINT.
2. IF FOR ANY REASON THE SUPPLY AIR PRESSURE EXCEEDS THE FIXED SUPPLY AIR PRESSURE LIMIT OF 3.5 INCHES OF W.C. THE SUPPLY FAN SHALL SHUT DOWN. THE UNIT SHALL BE ALLOWED TO RESTART THREE TIMES. IF THE OVERPRESSURIZATION CONDITION OCCURS ON THE FOURTH RESTART, THE UNIT SHALL SHUT DOWN AND A MANUAL RESET DIAGNOSTIC IS DISPLAYED AT THE REMOTE PANEL AND/OR THE BAS SYSTEM.

BUILDING PRESSURE CONTROL

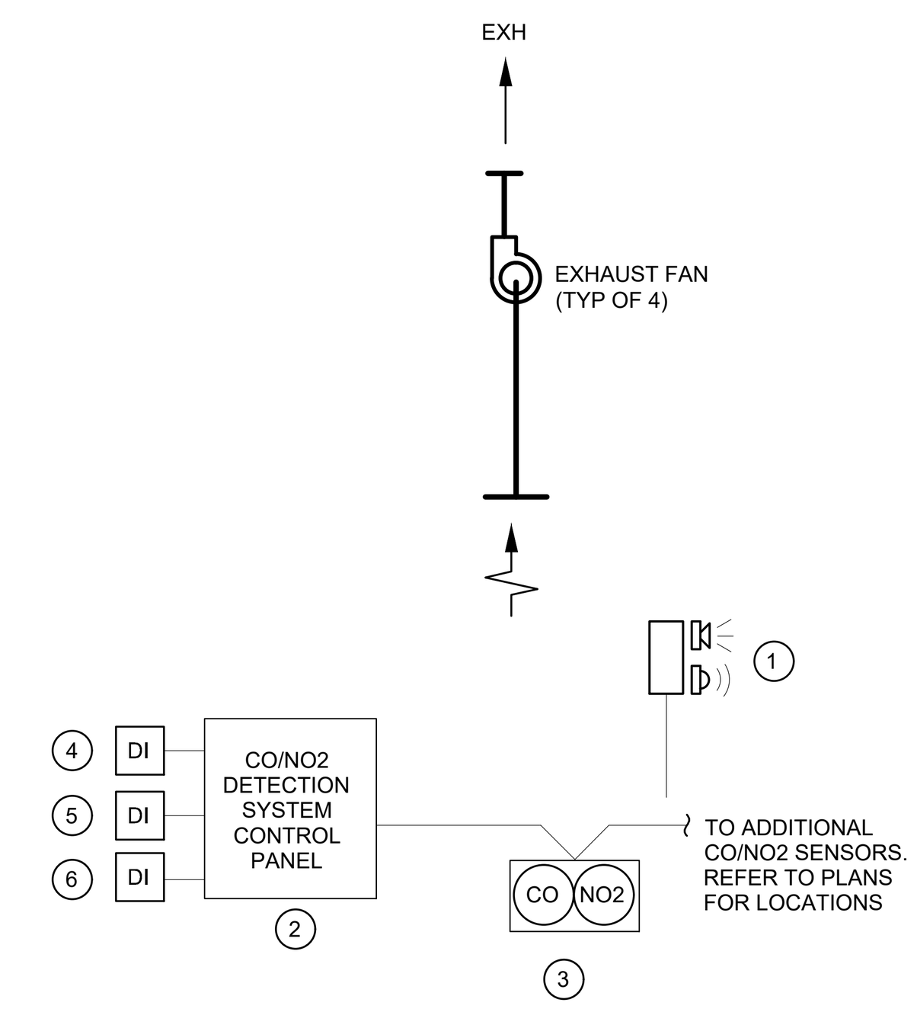
1. THE POWER EXHAUST SHALL ENABLE WHEN THE BUILDING DIFFERENTIAL PRESSURE EXCEEDS 2" WG (ADJ)
2. THE MAKE UP AIR DAMPER SHALL OPEN WHEN THE BUILDING DIFFERENTIAL PRESSURE DROPS BELOW 0.5" WG (ADJ)

SMOKE DETECTOR SHUTDOWN

1. THE UNIT SHALL SHUT DOWN IN RESPONSE TO A FIRE ALARM SIGNAL.

FILTER STATUS

1. A DIFFERENTIAL PRESSURE SWITCH SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE FILTER WHEN THE FAN IS RUNNING. IF THE SWITCH CLOSES FOR 2 MINUTES AFTER A REQUEST FOR FAN OPERATION A DIRTY FILTER ALARM SHALL BE ANNUNCIATED AT THE BAS.



2 APPARATUS BAY CO/NO2 SYSTEM CONTROL DIAGRAM

SCALE: NTS

KEYNOTES

(1) AUDIBLE AND VISUAL ALARM. LOCATE PER PLAN.

(2) PROVIDE CO/NO2 DETECTION SYSTEM CAPABLE OF ACTIVATING MULTIPLE EXHAUST FAN(S) AND INTAKE DEVICES. PROVIDE INTERCONNECTING WIRING FOR A COMPLETE SYSTEM. INSTALL PER MANUFACTURER'S REQUIREMENTS.

(3) TYPICAL CO/NO2 SENSORS. REFER TO PLANS FOR LOCATIONS.

(4) DRY CONTACT FOR FAN STATUS TO BAS

(5) ALARM RELAY OUTPUT TO BAS

(6) RELAY OUTPUT TO FAN START/STOP

SEQUENCE OF OPERATION

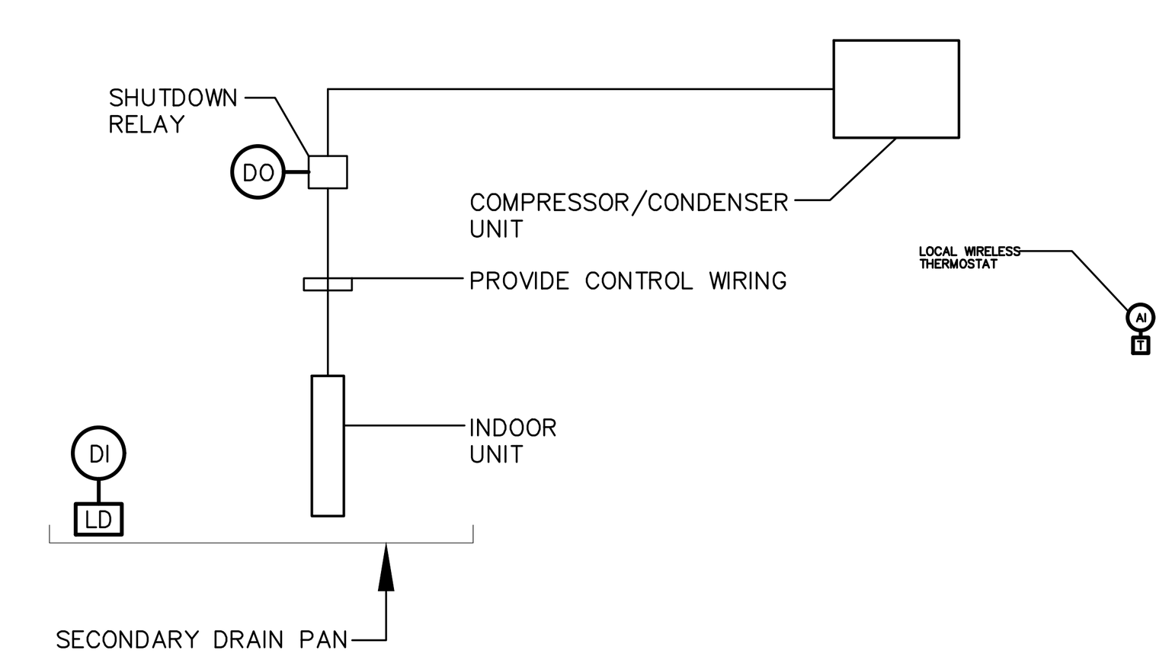
GENERAL
1. THE MECHANICAL VENTILATION SHALL BE ACTIVATED BY:
   1.1. OCCUPANCY SENSOR CONTROLS.
   1.2. GAS DETECTION SYSTEM.
2. THE GAS DETECTION SYSTEM SHALL PROVIDE DIGITAL OUTPUTS TO ENABLE EXHAUST FAN ON/OFF.
3. THE GAS DETECTION SYSTEM SHALL PROVIDE DIGITAL OUTPUTS TO THE BAS FOR STATUS AND ALARMING. THE BAS SHALL NOT CONTROL THE MECHANICAL VENTILATION SYSTEM.

SAFETIES AND ALARMS

1. IF A FAN IS COMMANDED ON AND IT DOES NOT ACTIVATE, AN ALARM SHALL BE GENERATED THROUGH THE BAS.
2. LOW LEVEL CO ALARM: 25 PPM
3. HIGH LEVEL CO ALARM: 100 PPM
4. NO2 ALARM: 1 PPM

OPERATION

1. EXHAUST FANS SHALL OPERATE WHEN THE APPARATUS BAY IS OCCUPIED.
2. IF GAS LEVELS AT ANY SENSOR REACH SETPOINT THE EXHAUST FAN SHALL RUN CONTINUOUSLY UNTIL THE VALUE DROPS BELOW SETPOINT.
3. IF BUILDING IS UNOCCUPIED AND NO ALARMS HAVE BEEN ACTIVATED EXHAUST FANS SHALL RUN FOR AN ADDITIONAL 10 MINUTES AND SHUT DOWN.
4. WHEN LOW/HIGH CO ALARM OR NO2 ALARM IS ACTIVATED AN ALARM SHALL BE GENERATED THROUGH THE BAS.



3 DUCTLESS SPLIT - CONTROL DIAGRAM

NTS

GENERAL
1. PROVIDE WALL MOUNTED CONTROLLER AS PROVIDED BY THE MANUFACTURER, .
2. THERMOSTAT SHALL BE SET TO 3F ABOVE THE GENERAL ROOM SETPOINT.
3.

SAFETIES AND ALARMS

1. UNIT SHALL SHUT DOWN UPON CONDENSATE OVERFLOW
2. UNIT SHALL SHUT DOWN UPON FIRE ALARM ACTIVATION

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54
HVAC SYSTEM

3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

HVAC CONTROLS DIAGRAMS

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

M-701

ELECTRICAL SPECIFICATIONS

1. THIS PROJECT COMPRISES ALTERATIONS AND RENOVATIONS TO THE EXISTING BUILDING. THE EXISTING BUILDING IS CURRENTLY OCCUPIED AND THE PROJECT WILL PROCEED IN A MANNER WHICH WILL MINIMIZE ANY INCONVENIENCE TO THE BUILDING OCCUPANTS.

2. PRIOR TO SUBMITTING BID, VISIT SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY IDENTIFIED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.

3. SCOPE OF WORK CONSISTS OF INSTALLATION OF MATERIALS TO BE FURNISHED UNDER THE CONTRACT DOCUMENTS AND WITHOUT LIMITING GENERALITY THEREOF CONSISTS OF FURNISHING LABOR, MATERIALS, EQUIPMENT, HOISTING, PLANT, TRANSPORTATION, RIGGING, STAGING, APPARTENANCES, AND SERVICES NECESSARY AND/OR INCIDENTAL TO PROPERLY COMPLETE ALL ELECTRICAL WORK AS SHOWN ON THE DRAWINGS AS DESCRIBED HEREIN.

4. THE FOLLOWING DEFINITIONS APPLY TO THIS CONTRACT:
   A. FURNISH: THE TERM "FURNISH" IS USED TO MEAN "SUPPLY AND DELIVER TO THE PROJECT SITE, READY FOR UNLOADING, UNPACKING, ASSEMBLY, INSTALLATION, AND SIMILAR OPERATIONS."
   B. INSTALL: THE TERM "INSTALL" IS USED TO DESCRIBE OPERATIONS AT PROJECT SITE INCLUDING THE ACTUAL "UNLOADING, UNPACKING, ASSEMBLY, ERECTION, PLACING, ANCHORING, APPLYING, WORKING TO DIMENSION, FINISHING, CURING, PROTECTING, CLEANING, AND SIMILAR OPERATIONS."
   C. PROVIDE: THE TERM "PROVIDE" MEANS TO FURNISH AND INSTALL, COMPLETE AND READY FOR THE INTENDED USE."
   D. REMOVE: THE TERM "REMOVE" MEANS TO DISCONNECT FROM ITS PRESENT POSITION, REMOVE FROM THE PREMISES AND TO DISPOSE OF IN A LEGAL MANNER."

5. PROVIDE ALL NECESSARY MATERIALS, EQUIPMENT AND LABOR NECESSARY TO COMPLETE THE WORK OUTLINED ON THESE CONTRACT DOCUMENTS. THE CONTRACTOR IS TO NOTE THAT THESE DOCUMENTS ARE DIAGRAMMATIC ONLY AND THAT FINAL PLACEMENT OF EQUIPMENT OR DEVICES IN THE FIELD MAY NOT DIRECTLY CORRESPOND TO THAT IN WHICH IS SHOWN ON THE DRAWINGS. IF A CONFLICT IN POSITIONING OCCURS THE CONTRACTOR IS TO NOTIFY THE ENGINEER IMMEDIATELY TO ASCERTAIN WHAT THE INTENT WAS BY THE DESIGN PROFESSIONAL.

6. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE LATEST CODES.
   A. FBC 7TH EDITION 2020
   B. NFPA 70 EDITION 2017, NATIONAL ELECTRICAL CODE

7. OBTAIN IN OWNER'S NAME WRITTEN EQUIPMENT AND MATERIAL WARRANTIES OFFERED IN MANUFACTURER'S PUBLISHED PRODUCT DATA WITHOUT EXCLUSION OR LIMITATION.

8. GUARANTEE WORK OF THESE CONTRACT DOCUMENTS IN WRITING FOR NOT LESS THAN ONE YEAR FROM DATE OF FINAL NOTICE OF ACCEPTANCE. REPAIR OR REPLACE DEFECTIVE MATERIALS, EQUIPMENT, WORKMANSHIP AND INSTALLATION THAT DEVELOP WITHIN THIS PERIOD, PROMPT AND TO OWNER'S SATISFACTION AND CORRECT DAMAGE CAUSED IN MAKING NECESSARY REPAIRS AND REPLACEMENTS UNDER GUARANTEE WITHIN CONTRACT PRICE.

9. SUPPLY TO THE OWNER AN OFFICIAL CERTIFICATE OF INSURANCE FOR THEIR RECORDS.

10. THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL PERMITS REQUIRED BY THE AUTHORITIES HAVING JURISDICTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ARRANGING AND BEING AVAILABLE FOR INSPECTIONS BY THE AUTHORITY HAVING JURISDICTION.

11. USE ADEQUATE NUMBERS OF SKILLED WORKMEN WHO ARE THOROUGHLY TRAINED AND EXPERIENCED IN THE NECESSARY CRAFTS AND WHO ARE COMPLETELY FAMILIAR WITH THE SPECIFIED REQUIREMENTS AND THE METHODS NEEDED FOR PROPER PERFORMANCE OF THE WORK.

12. ARRANGE INSTALLATION TO PROVIDE ACCESS TO EQUIPMENT FOR EASY MAINTENANCE AND REPAIR.

13. DO NOT SCALE DRAWINGS. SCALE INDICATED ON DRAWINGS IS FOR ESTABLISHING REFERENCE POINTS ONLY. ACTUAL FIELD CONDITIONS SHALL GOVERN ALL DIMENSIONS.

14. MATERIALS AND EQUIPMENT SHALL BE UL LISTED WHERE STANDARD HAS BEEN ESTABLISHED.

15. PRIOR TO ORDERING ANY MATERIALS AND EQUIPMENT, THOROUGHLY REVIEW THE SITE CONDITIONS TO DETERMINE IF ADEQUATE CLEARANCE AND ACCESS IS ALLOWED TO INSTALL THE COMPONENTS. ORDER EQUIPMENT DOWN AS NECESSARY TO ALLOW FOR PROPER HANDLING FOR PASSAGE THROUGH THE PROJECT AREA. PROVIDE ALL NECESSARY ALTERATIONS TO THE STRUCTURE OF THE BUILDING AS NECESSARY TO RIG THE EQUIPMENT IN PLACE. CAREFULLY INSPECT ALL BUILDING ELEMENTS PRIOR TO CUTTING OR DRILLING INTO WALL, FLOORS OR CEILINGS.

16. THE CONTRACTOR SHALL BE REQUIRED TO PROPERLY STORE MATERIALS AND EQUIPMENT SO AS TO AVOID THEFT OR VANDALISM. IF THEFT OR VANDALISM OCCURS, THE CONTRACTOR SHALL REPAIR OR REPLACE SUCH ITEMS AT THE DIRECTION OF THE ENGINEER.

17. PROVIDE TEMPORARY ELECTRIC POWER SERVICE: PROVIDE WEATHERPROOF, GROUNDED ELECTRIC POWER SERVICE AND DISTRIBUTION SYSTEM OF SUFFICIENT SIZE, CAPACITY, AND POWER CHARACTERISTICS DURING CONSTRUCTION PERIOD. INCLUDE METERS, TRANSFORMERS, OVERLOAD PROTECTED DISCONNECTS, AUTOMATIC GROUND-FAULT INTERRUPTERS AND MAIN DISTRIBUTION SWITCH GEAR.

18. THE CONTRACTOR MUST COORDINATE ALL INTERRUPTIONS OF SERVICES AND LIMITATIONS OF ACCESS WITH THE OWNER NO LESS THAN 3 DAYS PRIOR TO THE INTERRUPTION.

19. SERVICE-DISCONNECTING MEANS SHALL BE OF THE TYPE AS INDICATED WITH EXTERNAL HANDLE FOR MANUAL OPERATION. WHEN SERVICE DISCONNECTING MEANS IS A PART OF AN ASSEMBLY, THE ASSEMBLY SHALL BE LISTED AS SUITABLE FOR SERVICE ENTRANCE EQUIPMENT. ENCLOSURES SHALL BE SHEET METAL WITH HINGED COVER FOR SURFACE MOUNTING UNLESS OTHERWISE INDICATED.

20. MOUNT DISCONNECTING SWITCHES SO HEIGHT OF OPERATING HANDLE AT ITS HIGHEST POSITION IS MAXIMUM 78 INCHES ABOVE FLOOR.

21. PROVIDE LAMINATED PLASTIC NAMEPLATES FOR EACH EQUIPMENT ENCLOSURE, RELAY, SWITCH, AND DEVICE. EACH NAMEPLATE INSCRIPTION SHALL IDENTIFY THE FUNCTION AND, WHEN APPLICABLE, THE POSITION. NAMEPLATES SHALL BE MELAMINE PLASTIC, 0.125-INCH THICK, WHITE WITH BLACK CENTER CORE. SURFACE SHALL BE MATTE FINISH. CORNERS SHALL BE SQUARE. ACCURATELY ALIGN LETTERING AND ENGRAVE INTO THE CORE. MINIMUM SIZE OF NAMEPLATES SHALL BE 1 BY 2.5 INCHES. LETTERING SHALL BE A MINIMUM OF 0.25-INCH HIGH NORMAL BLOCK STYLE.

22. GROUNDING SHALL BE COMPLETED IN ACCORDANCE WITH NFPA 70. GROUND EXPOSED, NON-CURRENT-CARRYING METALLIC PARTS OF ELECTRICAL EQUIPMENT, METALLIC RACEWAY SYSTEMS, GROUNDING CONDUCTOR IN METALLIC AND NONMETALLIC RACEWAYS, GROUNDING CONDUCTOR OF NONMETALLIC SHEATHED CABLES, AND NEUTRAL CONDUCTOR OF WIRING SYSTEMS. [MAKE GROUND CONNECTION AT MAIN SERVICE EQUIPMENT, AND EXTEND GROUNDING CONDUCTOR TO POINT OF ENTRANCE OF METALLIC WATER SERVICE. MAKE CONNECTION TO WATER PIPE BY SUITABLE GROUND CLAMP WITH METER JUMPER OR LUG CONNECTION TO PLUGGED TEE. IF FLANGED PIPES ARE ENCOUNTERED, MAKE CONNECTION WITH LUG BOLTED TO STREET SIDE OF FLANGED CONNECTION. SUPPLEMENT METALLIC WATER SERVICE GROUNDING SYSTEM WITH ADDITIONAL MADE ELECTRODE IN COMPLIANCE WITH NFPA 70.] [MAKE GROUND CONNECTION TO DRIVEN GROUND RODS ON EXTERIOR OF BUILDING. GROUND RODS SHALL BE OF COPPER-CLAD STEEL CONFORMING TO UL 467 NOT LESS THAN [15.9 MM (5/8 INCH)] [19.1 MM (3/4 INCH)] IN DIAMETER BY [2.4 METER (8 FEET)] [3.1 METER (10 FEET)] IN LENGTH OF THE SECTIONAL TYPE DRIVEN FULL LENGTH INTO THE EARTH] WHERE GROUND FAULT PROTECTION IS EMPLOYED, ENSURE THAT CONNECTION OF GROUND AND NEUTRAL DOES NOT INTERFERE WITH CORRECT OPERATION OF FAULT PROTECTION.

23. CONDUCTORS NO. 8 AWG AND LARGER DIAMETER SHALL BE STRANDED ANNEALED COPPER. CONDUCTORS NO. 10 AWG AND SMALLER DIAMETER SHALL BE SOLID ANNEALED COPPER, EXCEPT THAT CONDUCTORS FOR REMOTE CONTROL, ALARM, AND SIGNAL CIRCUITS, CLASSES 1, 2, AND 3, SHALL BE STRANDED UNLESS SPECIFICALLY INDICATED OTHERWISE. CONDUCTOR SIZES AND AMPACITIES SHOWN ARE BASED ON COPPER, UNLESS INDICATED OTHERWISE. UNLESS SPECIFIED OR INDICATED OTHERWISE OR REQUIRED BY NFPA 70, POWER AND LIGHTING WIRES SHALL BE 600-VOLT, TYPE THWN/THHN ANNEALED COPPER, REMOTE-CONTROL AND SIGNAL CIRCUITS SHALL BE TYPE TW, THW, OR TF ANNEALED COPPER. WHERE LIGHTING FIXTURES REQUIRE 90 DEGREES C CONDUCTORS, PROVIDE ONLY CONDUCTORS WITH 90 DEGREE C INSULATION OR HIGHER.

24. MAKE ALL SPLICES IN ACCESSIBLE LOCATIONS. MAKE SPLICES IN CONDUCTORS NO. 10 AWG AND SMALLER DIAMETER WITH INSULATED, PRESSURE-TYPE CONNECTOR. MAKE SPLICES IN CONDUCTORS NO. 8 AWG AND LARGER DIAMETER WITH SOLDERLESS CONNECTOR, AND COVER WITH INSULATION MATERIAL EQUIVALENT TO CONDUCTOR INSULATION.

25. MAKE SPLICES OF ALUMINUM CONDUCTORS WITH SOLDERLESS CIRCUMFERENTIAL COMPRESSION-TYPE, ALUMINUM-BODIED CONNECTORS UL LISTED FOR AL/CU. REMOVE SURFACE OXIDES FROM ALUMINUM CONDUCTORS BY WIRE BRUSHING AND IMMEDIATELY APPLY OXIDE-INHIBITING JOINT COMPOUND AND INSERT IN CONNECTOR. AFTER JOINT IS MADE, WIPE AWAY EXCESS JOINT COMPOUND, AND INSULATE SPLICE.

26. PHASE CONDUCTORS SHALL BE IDENTIFIED BY COLOR CODING. THE COLOR OF THE INSULATION ON PHASES A, B, AND C RESPECTIVELY (FOR THREE PHASE) OR PHASES A AND B RESPECTIVELY (FOR SINGLE PHASE) OF DIFFERENT VOLTAGE SYSTEMS SHALL BE AS FOLLOWS: 120/208 VOLT, 3-PHASE: BLACK, RED, AND BLUE. 277/480 VOLT, 3-PHASE: BROWN, ORANGE, AND YELLOW. 120/240 VOLT, SINGLE/PHASE: BLACK AND RED. ON 3-PHASE, 4-WIRE DELTA SYSTEM, HIGH LEG SHALL BE ORANGE, AS REQUIRED BY NFPA 70.

27. UNLESS OTHERWISE INDICATED, THE WIRING METHOD SHALL CONSIST OF THE INSTALLATION OF INSULATED CONDUCTORS INSTALLED IN ELECTRICAL METALLIC AND INTERMEDIATE METAL CONDUIT, NONMETALLIC-SHEATHED CABLE. MAY BE INSTALLED IN GYPSUM BOARD WALL; ABOVE FINISHED CEILINGS AND IN PROTECTED AREAS AS PERMITTED BY NFPA 70. PROVIDE INSULATED, GREEN EQUIPMENT GROUNDING CONDUCTOR IN FEEDER AND BRANCH CIRCUITS, INSTALLED IN CONDUIT OR RACEWAYS, INCLUDING LIGHTING CIRCUITS. GROUNDING CONDUCTOR SHALL BE SEPARATE FROM ELECTRICAL SYSTEM NEUTRAL CONDUCTOR. METAL CONDUIT SHALL EXTEND THROUGH SHAFTS FOR MINIMUM DISTANCE OF 6 INCHES. CONDUIT SIZES SHOWN ARE BASED ON USE OF COPPER CONDUCTORS WITH INSULATION TYPES AS INDICATED HEREIN. IF THE USE OF ALUMINUM CONDUCTORS IS ALLOWED, THE CONTRACTOR SHALL UPSIZE ALL CONDUITS ACCORDING TO NFPA 70. MINIMUM SIZE OF RACEWAYS SHALL BE 15 MM (1/2 INCH). ONLY METAL CONDUITS WILL BE PERMITTED WHEN CONDUITS ARE REQUIRED FOR SHIELDING OR OTHER SPECIAL PURPOSES INDICATED, OR WHEN REQUIRED BY CONFORMANCE TO NFPA 70.

28. ELECTRICAL METALLIC TUBING MAY BE INSTALLED ONLY WITHIN BUILDINGS. ELECTRICAL METALLIC TUBING MAY NOT BE INSTALLED IN CONCRETE OR EXTERIOR TO BUILDINGS. EMT SHALL NOT BE INSTALLED IN DAMP OR WET LOCATIONS. DO NOT USE IN AREAS SUBJECT TO SEVERE PHYSICAL DAMAGE INCLUDING BUT NOT LIMITED TO EQUIPMENT ROOMS WHERE MOVING OR REPLACING EQUIPMENT COULD PHYSICALLY DAMAGE THE EMT. BUSHINGS, MANUFACTURED FITTINGS OR BOXES PROVIDING EQUIVALENT MEANS OF PROTECTION SHALL BE INSTALLED ON THE ENDS OF ALL CONDUITS AND SHALL BE OF THE INSULATING TYPE, WHERE REQUIRED BY NFPA 70. ONLY UL LISTED ADAPTERS SHALL BE USED TO CONNECT EMT TO RIGID METAL CONDUIT, CAST BOXES, AND CONDUIT BODIES. DO NOT USE IN FIRE PUMP ROOMS. METALLIC CONDUITS AND TUBING SHALL BE SECURELY AND RIGIDLY FASTENED IN PLACE AS REQUIRED BY NFPA 70.

29. PROVIDE ALL NECESSARY JUNCTION BOXES, PULL BOXES, PULL WIRES, COVER PLATES AND OTHER MISCELLANEOUS EQUIPMENT WHICH IS NOT SHOWN ON THE CONTRACT DOCUMENTS BUT NECESSARY TO COMPLETE THE WORK.

30. PROVIDE FIRESTOPPING AROUND ELECTRICAL PENETRATIONS IN ACCORDANCE WITH FIRESTOPPING REQUIREMENTS. PROVIDE ASBESTOS FREE FIRESTOPPING SYSTEM CAPABLE OF MAINTAINING AN EFFECTIVE BARRIER AGAINST FLAME AND GASES. SYSTEM SHALL BE UL LISTED AND COMPLY WITH ASTME 814.

31. CLEAN, PRIME AND PAINT ELECTRICAL EQUIPMENT AND THE EXPOSED PORTION OF THE CONDUIT SYSTEM TO MATCH THE FINISH OF THE ADJACENT SURFACES OR TO MEET THE INDICATED OR SPECIFIED SAFETY CRITERIA OR TO MEET THE COLOR SCHEME SET BY THE ARCHITECT. PAINTING SHALL BE AS SPECIFIED IN SECTION 09900, "PAINTING".

32. PROVIDE PRE-LABELED, SNAP AROUND PIPE MARKERS ON ALL CONDUITS. MARKERS SHALL COMPLY WITH ANSI A 13.1-1988 STANDARDS AND INDICATED VOLTAGE.

33. PROVIDE ALL NECESSARY WIRE, CONDUIT AND EQUIPMENT TO SUPPLY POWER TO THE HEATING, VENTILATION AND AIR CONDITIONING EQUIPMENT. CONTROL WIRING AND CONDUIT SHALL BE PROVIDED UNDER DIVISION 15.

34. COORDINATE ALL WORK WITH OTHER TRADES AND ARRANGE INSTALLATION TO AVOID CLASHES BETWEEN EQUIPMENT, WORK OF OTHER TRADES AND BUILDING STRUCTURE.

ELECTRICAL SYMBOL LIST

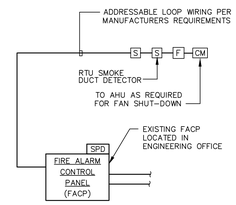
SYMBOL	DESCRIPTION
	DISCONNECT SWITCH
	FUSED DISCONNECT SWITCH
	COMBINATION STARTER/DISCONNECT SWITCH
	ELECTRICAL MOTOR
	BRANCH CIRCUIT WIRING, CONCEALED IN WALLS OR CEILINGS
	HOMERUN TO PANELBOARD, UNLESS INDICATED OTHERWISE SHALL BE CONNECTED TO A 1 POLE, 20 AMP CIRCUIT BREAKER

ELECTRICAL ABBREVIATIONS

A/AMP	AMPERE	JB	JUNCTION BOX
AC	ALTERNATING CURRENT	KCMIL	THOUSAND CIRCULAR MILS
ACU	AIR CONDITIONING UNIT	KVA	KILOVOLT AMPERE
AFF	ABOVE FINISHED FLOOR	KW	KILOWATT
AFG	ABOVE FINISHED GRADE	MAX	MAXIMUM
AHU	AIR HANDLING UNIT	MAU	MAKE UP AIR UNIT
AIC	AMPS INTERRUPTING CURRENT	MCC	MOTOR CONTROL CENTER
ATS	AUTOMATIC TRANSFER SWITCH	MCCB	MOLDED CASE CIRCUIT BREAKER
AWG	AMERICAN WIRE GAUGE	MH	METAL HALIDE
BSMT	BASEMENT	MIN	MINIMUM
C	CONDUIT	MLO	MAIN LUGS ONLY
CATV	CABLE TELEVISION	NA	NOT APPLICABLE
C/B	CIRCUIT BREAKER	NEC	NATIONAL ELECTRIC CODE
CKT	CIRCUIT	NIC	NOT IN CONTRACT
COMP	COMPRESSOR	NL	NEW LOCATION OF EXISTING RELOCATED
CP	CONDENSATE PUMP	NR	NEW TO REPLACE EXISTING
CT	CURRENT TRANSFORMER	NTS	NOT TO SCALE
CU	CONDENSING UNIT, COPPER	P	POLE
CUH	CABINET UNIT HEATER	PE	PRIMARY ELECTRICAL SERVICE
°	DEGREE	PF	POWER FACTOR
DIA/ø	DIAMETER	PH/ø	PHASE
DN	DOWN	PNL	PANEL
DWG	DRAWING	PVC	POLYVINYL CHLORIDE CONDUIT
E	EXISTING TO REMAIN	RE	REMOVE EXISTING
EF	EXHAUST FAN	RGS	RIGID GALVANIZED STEEL CONDUIT
ELEC	ELECTRICAL	RL	RELOCATE EXISTING
ELEV	ELEVATOR	RM	ROOM
EMT	ELECTRIC METALLIC TUBING	RR	REMOVE AND REPLACE ON NEW SURFACE
EUH	ELECTRIC UNIT HEATER	RTU	ROOFTOP UNIT
EWC	ELECTRIC WATER COOLER	SE	SECONDARY ELECTRICAL SERVICE
EWH	ELECTRIC WATER HEATER	SPEC	SPECIFICATION
ECB	ENCLOSED CIRCUIT BREAKER	SWBD	SWITCHBOARD
F	FAHRENHEIT	TELE	TELECOMMUNICATIONS/TELEPHONE
FA	FIRE ALARM	TV	TELEVISION
FACP	FIRE ALARM CONTROL PANEL	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
FC	FOOT CANDLE	T/TX	TRANSFORMER
FCU	FAN COIL UNIT	TYP	TYPICAL
G	GROUND	UH	UNIT HEATER
GFI	GROUND FAULT INTERRUPTER	V	VOLTS
HP	HORSE POWER	VA	VOLT AMPERE
HPS	HIGH PRESSURE SODIUM	VAC	VOLTS ALTERNATING CURRENT
HR	HOUR	W	WATT, WIRE
HZ	HERTZ	WG	WIRE GUARD
IG	ISOLATED GROUND	WP	WEATHERPROOF
IN	INCHES		

SCOPE OF WORK

1. REMOVE EXISTING MECHANICAL EQUIPMENTS IN THE BUILDING.
2. PROVIDE POWER REQUIREMENTS FOR NEW MECHANICAL EQUIPMENTS IN THE BUILDING.
3. RELOCATE EXISTING EXHAUST FANS IN THE 1ST AND 2ND FLOOR.



FACP GENERAL NOTES:

1. COORDINATE ALL PROGRAMMING WITH THE OWNER.
2. EXISTING SYSTEM SHALL BE RE-CERTIFIED AND TESTED BY AGENCY HAVING JURISDICTION.
3. HVAC AND EF SYSTEMS SHALL SHUTDOWN DURING FIRE ALARM ACTIVATION.

1 FIRE ALARM SYSTEM ONE-LINE DIAGRAM
N.T.S.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

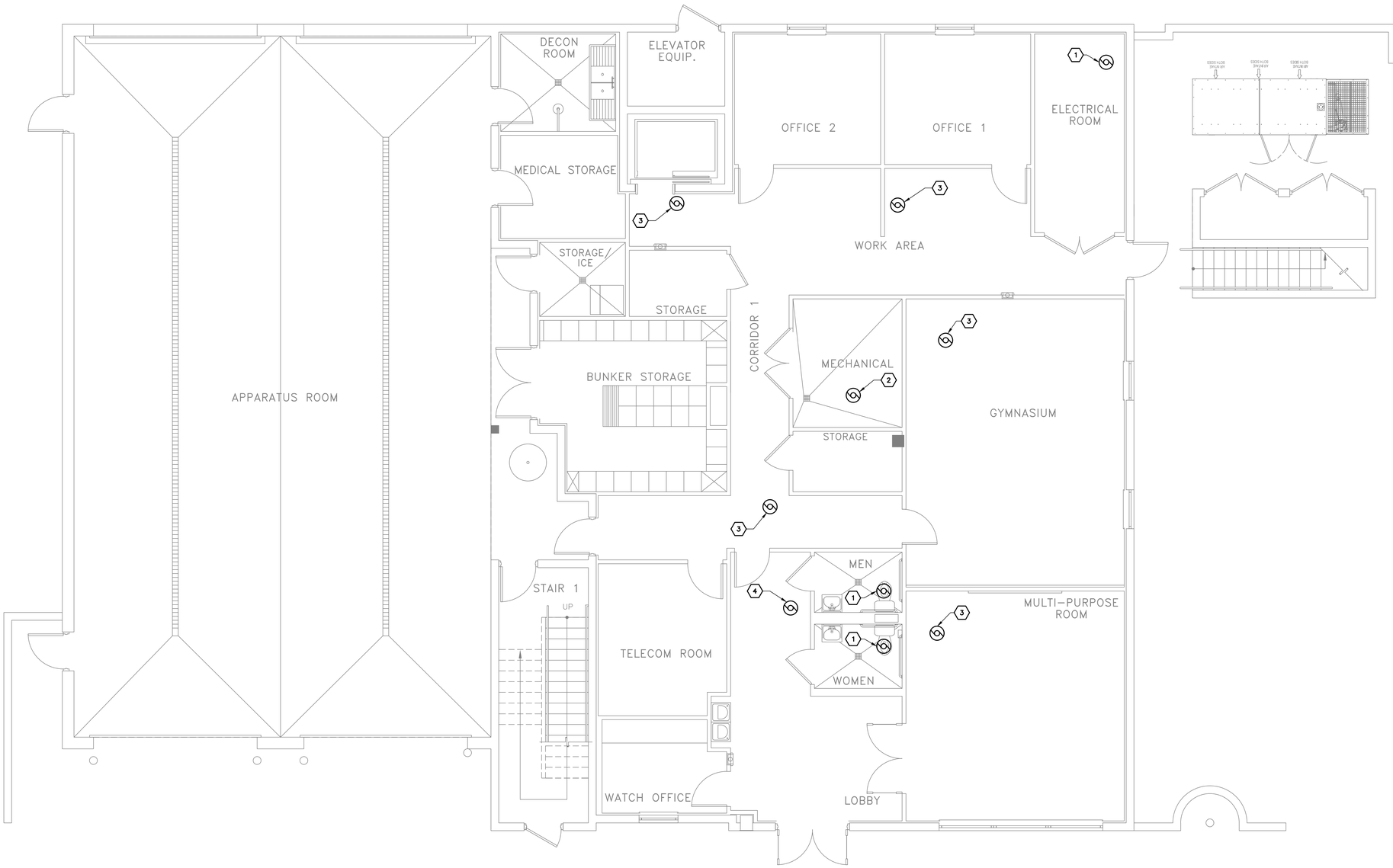
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

ELECTRICAL SPECIFICATION, ABBREVIATIONS, SYMBOLS AND NOTES

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

E-000



1 **ELECTRICAL DEMOLITION PLAN - FIRST FLOOR**
SCALE: 1/4"=1'0"

ELECTRICAL NOTES

1. ALL DEVICES INDICATED SHALL BE REMOVED UNLESS NOTED OTHERWISE. REMOVAL SHALL BE COMPLETE INCLUDING BOXES, BRACKETS, HANGERS AND BRANCH CIRCUIT WIRING BACK TO SOURCE PANELBOARD OR LAST ACTIVE DEVICE TO REMAIN (EXCEPT WHERE NOTED).
2. CONTRACTOR SHALL BE RESPONSIBLE FOR STORAGE AND HANDLING OF EXISTING TO BE RELOCATED EQUIPMENT.
3. CONTRACTOR SHALL MODIFY EXISTING CIRCUITS, WHEN EXISTING DEVICES ARE REMOVED, AS REQUIRED TO MAINTAIN CIRCUIT CONTINUITY.
4. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF ELECTRICAL DEMOLITION. ADDITIONAL DEMOLITION AND MODIFICATION WORK NOT SHOWN SHOULD BE ANTICIPATED.
5. PRIOR TO SUBMITTING BID, VISIT SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY IDENTIFIED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.
6. REFER TO DRAWING E-000 FOR SYMBOL LIST.

ELECTRICAL KEYNOTES

1. REMOVE EXISTING CEILING MOUNTED EXHAUST FAN, CONDUIT AND CONDUCTOR BACK TO SOURCE.
2. REMOVE EXISTING AIR HANDLING UNIT AND ASSOCIATED DISCONNECT FOR REPLACEMENT. REFER TO E-101 FOR NEW WORK.
3. REMOVE EXISTING VAV BOX AND ASSOCIATED CONDUIT AND CONDUCTORS BACK TO SOURCE.
4. REMOVE EXISTING VAV BOX FOR RELOCATION. VAV TO SERVE GYMNASIUM. REFER TO E-101 FOR NEW WORK.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL 33309
954.990.0556
Proj.#2021673.00

REVISIONS

NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

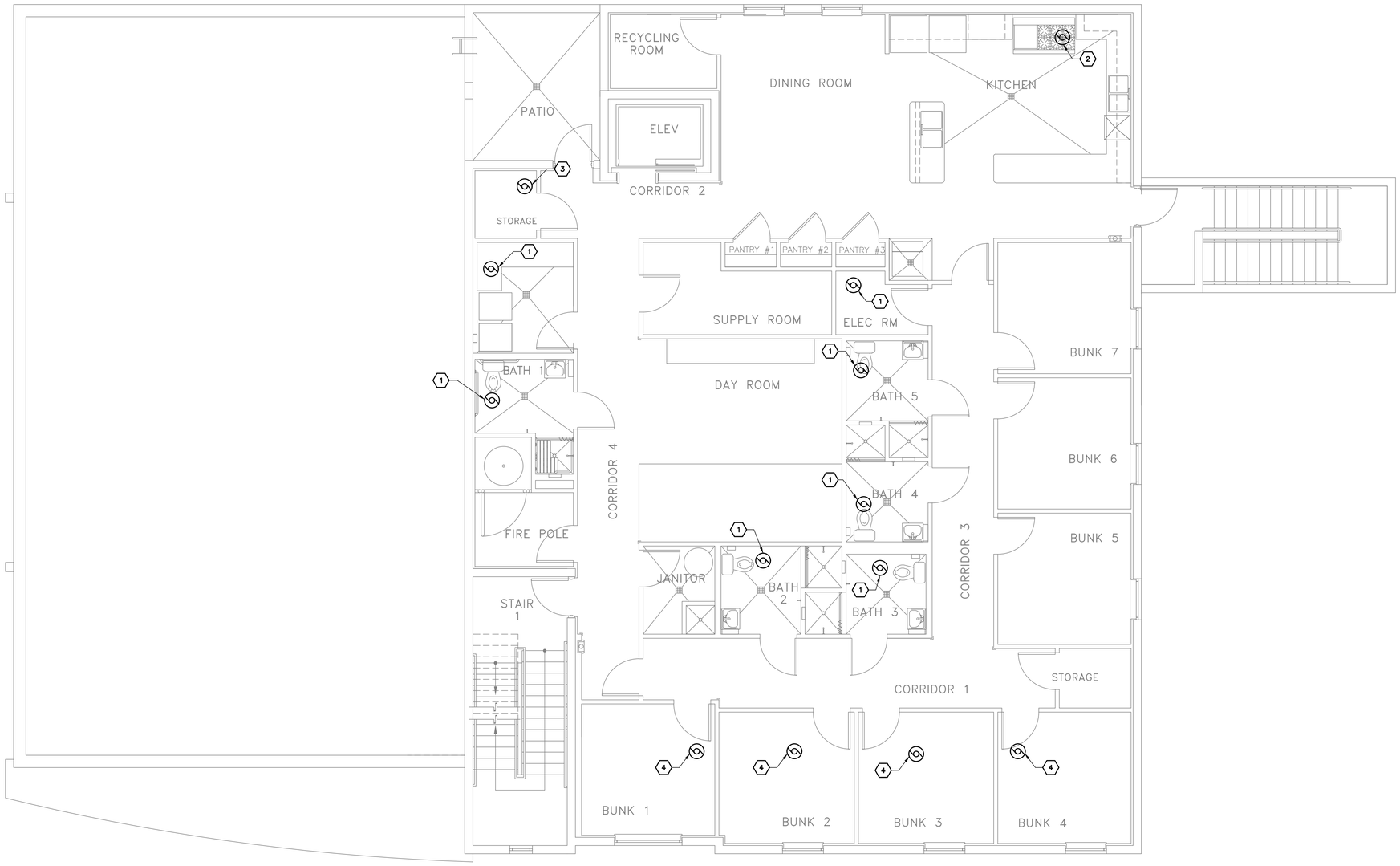
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

ELECTRICAL DEMOLITION PLAN FIRST FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

ED-101



1 **ELECTRICAL DEMOLITION PLAN - SECOND FLOOR**
SCALE: 1/4"=1'0"

ELECTRICAL NOTES

1. ALL DEVICES INDICATED SHALL BE REMOVED UNLESS NOTED OTHERWISE. REMOVAL SHALL BE COMPLETE INCLUDING BOXES, BRACKETS, HANGERS AND BRANCH CIRCUIT WIRING BACK TO SOURCE PANELBOARD OR LAST ACTIVE DEVICE TO REMAIN (EXCEPT WHERE NOTED).
2. CONTRACTOR SHALL BE RESPONSIBLE FOR STORAGE AND HANDLING OF EXISTING TO BE RELOCATED EQUIPMENT.
3. CONTRACTOR SHALL MODIFY EXISTING CIRCUITS, WHEN EXISTING DEVICES ARE REMOVED, AS REQUIRED TO MAINTAIN CIRCUIT CONTINUITY.
4. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF ELECTRICAL DEMOLITION. ADDITIONAL DEMOLITION AND MODIFICATION WORK NOT SHOWN SHOULD BE ANTICIPATED.
5. PRIOR TO SUBMITTING BID, VISIT SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY IDENTIFIED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.
6. REFER TO DRAWING E-000 FOR SYMBOL LIST.

ELECTRICAL KEYNOTES

1. REMOVE EXISTING EXHAUST FAN, AND ASSOCIATED CONDUIT AND CONDUCTORS BACK TO SOURCE.
2. REMOVE HVAC EQUIPMENT AND ASSOCIATED CONDUIT AND CONDUCTOR BACK TO SOURCE.
3. REMOVE EXISTING CEILING MOUNTED EXHAUST FAN FOR RELOCATION. REMOVE ASSOCIATED CONDUIT AND CONDUCTORS BACK TO SOURCE. REFER TO E-102 FOR NEW WORK.
4. REMOVE EXISTING VAV BOX FOR REPLACEMENT. RETAIN EXISTING CIRCUIT FOR RE-USE. REFER TO E-102 FOR NEW WORK.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

ELECTRICAL DEMOLITION PLAN SECOND FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

ED-102

1 **ELECTRICAL DEMOLITION PLAN - ROOF**
SCALE: 1/4"=1'0"

ELECTRICAL NOTES

1. ALL DEVICES INDICATED SHALL BE REMOVED UNLESS NOTED OTHERWISE. REMOVAL SHALL BE COMPLETE INCLUDING BOXES, BRACKETS, HANGERS AND BRANCH CIRCUIT WIRING BACK TO SOURCE PANELBOARD OR LAST ACTIVE DEVICE TO REMAIN (EXCEPT WHERE NOTED).
2. CONTRACTOR SHALL BE RESPONSIBLE FOR STORAGE AND HANDLING OF EXISTING TO BE RELOCATED EQUIPMENT.
3. CONTRACTOR SHALL MODIFY EXISTING CIRCUITS, WHEN EXISTING DEVICES ARE REMOVED, AS REQUIRED TO MAINTAIN CIRCUIT CONTINUITY.
4. THIS PLAN IS DIAGRAMMATIC AND NOT INTENDED TO DEPICT THE ENTIRE SCOPE OF ELECTRICAL DEMOLITION. ADDITIONAL DEMOLITION AND MODIFICATION WORK NOT SHOWN SHOULD BE ANTICIPATED.
5. PRIOR TO SUBMITTING BID, VISIT SITE AND IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK TO BE PERFORMED. NO COMPENSATION WILL BE GRANTED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY IDENTIFIED BY EXPERIENCED OBSERVERS. INCLUDE IN THE BID ALL DEMOLITION WORK REQUIRED.
6. REFER TO DRAWING E-000 FOR SYMBOL LIST.

ELECTRICAL KEYNOTES

1. REMOVE EXISTING ROOFTOP PACKAGED UNIT FOR REPLACEMENT. REFER TO E-103 FOR NEW WORK & E-500 FOR MOTOR CIRCUIT SCHEDULE.
2. EXISTING OUTDOOR AIR INTAKE HOODS TO REMAIN.
3. EXISTING CONDENSING UNIT TO REMAIN,
4. REMOVE EXISTING CONDENSING UNIT FOR REPLACEMENT. REFER TO E-103 FOR NEW WORK & E-500 FOR MOTOR CIRCUIT SCHEDULE.
5. EXISTING KITCHEN EXHAUST FAN TO REMAIN. REMOVE EXISTING KITCHEN SUPPLY FAN, AND ASSOCIATED CONDUITS, CONDUCTORS AND ACCESSORIES.
6. EXISTING EXHAUST FAN TO REMAIN.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

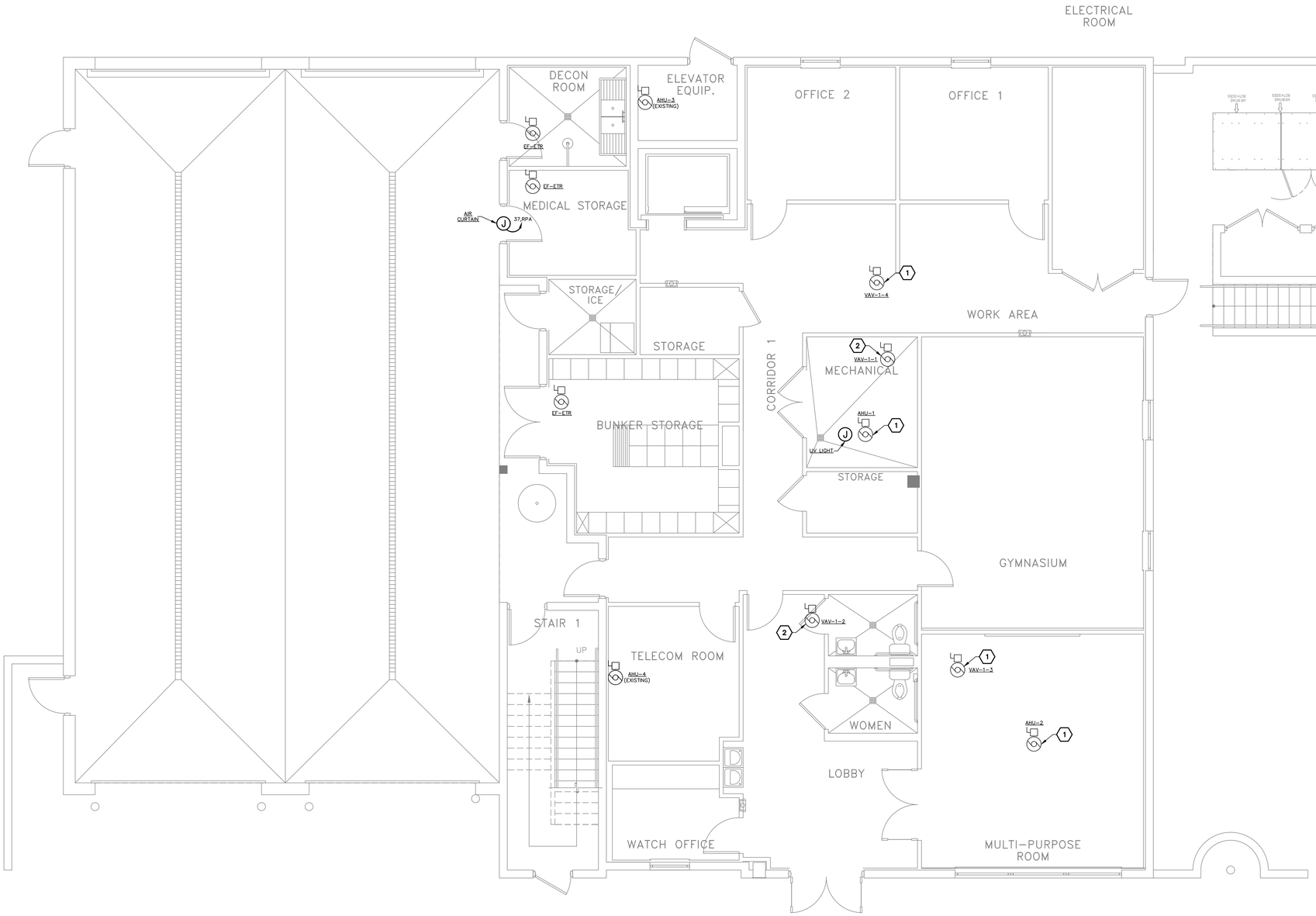
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

ELECTRICAL DEMOLITION PLAN ROOF

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

ED-103



1 **ELECTRICAL PLAN - FIRST FLOOR**
SCALE: 1/4"=1'0"

ELECTRICAL NOTES

1. CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL EQUIPMENT WITH THE VENDOR PRIOR TO INSTALLATION AND PROVIDE ALL REQUIRED DEVICES AND WIRING FOR A COMPLETE AND OPERATIONAL SYSTEM. COORDINATE EXACT LOCATIONS FOR EQUIPMENT AND ALL SPECIAL RECEPTACLE REQUIREMENTS WITH VENDOR AND OWNER.
2. CONTRACTOR SHALL BOND ALL ELECTRICAL RACEWAYS, BOXES, ELECTRICAL PANELS AND EQUIPMENT AND FURNISH EQUAL POTENTIAL GROUND TEST. THE RESISTANCE BETWEEN THE POWER DISTRIBUTION UNIT GROUND AND THE FACILITY GROUND SHALL NOT EXCESS 0.5 OHMS. THE TOTAL RESISTANCE BETWEEN THE POWER DISTRIBUTION UNIT GROUND AND THE EARTH GROUND SHALL NOT EXCEED 2 OHMS.
3. MAKE ALL FINAL CONNECTIONS IN ACCORDANCE WITH VENDOR DRAWINGS.
4. CONTRACTOR SHALL VERIFY MOUNTING HEIGHT OF ALL RECEPTACLES AND DEVICES WITH ARCHITECT AND OWNER'S REP PRIOR TO ROUGH-IN.
5. ALL 120V CIRCUITS REQUIRE A DEDICATED NEUTRAL.

ELECTRICAL KEYNOTES

1. NEW HVAC EQUIPMENT. REFER TO SHEET E-500 FOR MOTOR CIRCUIT SCHEDULE.
2. RELOCATED HVAC EQUIPMENT. REFER TO SHEET E-500 FOR MOTOR CIRCUIT SCHEDULE.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL 33309
954.990.0556
Proj.#2021673.00

REVISIONS

NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

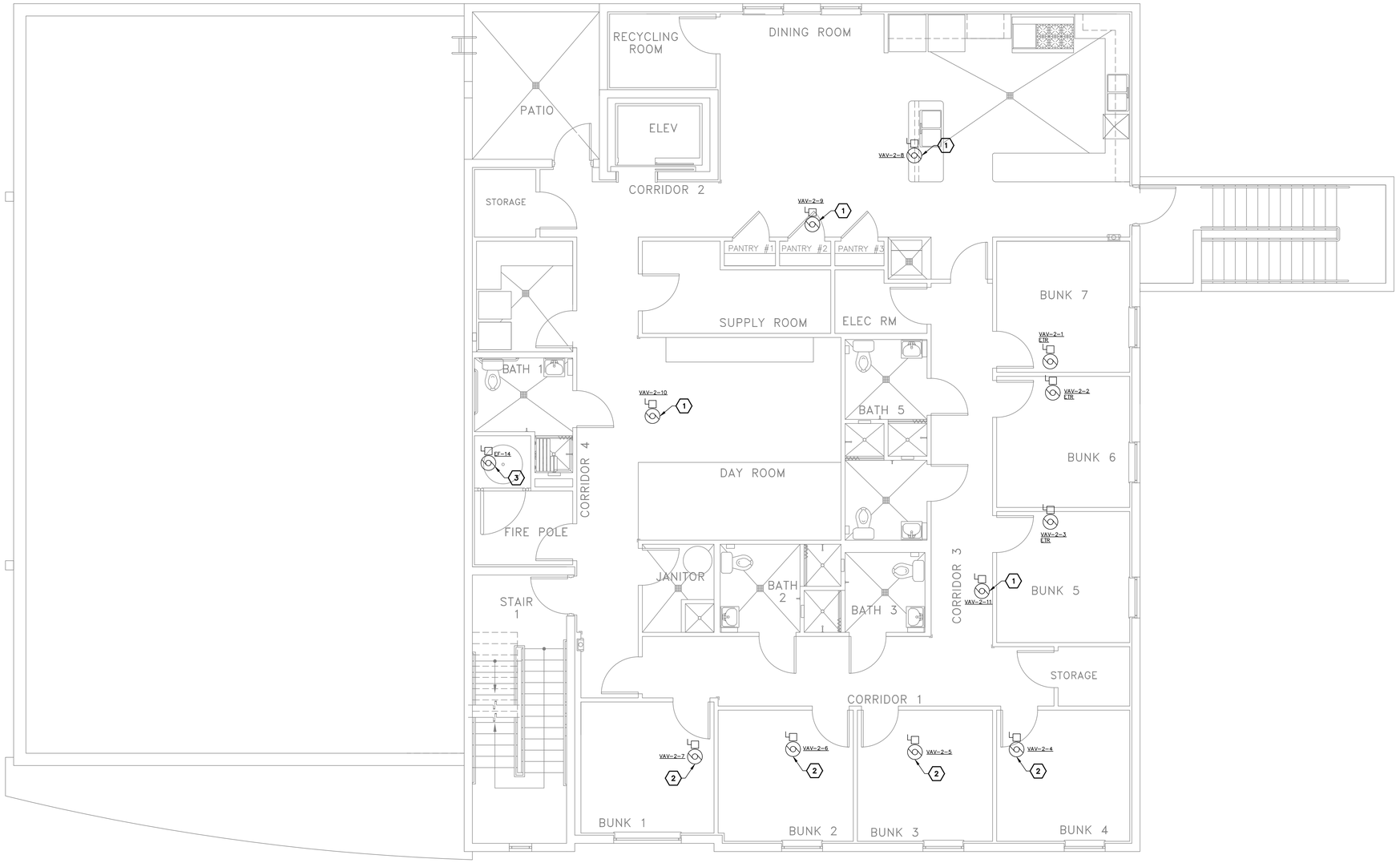
3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

ELECTRICAL PLAN
FIRST FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

E-101



1 ELECTRICAL PLAN - SECOND FLOOR
SCALE: 1/4"=1'0"

ELECTRICAL NOTES

1. CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL EQUIPMENT WITH THE VENDOR PRIOR TO INSTALLATION AND PROVIDE ALL REQUIRED DEVICES AND WIRING FOR A COMPLETE AND OPERATIONAL SYSTEM. COORDINATE EXACT LOCATIONS FOR EQUIPMENT AND ALL SPECIAL RECEPTACLE REQUIREMENTS WITH VENDOR AND OWNER.
2. CONTRACTOR SHALL BOND ALL ELECTRICAL RACEWAYS, BOXES, ELECTRICAL PANELS AND EQUIPMENT AND FURNISH EQUAL POTENTIAL GROUND TEST. THE RESISTANCE BETWEEN THE POWER DISTRIBUTION UNIT GROUND AND THE FACILITY GROUND SHALL NOT EXCESS 0.5 OHMS. THE TOTAL RESISTANCE BETWEEN THE POWER DISTRIBUTION UNIT GROUND AND THE EARTH GROUND SHALL NOT EXCEED 2 OHMS.
3. MAKE ALL FINAL CONNECTIONS IN ACCORDANCE WITH VENDOR DRAWINGS.
4. CONTRACTOR SHALL VERIFY MOUNTING HEIGHT OF ALL RECEPTACLES AND DEVICES WITH ARCHITECT AND OWNER'S REP PRIOR TO ROUGH-IN.
5. ALL 120V CIRCUITS REQUIRE A DEDICATED NEUTRAL.

ELECTRICAL KEYNOTES

1. NEW HVAC EQUIPMENT. REFER TO SHEET E-500 FOR MOTOR CIRCUIT SCHEDULE.
2. NEW HVAC EQUIPMENT, CONNECT TO EXISTING CIRCUIT PREVIOUSLY FED THE VAV BOX IN THIS AREA. NO LOAD INCREASE
3. RELOCATED HVAC EQUIPMENT. REFER TO SHEET E-500 FOR MOTOR CIRCUIT SCHEDULE.

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS

NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

ELECTRICAL PLAN SECOND FLOOR

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

E-102

1 **ELECTRICAL PLAN - ROOF**
SCALE: 1/4"=1'0"

ELECTRICAL NOTES

1. CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL EQUIPMENT WITH THE VENDOR PRIOR TO INSTALLATION AND PROVIDE ALL REQUIRED DEVICES AND WIRING FOR A COMPLETE AND OPERATIONAL SYSTEM. COORDINATE EXACT LOCATIONS FOR EQUIPMENT AND ALL SPECIAL RECEPTACLE REQUIREMENTS WITH VENDOR AND OWNER.
2. CONTRACTOR SHALL BOND ALL ELECTRICAL RACEWAYS, BOXES, ELECTRICAL PANELS AND EQUIPMENT AND FURNISH EQUAL POTENTIAL GROUND TEST. THE RESISTANCE BETWEEN THE POWER DISTRIBUTION UNIT GROUND AND THE FACILITY GROUND SHALL NOT EXCESS 0.5 OHMS. THE TOTAL RESISTANCE BETWEEN THE POWER DISTRIBUTION UNIT GROUND AND THE EARTH GROUND SHALL NOT EXCEED 2 OHMS.
3. MAKE ALL FINAL CONNECTIONS IN ACCORDANCE WITH VENDOR DRAWINGS.
4. CONTRACTOR SHALL VERIFY MOUNTING HEIGHT OF ALL RECEPTACLES AND DEVICES WITH ARCHITECT AND OWNER'S REP PRIOR TO ROUGH-IN.
5. ALL 120V CIRCUITS REQUIRE A DEDICATED NEUTRAL.

ELECTRICAL KEYNOTES

1. NEW HVAC EQUIPMENT. REFER TO SHEET E-500 FOR MOTOR CIRCUIT SCHEDULE.
2. NEW ROOFTOP PACKAGE UNIT. REFER TO SHEET E-500 FOR MOTOR CIRCUIT SCHEDULE AND ADDITIONAL INFORMATION. CONTRACTOR SHALL CONNECT THE UNIT TO THE EXISTING FIRE ALARM SYSTEM AND CONNECT NEW SMOKE DUCT DETECTOR TO EXISTING POINT OF CONNECTION.
3. NEW ROOFTOP DEDICATED OUTSIDE AIR UNIT (DOAS). REFER TO SHEET E-500 FOR MOTOR CIRCUIT SCHEDULE AND ADDITIONAL INFORMATION. CONTRACTOR SHALL CONNECT THE UNIT TO THE EXISTING FIRE ALARM SYSTEM.

CES
Engineering
Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL. 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54
HVAC SYSTEM

3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

ELECTRICAL PLAN
ROOF

DATE:	03/04/2022
PROJECT NO:	12735
CES PROJECT NO:	2021673.00
DRAWN:	SMP
CHECKED:	GJN
ISSUED FOR:	PERMIT SET
REVISIONS:	

SHEET NO.

E-103

Existing Panel: RPA

Location: 1ST FL ELECT ROOM
Supply From: PANEL MDP
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22k
Bus Material: Cu
Bus Rating: 100 A
MCB Rating / MLO: MLO

Notes:

CKT	Circuit Description	Trip	Poles	A (VA)		B (VA)		C (VA)		Poles	Trip	Circuit Description	CKT
1	EXISTING OFFICE 1 RECEPTACLES	20 A	1	720	80					3	20 A	TVSS	2
3	EXISTING OFFICE 1 RECEPTACLES	20 A	1			600	60			--	--	-	4
5	EXISTING WORK AREA #1	20 A	1					540	60	--	--	-	6
7	EXISTING WORK AREA #1	20 A	1	540	600					1	20 A	EXISTING IRRIGATION CONTROLLER	8
9	EXISTING OFFICE 2 RECEPTACLES	20 A	1			540	1080			1	20 A	EXISTING EXTERIOR RECEPTACLE	10
11	EXISTING OFFICE 2 RECEPTACLES	20 A	1					600	800	1	20 A	EXISTING DOOR SECURITY	12
13	EXISTING ELEVATOR GFI	20 A	1	180	1000					1	20 A	EXISTING FACP	14
15	EXISTING ELEVATOR SUMP PUMP	20 A	1			1200	600			1	20 A	EXISTING 1ST FLOOR EXHAUST FANS	16
17	EXISTING DOOR ROOM RECEPTACLES	20 A	1					360	600	1	20 A	EXISTING 1ST FLOOR BATHROOM GF	18
19	EXISTING MEDICAL STORAGE RECS.	20 A	1	540	600					1	20 A	EXISTING GYMNASIUM RECS.	20
21	EXISTING MEDICAL STORAGE RECS.	20 A	1			360	800			1	20 A	EXISTING GYMNASIUM RECS.	22
23	EXISTING GYMNASIUM RECS.	20 A	1					800	800	1	20 A	EXISTING GYMNASIUM RECS.	24
25	EXISTING GYMNASIUM RECS.	20 A	1	800	800					1	20 A	EXISTING GYMNASIUM RECS.	26
27	EXISTING GYMNASIUM RECS.	20 A	1			800	100			1	20 A	EXISTING MULTIPURPOSE A.V. EQUIP.	28
29	EXISTING GYMNASIUM RECS.	20 A	1					800	540	1	20 A	EXISTING MULTIPURPOSE A.V. EQUIP.	30
31	EXISTING HVAC CONTROLS	20 A	1	800	720					1	20 A	EXISTING MULTIPURPOSE A.V. EQUIP.	32
33	EXISTING BATHROOM GFI	20 A	1			360	800			1	20 A	EXISTING GENERATOR EQUIPMENT	34
35	EXISTING ELEVATOR EQUIPMENT	20 A	1					800	800	1	20 A	EXISTING GENERATOR EQUIPMENT	36
37	AIR CURTAIN	20 A	1	288								SPACE	38
39	SPACE											SPACE	40
41	SPACE											SPACE	42
		Total Load (VA):		7848		7308		7500					
		Total Amps (A):		65.4		60.9		62.5					
		Total (VA):		22648									
		Total Amps (A):		62.9									

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Total	
Receptacle	14620	100% First 10KVA, 50% After 10KVA	12310		
Lighting	8	125%	0	Total Conn. Load (VA):	22648
Motor	1000	125%	1250	Total Est. Demand (VA):	20568
Kitchen		65%	0	Total Conn. Current (A):	62.8
				Total Est. Demand Current (A):	57.1

Existing Panel: RPB

Location: 1ST FL ELECT ROOM
Supply From: PANEL MDP
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22k
Bus Material: Cu
Bus Rating: 100 A
MCB Rating / MLO: MLO

Notes:

CKT	Circuit Description	Trip	Poles	A (VA)		B (VA)		C (VA)		Poles	Trip	Circuit Description	CKT
1	EXISTING APPARATUS BAY RECS.	20 A	1	800						--	--	-	2
3	EXISTING APPARATUS BAY RECS.	20 A	1			800				--	--	-	4
5	EXISTING APPARATUS BAY RECS.	20 A	1					800		--	--	-	6
7	EXISTING APPARATUS BAY RECS.	20 A	1	800	1800					1	20 A	EXISTING ROLL-UP DOOR #1	8
9	EXISTING APPARATUS BAY RECS.	20 A	1			800	1800			1	20 A	EXISTING ROLL-UP DOOR #2	10
11	EXISTING APPARATUS BAY RECS.	20 A	1					800	1800	1	20 A	EXISTING ROLL-UP DOOR #3	12
13	EXISTING APPARATUS BAY RECS.	20 A	1	800	1800					1	20 A	EXISTING ROLL-UP DOOR #4	14
15	EXISTING APPARATUS BAY RECS.	20 A	1			800	912			2	15 A	AHU-1	16
17	VAV-1-4	20 A	2					1704	912	--	--		18
19	-	--	--	1704	2800					2	30 A	CU-2	20
21	VAV-1-3	15 A	2			864	2800			--	--	-	22
23	-	--	--					864	152	1	15 A	AHU-1 UV LIGHT	24
25	VAV-1-1	15 A	2	432								SPACE	26
27	-	--	--			432						SPACE	28
29	VAV-1-2	15 A	2					432				SPACE	30
31	-	--	--	432	540					1	20 A	EXISTING APPARATUS BAY RECS.	32
33	AHU-2	15 A	1			120	540			1	20 A	EXISTING APPARATUS BAY RECS.	34
35										1	20 A	SPARE	36
37	TVSS	20 A	3	60						1	20 A	SPARE	38
39	TVSS					60						SPACE	40
41	TVSS							60				SPACE	42
		Total Load (VA):		11968		9928		7534					
		Total Amps (A):		99.7		82.7		62.8					
		Total (VA):		29430									
		Total Amps (A):		81.7									

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Total	
Receptacle	7480	100% First 10KVA, 50% After 10KVA	7480		
Lighting	0	125%	0	Total Conn. Load (VA):	29430
Motor	2800	125%	3500	Total Est. Demand (VA):	30130
Kitchen		65%	0	Total Conn. Current (A):	81.7
				Total Est. Demand Current (A):	83.6

Existing Panel: RPE

Location: 2ND FL ELECT ROOM
Supply From: PANEL MDP
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22k
Bus Material: Cu
Bus Rating: 100 A
MCB Rating / MLO: 100 A

Notes:

CKT	Circuit Description	Trip	Poles	A (VA)		B (VA)		C (VA)		Poles	Trip	Circuit Description	CKT
1	EXISTING REFRIGERATOR	20 A	1	1000	60					3	40 A	TVSS	2
3	EXISTING REFRIGERATOR	20 A	1			1000	60			--	--	TVSS	4
5	EXISTING MICROWAVE	20 A	1					1200	60	--	--	TVSS	6
7	EXISTING DISPOSAL	20 A	1	1000	1920					1	20 A	EXISTING WASHING MACHINE	8
9	EXISTING DISWASHER	20 A	1			800	1920			1	20 A	EXISTING DRYER	10
11	EXISTING APPLIANCES RECS.	20 A	1					900	1920	1	20 A	-	12
13	EXISTING WASHING MACHINE	20 A	1	1200	1920					1	20 A	EXISTING LAUNDRY RECEPTACLES	14
15	EXISTING KITCHEN RECEPTACLES	20 A	1			540				1	20 A	EXISTING SUPPLY ROOM RECS.	16
17	RELOCATED EXHAUST FAN	20 A	2					800		1	20 A	EXISTING CORRIDOR RECS.	18
19	-	--	--	800	800					1	20 A	EXISTING WATER HEATER CONTROLS	20
21	EXISTING KITCHEN RECEPTACLES	20 A	2			720				1	20 A	EXISTING DAY ROOM RECS.	22
23	SPARE	20 A	2					350		1	20 A	EXISTING DAY ROOM RECS.	24
25	EXISTING KITCHEN HOOD	40 A	2	350						1	20 A	EXISTING DAY ROOM RECS.	26
27	-	--	--							1	20 A	EXISTING CORRIDOR RECS.	28
29	SPACE	--	--							1	20 A	EXISTING WASHING MACHINE	30
		Total Load (VA):		9050		5040		5230					
		Total Amps (A):		75.4		42.0		43.6					
		Total (VA):		19320									
		Total Amps (A):		53.6									

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Total	
Receptacle	16120	100% First 10KVA, 50% After 10KVA	13060		
Lighting	0	125%	0	Total Conn. Load (VA):	19320
Motor	3200	125%	4000	Total Est. Demand (VA):	17060
Kitchen		65%	0	Total Conn. Current (A):	53.6
				Total Est. Demand Current (A):	47.4

Existing Panel: RPF

Location: 2ND FL ELECT ROOM
Supply From: PANEL MDP
Mounting: Surface
Enclosure: Type 1

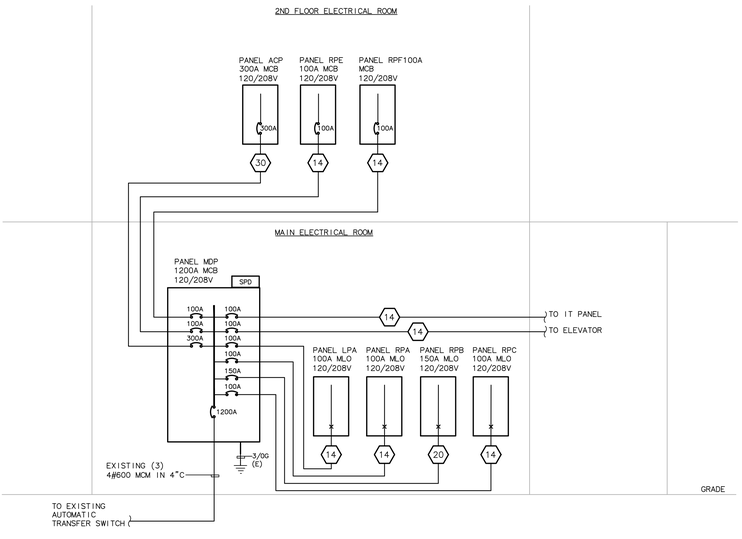
Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22k
Bus Material: Cu
Bus Rating: 100 A
MCB Rating / MLO: 100 A

Notes:

CKT	Circuit Description	Trip	Poles	A (VA)		B (VA)		C (VA)		Poles	Trip	Circuit Description	CKT
1	EXISTING BUNK #1 RECEPTACLES	20 A	1	540	60					3	20 A	TVSS	2
3	EXISTING BUNK #2 RECEPTACLES	20 A	1			540	60			--	--	-	4
5	EXISTING BUNK #3 RECEPTACLES	20 A	1					540	60	--	--	-	6
7	EXISTING BUNK #4 RECEPTACLES	20 A	1	540	180					1	20 A	EXISTING ROOFTOP RECEPTACLE	8
9	EXISTING BUNK #5 RECEPTACLES	20 A	1			540	1704			2	20 A	VAV-2-8	10
11	EXISTING BUNK #6 RECEPTACLES	20 A	1					540	1704	--	--	-	12
13	EXISTING BUNK #7 RECEPTACLES	20 A	1	540	432					2	15 A	VAV-2-9	14
15	EXISTING BATHROOM RECEPTACLE	20 A	1			360	432			--	--	-	16
17	EXISTING 2ND FLOOR EXHAUST FANS	20 A	1					900	864	2	15 A	VAV-2-10	18
19	EXISTING MOTORIZED DAMPERS	20 A	2	400	864					--	--	-	20
21	SPARE	20 A	1				432			2	15 A	VAV-2-11	22
23	SPACE								432	--	--	-	24
25	EXISTING HVAC EQUIPMENT	20 A	2	1296								SPACE	26
27	-	--	--			1296						SPACE	28
29	EXISTING HVAC EQUIPMENT	20 A	2					1296				SPACE	30
31	-	--	--	1296								SPACE	32
33	EXISTING HVAC EQUIPMENT	20 A	2			1296						SPACE	34
35	-	--	--					1296				SPACE	36
37	SPACE											SPACE	38
39	SPACE											SPACE	40
41	SPACE											SPACE	42
		Total Load (VA):		6748		6660		7632					
		Total Amps (A):		51.2		55.5		63.6					
		Total (VA):		20640									
		Total Amps (A):		56.7									

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Total	
Receptacle	6052	100% First 10KVA, 50% After 10KVA	6052		
Lighting	0	125%	0	Total Conn. Load (VA):	20640
Motor	6000	125%	7500	Total Est. Demand (VA):	21940
Kitchen		65%	0	Total Conn. Current (A):	56.7
				Total Est. Demand Current (A):	60.9



1 PARTIAL ELECTRICAL RISER DIAGRAM
SCALE: N.T.S.

MOTOR CIRCUIT SCHEDULE

EQUIPMENT	SOURCE PANEL	O.C.P. DEVICE	BRANCH CIRCUIT	LOCAL DISC. SW.	LOAD HP	LOAD PH	LOAD VOLT	REMARKS
EF-14	17,19,RPE	20A-2P	2#12,#12G.,3/4"C.	MOTOR RATED SW.	--	1	208	
VAV-1-1	25,27,RPB	15A-1P	2#12,#12G.,3/4"C.	MOTOR RATED SW.	--	1	208	
VAV-1-2	29,31,RPB	15A-1P	2#12,#12G.,1/2"C.	MOTOR RATED SW.	--	1	208	
VAV-1-3	21,23,RPB	15A-1P	2#12,#12G.,1/2"C.	MOTOR RATED SW.	--	1	208	
VAV-1-4	17,19,RPB	15A-1P	2#12,#12G.,1/2"C.	MOTOR RATED SW.	--	1	208	
AHU-1	16,18,RPB	15A-2P	2#12,#12G.,1/2"C.	30/2/15	--	1	208	
AHU-2	33,35,RPB	15A-2P	2#12,#12G.,1/2"C.	30/2/15	--	1	208	
VAV-2-8	10,12,RPF	15A-1P	2#12,#12G.,3/4"C.	MOTOR RATED SW.	--	1	208	
VAV-2-9	14,16,RPF	15A-1P	2#12,#12G.,1/2"C.	MOTOR RATED SW.	--	1	208	
VAV-2-10	18,20,RPF	15A-1P	2#12,#12G.,1/2"C.	MOTOR RATED SW.	--	1	208	
VAV-2-11	22,24,RPF	15A-1P	2#12,#12G.,1/2"C.	MOTOR RATED SW.	--	1	208	
RTU-1	1,3,5,ACP	45A-3P	3#8,#10G.,3/4"C.	60/3/45	--	3	208	
DOAS-1	7,9,11,ACP	100A-3P	3#2,#6G.,2"C.	100/3/100	--	3	208	
CU-1	13,15,ACP	35A-2P	3#8,#10G.,3/4"C.	60/3/35	--	1	208	
CU-2	20,22,RPB	30A-2P	3#10,#10G.,3/4"C.	30/2/30	--	1	208	

Existing Panel: ACP

Location: 2ND FL ELECT ROOM
Supply From: PANEL MDP
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 22k
Bus Material: Cu
Bus Rating: 300 A
MCB Rating / MLO: 300 A

Notes:

CKT	Circuit Description	Trip	Poles	A (VA)		B (VA)		C (VA)		Poles	Trip	Circuit Description	CKT
1	RTU-1	45 A	3	3372	60					3	20 A	TVSS	2
3	-	--	--			3372	60			--	--	-	4
5	-	--	--					3372	60	--	--	-	6
7	DOAS-1	100 A	3	8556								SPACE	8
9	-	--	--			8556						SPACE	10
11	-	--	--					8556				SPACE	12
13	CU-1	35 A	2	3474	1000					1	20 A	EXISTING EF APPARATUS BAY	14
15	-	--	--			3474	1000			1	20 A	EXISTING EF APPARATUS BAY	16
17	RTU-1 UV LIGHT	15 A	1					160	1000	1	20 A	EXISTING EF APPARATUS BAY	18
19	EXISTING CU-2	20 A	2	1920	1000					1	20 A	EXISTING EF APPARATUS BAY	20
21	-	--	--			1800	1000			3	20 A	EXISTING KITCHEN HOOD EXHAUST	22
23	EXISTING CU-3	20 A	2					1920	1000	--	--	-	24
25	-	--	--	1920	1000					--	--	-	26
27	SPACE						1000			3	20 A	EXISTING KITCHEN HOOD MAKE UP AIR	28
29	SPACE								1000	--	--	-	30
31	SPACE				1000					--	--	-	32
33	SPACE											SPACE	34
35	SPACE											SPACE	36
37	SPACE											SPACE	38
39	SPACE											SPACE	40
41	SPACE											SPACE	42
		Total Load (VA):		23302		20262		17068					
		Total Amps (A):		194.2		168.9		142.2					
		Total (VA):		60632									
		Total Amps (A):		168.3									

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Total	
Receptacle	0	100% First 10KVA, 50% After 10KVA	0		
Lighting	0	125%	0	Total Conn. Load (VA)	60632
Motor	25668	125%	32085	Total Est. Demand (VA)	67049
Kitchen		65%	0	Total Conn. Current (A)	168.3
				Total Est. Demand Current (A)	186.1

LEGEND OF FEEDER SIZES

FEEDER SYMBOL	COPPER CONDUCTORS: CONDUCTORS (3 PHASE, 3 WIRE) WITH GROUND	RACEWAY SIZE CONDUIT	CONDUCTORS (3 PHASE, 4 WIRE) WITH GROUND	RACEWAY SIZE CONDUIT	NOMINAL AMPERE RATING
1	3#12 & 1#12G	1/2"			20
2			4#12 & 1#12G	1/2"	
3	3#10 & 1#12G	3/4"			30
4			4#10 & 1#10G	3/4"	
5	3#8 & 1#10G	3/4"			40
6			4#8 & 1#10G	3/4"	
7	3#8 & 1#10G	3/4"			50
8			4#8 & 1#10G	3/4"	
9	3#6 & 1#10G	1"			60
10			4#6 & 1#10G	1 1/4"	
11	3#4 & 1#8G	1 1/4"			70
12			4#4 & 1#8G	1 1/4"	
13	3#2 & 1#6G	1 1/4"			100
14			4#2 & 1#6G	2"	
15	3#2 & 1#6G	1 1/4"			115
16			4#2 & 1#6G	2"	
17	3#1 & 1#6G	1 1/2"			125
18			4#1 & 1#6G	2"	
19	3#1/0 & 1#6G	2"			150
20			4#1/0 & 1#6G	2"	
21	3#2/0 & 1#6G	2"			175
22			4#2/0 & 1#6G	2"	
23	3#3/0 & 1#6G	2"			200
24			4#3/0 & 1#6G	2 1/2"	
25	3#4/0 & 1#4G	2 1/2"			225
26			4#4/0 & 1#4G	2 1/2"	
27	3#250 KCMIL & 1#4G	3"			250
28			4#250 KCMIL & 1#4G	3"	
29	3#350 KCMIL & 1#4G	3"			300
30			4#350 KCMIL & 1#4G	3"	
31	3#500 KCMIL & 1#3G	3 1/2"			350
32			4#500 KCMIL & 1#3G	4"	
33	3#600 KCMIL & 1#3G	3 1/2"			400
34			4#600 KCMIL & 1#3G	4"	
35	6#250 & 2#2G	2-2 1/2"			500
36			8#250 KCMIL & 2#2G	2-3"	
37	6#350 KCMIL & 2#1G	2-3"			600
38			8#350 KCMIL & 2#1G	2-3"	
39	6#500 KCMIL & 2#1/0G	2-3 1/2"			800
40			8#500 KCMIL & 2#1/0G	2-4"	

CES
Engineering Services, LLC
2937 W. Cypress Creek Rd.
Suite 102
Fort Lauderdale, FL 33309
954.990.0556
Proj.#2021673.00

REVISIONS		
NO.	DATE	DESCRIPTION

FIRE STATION 54 HVAC SYSTEM

3211 NE 32ND STREET
FORT LAUDERDALE, FL 33308

ELECTRICAL SCHEDULES & PARTIAL ELECTRICAL RISER DIAGRAM

DATE: 03/04/2022
PROJECT NO: 12735
CES PROJECT NO: 2021673.00
DRAWN: SMP
CHECKED: GJN
ISSUED FOR: PERMIT SET
REVISIONS:

SHEET NO.

E-500

GENERAL STRUCTURAL NOTES

DESIGN CRITERIA

D1 ALL WORK SHALL CONFORM TO AT LEAST THE MINIMUM STANDARDS OF THE FLORIDA BUILDING CODE, FIFTH EDITION (2014)

D2 DESIGN LOADS PER FLORIDA BLDG. CODE,
SEE PLAN SHEETS FOR FLOOR AND ROOF DESIGN LOADS
WIND DESIGN PER ASCE 7-10
V=180 MPH (3 SECOND ULTIMATE GUST); Vservice = 140 MPH
RISK CATEGORY IV

a=7'-0"	EXPOSURE D
Kd=0.85	ENCLOSED BUILDING
qh (ult) = 82.2 PSF	qh (allowable) = 49.3 PSF

SEE SHEET S1.1 FOR ROOF UPLIFT AND WALL CLADDING PRESSURES

D3 FOUNDATION DESIGN RECOMMENDATIONS:

PILE FOUNDATIONS ARE RECOMMENDED FOR THIS PROJECT PER THE REPORT PREPARED BY TERRACON DATED JANUARY 9, 2013. PER THE RECOMMENDATION, THE DESIGN UTILIZES 14" DIAMETER AUGER CAST PILES WITH DESIGN CAPACITIES OF 37 TONS COMPRESSION, AND 28 TONS TENSION. TERRACON ALSO PROVIDED A SUPPLEMENTAL LETTER DATED MAY 15, 2013 TO ADDRESS THE EXISTING PILES ON SITE.

THE GC IS REQUIRED TO FAMILIARIZE THEMSELVES WITH THE REPORT AND THE RECOMMENDATIONS.

THE GC SHALL EMPLOY TERRACON TO MONITOR THE PILE INSTALLATION AND CERTIFY THE PILE FOUNDATIONS.

D4 TO THE BEST OF THE ENGINEER'S KNOWLEDGE. THE STRUCTURAL PLANS AND SPECIFICATIONS HAVE BEEN DESIGNED IN ACCORDANCE WITH THE FLORIDA BUILDING CODE LATEST EDITION.

GENERAL

G1 THE GENERAL CONTRACTOR SHALL REVIEW AND DETERMINE THAT DIMENSIONS ARE COORDINATED BETWEEN ARCHITECTURAL AND STRUCTURAL DRAWINGS PRIOR TO FABRICATION OR START OF CONSTRUCTION.

G2 THE GENERAL CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURE, THE WORK PERSONS, AND OTHER PEOPLE DURING CONSTRUCTION. HE SHALL SUPERVISE AND DIRECT THE WORK AND BE RESPONSIBLE FOR ALL CONSTRUCTION.

G3 NO STRUCTURAL MEMBER SHALL BE CUT, NOTCHED OR OTHERWISE REDUCED IN STRENGTH.

G4 THE GENERAL CONTRACTOR SHALL COORDINATE ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR ANCHORED, EMBEDDED, SUPPORTED ITEMS WHICH AFFECT THE STRUCTURAL DRAWINGS AND NOTIFY THE ARCHITECT/ENGINEER OF ANY DISCREPANCIES.

G5 ALL WINDOWS, DOORS, AND LOUVERS SHALL BE INSTALLED PER THEIR DADE COUNTY PRODUCT APPROVAL REQUIREMENTS.

G6 SUBMIT SHOP DRAWINGS IN ELECTRONC FORM FOR APPROVAL. PAPER COPIES WILL NOT BE REVIEWED. FINAL SEALED SHOP DRAWINGS AND CALCULATIONS TO BE SUBMITTED IN PRINTED FORM FOR SUBMISSION TO THE BUILDING DEPARTMENT AFTER INCORPORATING ALL COMMENTS FROM THE A/E DESIGN TEAM.

SLAB ON GRADE

S1 REFER TO THE GEOTECHNICAL REPORTS NOTED ABOVE FOR PROPER PREPARATION OF THE SUBGRADE FOR THE PROJECT.

S2 GC SHALL PROPERLY CURE THE STRUCTURAL SLAB AT GRADE LEVEL. AS THIS IS A STRUCTURAL SLAB, SAW JOINTS ARE NOT REQUIRED. ONCE THE SLAB IS POURED AND FINISHED, PROVIDE 7 DAY WET CURE OF THE SLAB.

CONCRETE AND REINFORCING

C1 CONCRETE WORK SHALL CONFORM TO ACI CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318-11)

C2 ALL CONCRETE SHALL HAVE A MINIMUM 28 DAY STRENGTH & PROPERTIES AS FOLLOWS:

		SLUMP	MAX. W/C
FILLED SECOND FLOOR DECK	4000 PSI	5±1"	0.50
ALL OTHER CIP CONCRETE	6000 PSI	5±1"	0.40
FILLED CELLS	3000 PSI	9±1"	0.55

C3 CONCRETE MIX DESIGN SUBMITTALS MUST INCLUDE THE AREA IN WHICH THE CONCRETE IS TO BE PLACED (e.g. FOUNDATIONS, SLAB-ON-GRADE, FILLED CELLS, COLUMNS, etc.). FAILURE TO DO SO WILL CAUSE DELAY AND/OR REJECTION OF SUBMITTALS.

C4 REBARS SHALL CONFORM TO ASTM-615 GRADE 60. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A-185.

C5 MIMIMUM COVER FOR REINFORCING SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED.

FOOTINGS	3"
SLABS ON GRADE	1 1/2" FROM TOP
BEAMS	1 1/2" (ON TIES)
COLUMNS	1 1/2" (ON TIES)

C6 SPLICES AND ANCHORAGE OF REINFORCING SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED.

WELDED WIRE FABRIC	6"
ALL OTHER	48 DIA. (12" MIN)

C7 REINFORCEMENT IN WALLS, FOOTINGS AND BEAMS SHALL BE CONTINUOUS AND LAPPED AS SHOWN ON NOTE M11. HOOK AND LAP ALL CORNER AND INTERSECTING BARS. (SEE TYPICAL DETAILS)

C8 TERMINATE ALL DISCONTINUED ELEVATED SLAB TOP BARS WITH A 180 DEGREE STANDARD HOOK UNLESS OTHERWISE NOTED.

C9 CONTINUOUS TOP BARS SHALL BE SPLICED AT MIDSPAN. CONTINUOUS BOTTOM BARS SHALL BE SPLICED AT CENTER-LINE OF SUPPORTS (OR AS SHOWN ON TYPICAL DETAILS).

C10 AT CHANGES IN DIRECTION OF CONCRETE WALLS, STRIP FOOTINGS AND GRADE BEAMS PROVIDE CORNER BARS AT SAME SIZE AND SPACING AS HORTIZONTAL BARS. (REFER TO B/S4.0)

C11 SUBMIT CONCRETE MIX DESIGN FOR APPROVAL.

MASONRY

M1 MASONRY CONSTRUCTION SHALL CONFORM TO ACI STANDARD BUILDING CODE REQUIREMENTS FOR CONCRETE MASONRY STRUCTURES (ACI 530-11/ASCE 5-11/TMS 402-11), SPECIFICATIONS FOR MASONRY STRUCTURES (ACI 530.1-11 /ASCE 6-11/TMS 602-11 ASTM C476, ASTM C1019, AND NCMA TEK 107.

M2 CONCRETE BLOCKS SHALL CONFORM TO ASTM C-90.
8" CMU: (f'm = 2000 PSI) (2800 PSI ON THE NET AREA)

M3 MORTAR SHALL COMPLY WITH ASTM C270, TYPE M OR S. (COMPRESSIVE STRENGTH = 2500 PSI AND 1800 PSI, RESPECTIVELY. SITE TESTED MORTAR CUBES SHALL ACHIEVE A MINIMUM OF 80% OF THE DESIGN COMPRESSIVE STRENGTH)

M4 BLOCK SHALL NOT BE MOISTENED BEFORE GROUTING.

M5 ALL MASONRY CROSS WEBS SHALL BE FULLY BEDDED IN MORTAR AROUND CELLS TO BE GROUTED.

M6 THE MINIMUM CONTINUOUS UNOBSTRUCTED CELL AREA IN CELL TO RECEIVE GROUT MUST BE NOT LESS THAN 2"x3". MORTAR FINS MUST BE REMOVED AS BLOCK PLACEMENT PROCEEDS. MORTAR DROPPINGS MUST BE KEPT OUT OF CELLS WHICH ARE TO BE GROUTED.

M7 REINFORCE WALLS WITH LADDER TYPE (ASTM A-82, #9 GAGE WIRE) REINFORCEMENT EQUAL TO DURO-WALL IN BED JOINTS AT 16" OC UNO, MEASURED VERTICALLY PLACE PER MFR INSTR. LAP ALL HORIZONTAL JOINT REINFORCING 8", MIN.
EXTEND HORIZONTAL REINFORCEMENT 4" INTO CONCRETE COLUMNS OR TIE COLUMNS.

M8 WHERE SHOWN, CELLS OF BLOCK MASONRY SHALL BE FILLED WITH GROUT WITH MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT 28 DAYS, AND MEET ASTM C476. GROUT SHALL BE PROVIDED BY CONCRETE SUPPLIER FROM THEIR BATCH PLANT WITH A SLUMP OF 8" TO 10". JOB SITE MIXING OF GROUT SHALL NOT BE PERMITTED. TESTING SHALL CONFORM TO ASTM C1019.

M9 GROUT FOR FILLED CELLS SHALL BE POURED OR PUMPED IN LIFTS NOT TO EXCEED FOUR (4) FEET IN HEIGHT, AND A MAX POUR OF 12 FT. FILLED CELLS SHALL BE CONSOLIDATED AT TIME OF POURING BY RODDING OR VIBRATING BETWEEN LIFTS.

M10 PROVIDE KNOCK-OUT CMU AT BASE OF EACH FILLED CELL TO ALLOW VISUAL VERIFICATION OF COMPLETE GROUT PENETRATION (FOR LIFTS OF 5'-0" OR LESS, A KNOCK-OUT AT BASE OF LIFT WILL NOT BE REQUIRED).

M11 VERTICAL REINFORCING MUST HAVE A MINIMUM CLEARANCE OF 1/2" TO INSIDE FACE. MIN VERTICAL BAR LAP = 40 x BAR DIAMETER. VERTICAL REINFORCEMENT IN WALLS SHALL BE SECURED AND LATERALLY SUPPORTED AGAINST DISPLACEMENT AT INTERVALS NOT EXCEEDING 192 x BAR DIAMETER NOR 10 FT.

M12 GROUT PLACEMENT STOPPED FOR (1) HOUR OR MORE SHOULD BE STOPPED (1 1/2") BELOW THE TOP OF THE MASONRY UNIT TO PROVIDE A KEY FOR SUBSEQUENT GROUTING.

M13 SEE SHEET S2.5 FOR WALLTYPES, VERT REINFORCING. TYP VERTICAL REINFORCING SIZE & SPACING SHALL BE ABOVE AND BELOW ALL WALL OPENINGS.

M14 TEMPORARY BRACING AND SHORING OF WALLS TO PROVIDE STABILITY DURING CONSTRUCTION TO BE THE RESPONSIBILITY OF THE CONTRACTOR.

M15 MASONRY CONSTRUCTION MATERIALS AND INSPECTIONS SHALL CONFORM TO ALL REQUIREMENTS OF "SPECIFICATIONS FOR MASONRY STRUCTURES (ACI-ASCE 530.1)" EXCEPT AS MODIFIED BY THE REQUIREMENTS OF THESE DOCUMENTS.

M16 PROVIDE FILLED PRECAST U-LINTELS WITH (1) #5 CONT AT ALL OPENINGS WHERE CONCRETE BEAMS ARE NOT SHOWN OR NOTED. MINIMUM UNFILLED LINTEL CAPACITY = 400 lb/LF FOR SPAN INDICATED.

M17 STOPPING AND RESUMING WORK: RACK BACK 1/2-UNIT LENGTH IN EACH COURSE. DO NOT TOOTH. CLEAN EXPOSED SURFACES OF SET MASONRY WET UNITS LIGHTLY (IF REQ'D) AND REMOVE LOOSE MAS UNITS AND MORTAR PRIOR TO LAYING FRESH MASONRY.

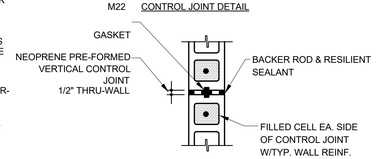
M18 REINFORCE MASONRY OPENINGS GREATER THAN 1'-0" WIDE, WITH HORIZ JT REINF PLACED IN (2) HORIZ JT'S APPROXIMATELY 8" APART, IMMEDIATELY ABOVE THE LINTEL AND IMMEDIATELY BELOW THE SILL. EXTEND REINFORCING A MINIMUM OF 2'-0" BEYOND JAMBS OF THE OPENING EXCEPT AT CONTROL JOINTS. SEE PLAN FOR ADDITIONAL REQUIREMENTS.

M19 DO NOT APPLY UNIFORM LOADS TO MASONRY WALLS FOR (3) DAYS.

M20 DO NOT APPLY CONCENTRATED LOADS TO MASONRY WALLS FOR (7) DAYS.

M21 EXTEND ALL VERTICAL WALL REINFORCEMENT TO WITHIN 2" OF TOP OF WALL OR BEAM UNLESS NOTED OTHERWISE. TERMINATE REINFORCING WITH STANDARD ACI HOOK.

M22 CONTROL JOINT DETAIL



NOTES:
1. THRU WALL JOINT SHALL BE CONTINUOUS WITHOUT INTERRUPTION FROM FOUNDATION TO TOP OF WALL.
2. TERMINATE TYPICAL HORIZONTAL JOINT REINFORCING AT JOINT.
3. CONTINUE ALL BOND BEAM OR TIE BEAM REINFORCING THRU JOINT AT ROOF LEVEL. TERMINATE ALL OTHER HORIZONTAL BEAM REINFORCING AT JOINT.
4. MAXIMUM SPACING OF CONTROL JOINTS SHALL BE (3XWALL HEIGHT) OR 50'-0", WHICHEVER IS LESS. SEE ARCH'L PLAN FOR MCJ LOCATION.
5. COORDINATE LOCATION OF CONTROL JOINTS WITH ARCHITECT.

STRUCTURAL STEEL

SS1 GENERAL CONTRACTOR SHALL ENGAGE A CERTIFIED TESTING AGENCY TO PERFORM INDUSTRY STANDARD INSPECTIONS TO ENSURE CONFORMANCE WITH PLANS AND SPECIFICATIONS (IF PROVIDED). SUBMIT REPORTS TO ARCHITECT AND ENGINEER.

SS2 STEEL WORK SHALL CONFORM TO THE AISC "SPECIFICATIONS" FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL BUILDINGS", LATEST EDITION.

SS3 STEEL TUBING SHALL CONFORM TO ASTM A500 GRADE B.

SS4 STRUCTURAL WF SHAPES SHALL BE TO ASTM A992 Fy=50KSI, UNLESS NOTED OTHERWISE. ALL OTHER SHAPES SHALL BE A36. ALL STRUCTURAL STEEL SHALL BE DOMESTICALLY PRODUCED.

SS5 BRACE AND MAINTAIN ALL STEEL IN ALIGNMENT UNTIL OTHER PARTS OF CONSTRUCTION NECESSARY FOR PERMANENT SUPPORT ARE COMPLETED. CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING TEMPORARY SHORING AS REQUIRED FOR THE STABILITY OF THE STEEL FRAME UNTIL ALL STRUCTURAL ELEMENTS HAVE BEEN COMPLETED AND BUILDING IS ENCLOSED.

SS6 ALL WELDING SHALL CONFORM TO THE REQUIREMENTS OF "THE STANDARD CODE FOR WELDING IN BUILDING CONSTRUCTION" OF THE AMERICAN WELDING SOCIETY. WELDING ELECTRODES SHALL BE E70XX-LOW HYDROGEN FOR SHIELD AND METAL ARC WELDING. ALL WELDING TO BE PERFORMED BY CERTIFIED WELDERS.

SS7 GROUT FOR COLUMN BASE PLATES AND PRESET BEARING PLATES SHALL BE NON-SHRINK, NON-METALLIC GROUT. (5000 PSI MIN)

SS8 SUBMIT SHOP DRAWINGS INDICATING ALL SHOP AND ERECTION DETAILS INCLUDING PROFILES, SIZES, SPACING AND LOCATIONS OF STRUCTURAL MEMBERS, CONNECTION ATTACHMENTS, FASTENERS, LOADS AND TOLERANCES.

SS9 ALL WELDED CONN. SHALL BE 1/4" FILLET ALL AROUND, UNO. ALL BOLTED CONN. SHALL BE 3/4"DIA. A325 BOLTS, UNO.

SS10 ALL STEEL EXPOSED TO WEATHER SHALL BE HOT DIPPED GALVANIZED

EXPANSION ANCHORS

EA1. CARBON STEEL EXPANSION ANCHORS SHALL HAVE A ONE PIECE ANCHOR BODY WITH A LENGTH IDENTIFICATION CODE. THE ANCHORS SHALL HAVE AN EXPANSION MECHANISM WHICH CONSISTS OF A PAIR OF INTERLOCKING INDEPENDENT WEDGES. CARBON STEEL COMPONENTS SHALL BE PLATED ACCORDING TO ASTM SPECIFICATION B 633. EXPANSION ANCHORS MUST MEET THE DESCRIPTION IN FEDERAL SPECIFICATION FF-S-325 FOR CONCRETE EXPANSION ANCHORS.

EA2. EXPANSION ANCHORS SHALL BE INSTALLED PER MANUFACTURERS RECOMMENDATIONS.

EA3. EXPANSION ANCHORS SHALL HAVE A MINIMUM ULTIMATE TENSILE AND SHEAR LOADS (LBS) AS SHOWN IN SCHEDULE BELOW:

DIA.	EMBEDMENT (IN)	MIN. EDGE DIST./ MIN. SPACING	f'c=3,000 psi		f'c=4,000 psi		INSTALLATION TORQUE (ft/lbs)
			TENSILE	SHEAR	TENSILE	SHEAR	
1/2"	2 1/4"	6 3/4"	4925	7360	5450	7360	65
	3 1/2"		8000	9200	9000	9200	
	6"		8650	9200	9500	9200	
5/8"	2 3/4"	8"	7000	11500	8000	11500	110
	4"		10670	14200	12350	14200	
	7"		13000	14200	14000	14200	
3/4"	3 1/4"	11 1/4"	8700	15500	10000	15500	235
	4 3/4"		15500	19200	18000	19200	
	8"		18500	19200	22000	19200	
1"	4 1/2"	13 1/2"	15200	28500	17500	30500	450
	6"		22500	34500	26500	34500	
	9"		28750	34500	32500	34500	

METAL DECKING

MD1 FLOOR DECKING SHALL BE COMPOSITE, GALVANIZED G60 METAL FLOOR DECK. SEE PLAN NOTES FOR DECK DEPTH, GAGE, AND ATTACHMENT TO THE STRUCTURE.

MD2 ROOF DECK SHALL BE 1.5" GALVANIZED G90 METAL DECK. REFER TO PLAN NOTES FOR DECK GAGE AND ATTACHMENT TO STRUCTURE.

MD3 ALL DECK SHALL BE FABRICATED BY VULCRAFT OR APPROVED EQUAL.

MD4 PROVIDE SHOP DRAWINGS SHOWING ALL END OF DECK CONDITIONS AND ATTACHMENT REQUIREMENTS FOR APPROVAL.

MD5 FRAME ALL ROOF OPENINGS LARGER THAN 12 INCHES SQUARE WITH STEEL ANGLE FRAME. USE L3x3x1/4" UNO ON PLAN

EXTERIOR LIGHT GAGE METAL FRAMING

MS1 DESIGN OF LIGHT GAGE METAL FRAMING AND THEIR CONNECTIONS TO THE SUPPORTING STRUCTURE IS A DELEGATED ITEM FOR THIS PROJECT. ALL STUD SIZES SHOWN SHALL BE USED FOR BID PURPOSES BUT THE FINAL DESIGN OF THE METAL FRAMING ELEMENTS SHALL BE BY THE SPECIALTY ENGINEER OF RECORD.

MS2 MINIMUM GAGE OF MATERIAL SHALL BE 18 GAGE WHERE SHEATHING IS ATTACHED. (I.E. SOFFIT STUDS, ROOF STUDS, ETC.). ALL MATERIAL TO BE GALVANIZED G90.

MS3 SPECIALTY ENGINEER SHALL HAVE A MINIMUM OF 5 YEARS EXPERIENCE IN SIMILAR STRUCTURAL DESIGNS.

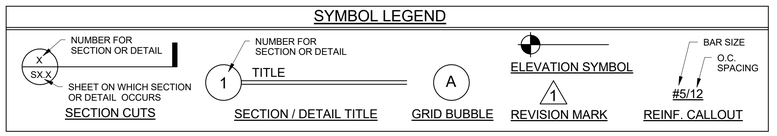
MS4 PLANS SHALL SHOW ALL PERMINENT BRACING AND BLOCKING REQUIREMENTS.

MS5 SEE NOTE G6 ON THIS SHEET REGARDING SUBMISSION REQUIREMENTS.

STRUCTURAL ABBREVIATIONS

AB	ANCHOR BOLT
ABV	ABOVE
A.C.I.	AMERICAN CONCRETE INSTITUTE
ADD'L	ADDITIONAL
AFF	ABOVE FINISH FLOOR
AGGR	AGGREGATE
A.I.S.C.	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
A.I.S.I.	AMERICAN IRON AND STEEL INSTITUTE
AL	ALUMINUM
ALT	ALTERNATE
ARCH	ARCHITECT(URAL)
A.S.T.M.	AMERICAN SOCIETY OF TESTING MATERIALS
A.W.S.	AMERICAN WELDING SOCIETY
B/	BOTTOM OF
BB	BOND BEAM
BLDG	BUILDING
BLW	BELOW
BM	BEAM
BOT	BOTTOM
BP	BASE PLATE
BRDG	BRIDGING
BRG	BEARING
BRK	BRICK
BS	BOTH SIDES
BTJ	BOLTED TIE JOIST
BTWN	BETWEEN
C/C	CENTER TO CENTER
CANT	CANTILEVER
CB	CONCRETE BEAM
CC	CONCRETE COL
CIP	CAST IN PLACE
CJ	CONSTRUCTION JOINT OR CONTROL JOINT
CL	CENTERLINE
CLR	CLEAR(ANCE)
CM	CONCRETE MASONRY
CMU	CONCRETE MASONRY UNIT
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONT	CONTINUOUS
CONTR	CONTRACTOR
CSK	COUNTER SINK
CTR	CENTER
CTR'D	CENTERED
DIA	DIAMETER
DL	DEAD LOAD
DN	DOWN
DTL	DETAIL
DWG	DRAWING
DWL	DOWEL
EA	EACH
EE	EACH END
EF	EACH FACE
EJ	EXPANSION JOINT
ENG	ENGINEER
EL	ELEVATION
EQ	EQUAL
EQ SP	EQUAL SPACE(S) (ING)
ES	EACH SIDE
EW	EACH WAY
EXT	EXTERIOR
F/	FACE OF
FD	FLOOR DRAIN
FDN	FOUNDATION
FIN	FINISH
FL	FLOOR
FLG	FLANGE
FS	FAR SIDE
FT	FOOT
FTG	FOOTING
GA	GAGE, GAUGE
GALV	GALVANIZE
GB	GRADE BEAM
GC	GENERAL CONTRACTOR
GLB	GLU-LAM BEAM
GR	GRADE
HC	HOLLOW CORE
HK	HOOK
HORIZ	HORIZONTAL
HP	HIGH POINT
HS	HEADED STUD
ID	INSIDE DIAMETER
IF	INSIDE FACE
INT	INTERIOR
JST	JOIST
K	KIP
KO	KNOCK OUT
LG	LONG
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LNTL	LINTEL
LSL	LONG SLOTTED HOLES
LONG	LONGITUDINAL
LP	LOW POINT
MAS	MASONRY
MAX	MAXIMUM
MBM	METAL BUILDING MFR
MC	MOMENT CONNECTION
MCJ	MASONRY CONTROL JT
MECH	MECHANICAL
MEZZ	MEZZANINE
MFR	MANUFACTURE(ER)
MIN	MINIMUM
MO	MASONRY OPENING
MS	METAL STUD
MTL	METAL
NS	NEAR SIDE
NTS	NOT TO SCALE
OA	OVERALL
OC	ON CENTER
OD	OUTSIDE DIA.
OF	OUTSIDE FACE
OPNG	OPENING
OPP	OPPOSITE
PAF	POWDER ACTUATED FASTENERS
PERP	PERPENDICULAR
PC	PRECAST
PL	PLATE
PLYWD	PLYWOOD
PNL	PANEL
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PTN	PARTITION
R	RADIUS
REF	REFERENCE
REINF	REINFORCE(D) (ING)
REQ	REQUIRE
REQ'D	REQUIRED
RF	ROOF
RTN	RETURN
RW	RETAINING WALL
SCH	SCHEDULE
SE	SLAB EDGE
SECT	SECTION
SHT	SHEET
SIM	SIMILAR
SJ	SAWCUT JOINT
SJI	STEEL JOIST INSTITUTE
SL	SLOPE
SP	SPACE(S)
SPECS	SPECIFICATIONS
SQ	SQUARE
SS	STAINLESS STEEL
STD	STANDARD
STL	STEEL
STR	STRENGTH
STRL	STRUCTURAL
SW	SHEAR WALL
SYMM	SYMMETRICAL
SYP	SOUTHERN YELLOW PINE
TB	TIE BEAM
T&B	TOP & BOTTOM
TC	TIE COLUMN
TDS	TURN DOWN SLAB
TEMP	TEMPERATURE
THK	THICK
THNS	THICKEN SLAB
TOP'G	TOPPING
TYP	TYPICAL
T/	TOP OF
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
WF	WALL FOOTING
WO	WINDOW OPENING (MASONRY)
WP	WORKING POINT
WS	WATERSTOP
WWF	WELDED WIRE FABRIC
W/	WITH

SYMBOL LEGEND



791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PGAL

CONSULTANT ARCHITECT

PROFESSIONAL SEAL:

DRAWN BY: JSG | DATE: 10/27/2016
DESIGNED BY: EB / MJ | SCALE:
CHECKED BY: JSG
FIELD HOOK:

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

NO.	DATE	BY	CHK'D	DESCRIPTION
2	02/20/2017	MJ		PERMIT COMMENTS

100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
STRUCTURAL NOTES
3211 NE 32nd STREET, FORT LAUDERDALE

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO. S1.0 | 16
TOTAL: 103
REVIT FILE: 10914-S.RVT
DRAWING FILE NO. 4-130-07

160628

STEEL JOISTS

SJ1 GENERAL CONTRACTOR SHALL ENGAGE A CERTIFIED TESTING AGENCY TO PERFORM INDUSTRY STANDARD INSPECTIONS TO ENSURE CONFORMANCE WITH PLANS AND SPECIFICATIONS (IF PROVIDED). SUBMIT REPORTS TO ARCHITECT AND ENGINEER.

SJ2 ALL DESIGN, FABRICATION AND ERECTION OF STEEL JOISTS AND BRIDGING SHALL BE IN STRICT ACCORDANCE WITH THE CURRENT SPECIFICATIONS OF STEEL JOIST INSTITUTE AND RECOMMENDED CODE OF STANDARD PRACTICE.

SJ3 THE ENDS OF ALL BRIDGING LINES TERMINATING AT WALLS OR BEAMS SHALL BE ANCHORED TO THE WALL OR BEAM.

SJ4 ALL STEEL JOISTS ARE TO BE CAMBERED AS SPECIFIED BY SJI.

SJ5 PROVIDE BOTTOM AND/OR TOP CHORD EXTENSIONS AS SHOWN ON DRAWINGS.

SJ6 UNLESS NOTED OTHERWISE, MINIMUM JOIST BEARING SHALL BE 2 1/2" ON A STEEL MEMBER OR EMBED PLATE.

SJ7 BRIDGING SHALL BE FURNISHED AND INSTALLED TO MEET THE SIZE AND SPACING REQUIREMENTS OF THE SJI STANDARD SPECIFICATIONS FOR OPEN WEB STEEL JOISTS. ALL BRIDGING AND BRIDGING ANCHORS SHALL BE COMPLETELY INSTALLED BEFORE CONSTRUCTION LOADS ARE PLACED ON THE JOISTS. THE LAST TWO JOIST SPACES IN A LINE OF BRIDGING SHALL BE "X" TYPE. ALL JOISTS 40'-0" OR LONGER REQUIRE A ROW OF BOLTED BRIDGING TO BE IN PLACE BEFORE SLACKENING OF HOISTING LINES. OTHER JOISTS REQUIRE SIMILAR BRIDGING CONSULT LATEST SJI SPECIFICATIONS.

SJ8 ALL HANGERS TO SUPPORT MECHANICAL EQUIPMENT, ETC. TO BE SUPPORTED BY THE BOTTOM CHORD OF JOISTS SHALL BE LOCATED AT THE PANEL POINT OF THE JOIST. IF HANGERS MUST BE LOCATED BETWEEN PANEL POINTS, PROVIDE JOIST STIFFENERS. L1 1/2 x 1 1/2 x 3/16 JOIST STIFFENERS MUST BE INSTALLED FROM HANGER TO OPPOSITE CHORD PANEL POINT BEFORE LOAD IS APPLIED.

SJ9 CONTRACTOR TO FURNISH BAR JOIST CERTIFICATIONS SIGNED AND SEALED BY AN ENGINEER REGISTERED IN THE SAME STATE AS THE PROJECT LOCATION.

SJ10 FOR NET UPLIFT SEE NET UPLIFT PLAN ON THIS SHEET. PROVIDE UPLIFT BRIDGING.

SJ11 ALL SPRINKLER AND ROOF DRAIN PIPES MUST BE SUPPORTED NO FURTHER THAN 3" FROM THE JOIST TOP CHORD PANEL POINTS. THIS WILL BE STRICTLY ENFORCED. WHEN PIPES ARE PERPENDICULAR TO JOISTS, HANGERS SHALL BE PROVIDED EVERY OTHER JOIST (APPROX 10'-0" OC). WHEN PIPES ARE PARALLEL TO JOISTS, TWO CASES EXIST. FIRST, PIPES THAT ARE 4" AND LESS MAY BE SUPPORTED BY A SINGLE JOIST WITH HANGERS NOT TO EXCEED 10'-0" OC. SECOND, PIPES THAT ARE LARGER THAN 4" MUST BE CENTERED BETWEEN TWO JOISTS AND SUPPORTED FROM L4x4x5/16 ANGLE BEARING ON JOIST TOP CHORD PANEL POINTS WITH SPACING NOT TO EXCEED 10'-0" OC. GENERAL CONTRACTOR SHALL COORDINATE THESE REQUIREMENTS WITH THE APPROPRIATE TRADES.

SJ12 ALL ITEMS SUSPENDED FROM JOISTS (i.e. CATWALKS, BALCONIES, OPERABLE PARTITIONS, etc...) SHALL BE INSTALLED AFTER DEAD LOAD HAS BEEN APPLIED.

JOIST BRIDGING NOTES:

JB1 BRIDGING STANDARD WITH THE MANUFACTURER AND COMPLYING WITH THE STEEL JOIST INSTITUTE STANDARD SPECIFICATIONS LOAD TABLES AND WEIGHT TABLES OF THE LATEST ADOPTION SHALL BE USED FOR BRIDGING ALL JOISTS FURNISHED BY THE MANUFACTURER. POSITIVE ANCHORAGE SHALL BE PROVIDED AT THE ENDS OF EACH BRIDGING ROW AT BOTH TOP AND BOTTOM CHORDS.

JB2 FOR "K" AND "LH" SERIES JOISTS HORIZONTAL BRIDGING IS RECOMMENDED FOR SPANS UP TO AND INCLUDING 60 FEET EXCEPT WHERE THE STEEL JOIST INSTITUTE STANDARD SPEC LOAD TABLES & WEIGHT TABLES REQUIRE BOLTED DIAGONAL BRIDGING FOR ERECTION STABILITY.

JB3 "LH" AND "DLH" SERIES JOISTS EXCEEDING 60 FEET IN LENGTH SHALL HAVE BOLTED DIAGONAL BRIDGING FOR ALL ROWS.

JB4 REFER TO SJI SECTION 6 IN THE "K" SERIES SPECIFICATIONS AND SECITON 105 IN THE "LH" AND "DLH" SERIES SPECIFICATIONS FOR ERECTION STABILITY REQUIREMENTS.

JB5 REFER TO APPENDIX E FOR OSHA STEEL JOIST ERECITON STABILITY REQUIREMENTS.

JB6 HORIZONTAL BRIDGING SHALL CONSISTS OF CONTINUOUS HORIZONTAL STEEL MEMBERS. THE l/r RATIO FOR HORIZONTAL BRIDGING SHALL NOT EXCEED 300.

JB7 DIAGONAL CROSS BRIDGING CONSISTING OF ANGLES OR OTHER SHAPES CONNECTED TO THE TOP AND BOTTOM CHORDS, OF "K", "LH" AND "DLH" SERIES JOISTS SHALL BE USED WHEN REQUIRED BY THE APPLICABLE STEEL JOIST INSTITUTE STANDARD SPECIFICATIONS LOAD TABLES AND WEIGHT TABLES OF LATEST ADOPTION.

JB8 DIAGONAL BRIDGING, WHEN USED, SHALL HAVE AN l/r RATIO < 200.

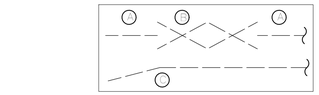
JB9 WHEN BOLTED DIAGONAL ERECTION BRIDGING IS REQUIRED, THE FOLLOWING SHALL APPLY:
- A. THE BRIDGING SHALL BE INDICATED ON THE JOIST LAYOUT PLAN
- B. THE JOIST LAYOUT PLAN SHALL BE THE EXCLUSIVE INDICATOR FOR THE PROPER PLACEMENT OF THIS BRIDING.
- C. SHOP INSTALLED BRIDGING CLIPS, OR FUNCTIONAL EQUIVALENT SHALL BE PROVIDED WHERE THE BRIDGING BOLTS TO THE STEEL JOISTS.
- D. WHEN TWO PIECES OF BRIDGING ARE ATTACHED TO THE STEEL JOIST BY A COMMON BOLT, THE NUT THAT SECURES THE FIRST PIECE OF BRIDGING SHALL NOT BE REMOVED FROM THE BOLT FOR THE ATTACHMENT OF THE SECOND PIECE.
- E. BRIDING ATTACHMENTS SHALL NOT PROTRUDE ABOVE THE TOP CHORD OF THE STEEL JOISTS.

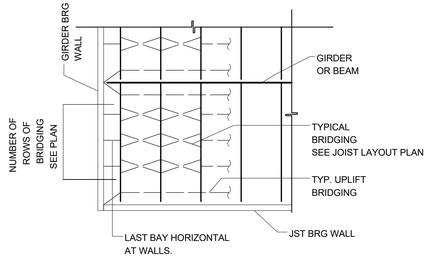
JB10 PROVIDE UPLIFT BRIDGING AT FIRST BOTTOM CHORD PANEL POINT EACH END OF JOIST. REFER TO SECITON A/S1.1 FOR UPLIFT BRIDGING CONNECITON DETAILS.

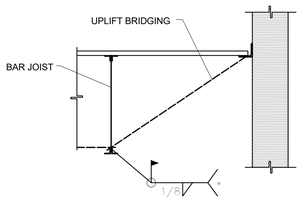
JB11 DO NOT WELD BRIDGING TO JOIST WEB MEMBERS. DO NOT HANG ANY MECHANICAL, ELECTRICAL, PLUMBING, ETC. FROM BRIDGING.

JB12 BRIDGING LEGEND FOR PLAN BELOW:

- (A) HORIZONTAL BRIDGING ATTACHED TO TOP & BOTTOM CHORD
- (B) BOLTED OR WELDED CROSS BRIDGING AS SHOWN
- (C) SINGLE LINE HORIZONTAL UPLIFT BRIDGING





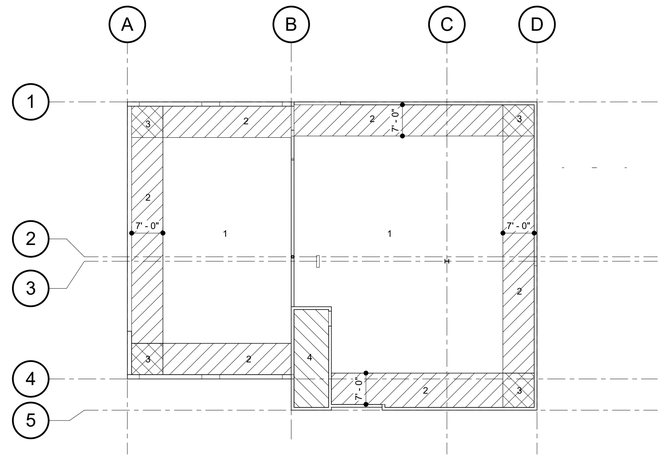


@ WALL

*WELD ALL POINTS OF CONTACT

(A) BRIDGING DETAILS AND PLAN

SCALE: N.T.S.



ROOF UPLIFT PLAN - SERVICE

ZONE	BAR JOISTS*	ROOFING
1	-53.2 PSF	-58.2 PSF
2	-63.1 PSF	-97.6 PSF
3	-63.1 PSF	-146.9 PSF
4	-102.7 PSF	-153.8 PSF

* BASED ON TRIBUTARY AREA
LOADS PER ASCE 7-10 DESIGN PARAMETERS: a=7'-0".
PRESSURES SHOWN ARE SERVICE LOAD PRESSURES = 0.6 * ULTIMATE

WALL WIND PRESSURES - SERVICE

OPENING AREA	POSITIVE WIND PRESSURE	NEGATIVE ZONE 4 PRESSURE	NEGATIVE ZONE 5 PRESSURE
10 SF	53.2 PSF	-57.7 PSF	-71.0 PSF
20 SF	50.8 PSF	-55.2 PSF	-66.1 PSF
35 SF	48.8 PSF	-53.2 PSF	-62.6 PSF
50 SF	47.8 PSF	-52.3 PSF	-60.1 PSF
100 SF	45.4 PSF	-49.8 PSF	-55.2 PSF
150 SF	43.9 PSF	-48.3 PSF	-52.8 PSF
200 SF	42.9 PSF	-47.3 PSF	-50.8 PSF
350 SF	40.9 PSF	-45.4 PSF	-46.8 PSF
500 SF	39.9 PSF	-44.4 PSF	-44.4 PSF

LOADS PER ASCE 7-10 DESIGN PARAMETERS; a=7'-0".
PRESSURES SHOWN ARE SERVICE LOAD PRESSURES = 0.6 * ULTIMATE

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

CONSULTANT ARCHITECT

PROFESSIONAL SEAL:

DRAWN BY: JSG | DESIGNED BY: EB / MJ | CHECKED BY: JSG | DATE: 10/27/2016 | SCALE: | FIELD BOOK:

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS

NO.	DATE	BY	CHK'D	DESCRIPTION

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
STRUCTURAL NOTES & SHEDULES
3211 NE 32nd STREET, FORT LAUDERDALE

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO. S1.1 | 16

TOTAL: 103

REVIT FILE: 10914-S.RVT

DRAWING FILE NO. 4-130-07

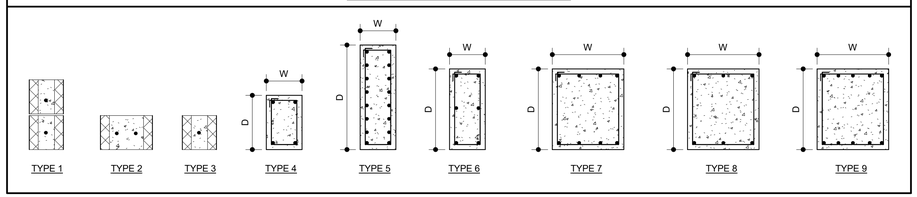
160628

TIE / BOND BEAM / AND CONCRETE BEAM SCHEDULE

MARK	TYPE	T/BEAM	NOM. SIZE	BEAM REINFORCEMENT BOTTOM	BEAM REINFORCEMENT TOP	BEAM REINFORCEMENT MID	BEAM REINFORCEMENT OTHER	STIRRUP SIZE	STIRRUP SPACING	COMMENTS
BB301	2	+22' - 2"	12"x8"			(2) #7				
BB302	2	+25' - 4"	12"x8"			(2) #7				
BB401	3	+31' - 10"	8"x8"			(1) #7				
BB402	3	+33' - 10"	8"x8"			(1) #7				
CB101	4	+8' - 0"	8"x14"	(2) #5	(2) #5			#3	6" O.C. THROUGHOUT	
CB201	4	+14' - 0"	8"x32"	(2) #6	(2) #6			#3	10" O.C. THROUGHOUT	
CB202	4	+15' - 4"	8"x24"	(2) #6	(2) #6			#3	8" O.C. THROUGHOUT	
CB203	4	+14' - 0"	8"x16"	(2) #5	(2) #6			#3	6" O.C. THROUGHOUT	SEE SECTION 2 ON S3.2
CB204	4	+9' - 4"	8"x26"	(2) #5	(2) #5			#3	12" THROUGHOUT	
CB301	5	+20' - 0"	12"x72"	(2) #5	(2) #5	(6) #7		#3	24" THROUGHOUT	
CB302	5	+20' - 2"	12"x74"	(2) #5	(2) #5	(6) #7		#3	24" THROUGHOUT	
CB401	4	+31' - 2"	8"x14"	(2) #5	(2) #5			#3	12" THROUGHOUT	EXTEND WALL TO WALL
CB402	4	+24' - 8"	8"x20"	(2) #5	(2) #5			#3	8" O.C. THROUGHOUT	
GB1	7	-2' - 0"	18"x24"	(4) #6	(4) #6			#3	10" O.C. THROUGHOUT	
GB2	7	-2' - 0"	18"x36"	(4) #6	(4) #6			#3	16" O.C. THROUGHOUT	
GB3	7	-5' - 0"	18"x36"	(4) #6	(4) #6			#3	16" O.C. THROUGHOUT	
GB4	7	-2' - 8"	18"x28"	(4) #6	(4) #6			#3	12" O.C. THROUGHOUT	
GB5	8	-2' - 11"	18"x25"	(3) #6	(3) #6			#3	10" O.C. THROUGHOUT	
GB6	9	-2' - 0"	26"x24"	(5) #6	(5) #6			#3	10" O.C. THROUGHOUT	
RB401	4		8"x14" MIN	(2) #5	(2) #5			#3	12" THROUGHOUT	T/BEAM = T/JOIST; B/BEAM EL+27'-4"
TB201	6	+14' - 0"	8"x32"	(2) #5	(2) #5	(2) #5		#3	24" THROUGHOUT	
TB202	6	+13' - 7"	8"x27"	(2) #5	(2) #5	(2) #5		#3	12" THROUGHOUT	
TB203	4	+12' - 10"	8"x18"	(2) #5	(2) #5			#3	12" O.C. THROUGHOUT	
TB301	4	+19' - 6"	12"x26"	(2) #5	(2) #5			#3	24" THROUGHOUT	
TB302	4	+20' - 0"	8"x24"	(2) #5	(2) #5			#3	24" THROUGHOUT	
TB303	6	+20' - 8"	8"x32"	(2) #5	(2) #5	(2) #5		#3	24" THROUGHOUT	
TB401	4	+28' - 6"	8"x22"	(2) #5	(2) #5			#3	24" THROUGHOUT	
TB402	6	+29' - 10"	8"x30"	(2) #5	(2) #5	(2) #5		#3	24" THROUGHOUT	
TB403	4	+29' - 10"	8"x20"	(2) #5	(2) #5			#3	24" THROUGHOUT	
TB404	4	+28' - 6"	8"x14"	(2) #5	(2) #5			#3	12" THROUGHOUT	
TB405	4	+28' - 8 1/2"	8"x16.5"	(2) #5	(2) #5			#3	12" THROUGHOUT	
TB501	4	+39' - 3"	8"x25"	(2) #5	(2) #5			#3	24" THROUGHOUT	

Grand total: 115

CONCRETE BEAM TYPES

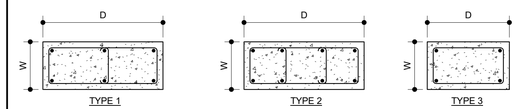


TIE / CONCRETE COLUMN SCHEDULE

MARK	TYPE	SIZE (W x D)	VERTICALS	#3 TIES (UNO)	REMARKS
TC1	1	8"x16"	(6) #6	@ 8" O.C.	
TC2	1	8"x24"	(6) #6	4" O.C.	
TC3	2	8"x32"	(8) #6	@ 4" O.C.	
TC4	1	12"x32"	(6) #8	@ 5" O.C.	
TC5	2	12"x48"	(8) #8	@ 5" O.C.	
TC6	3	8"x12"	(4) #6	@8" O.C.	

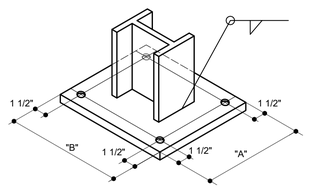
Grand total: 12

CONCRETE COLUMN TYPES

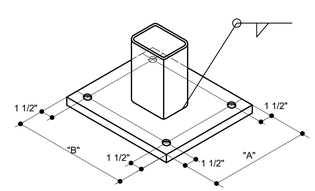


STEEL COLUMN / BASE PLATE SCHEDULE

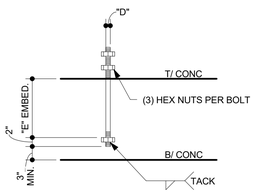
COLUMN MARK	COLUMN SIZE	BASE PLATE A	BASE PLATE B	BASE PLATE T	ANCHOR BOLT E	ANCHOR BOLT D	CAP PLATE	REMARKS
C1	W10x49	16"	16"	1"	8"	3/4"	1/4"	
C2	HSS 6x6X3/8"	12"	12"	3/4"	6"	3/4"	3/4"	



BASE PLATE DETAIL
NTS



BASE PLATE DETAIL
NTS



ANCHOR BOLT DETAIL
NTS

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PROFESSIONAL SEAL:

DRAWN BY: JSG
DESIGNED BY: EB/MJ
CHECKED BY: JSG
DATE: 10/27/2016
SCALE:
FIELD BOOK:

CONSULTANT ARCHITECT

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS

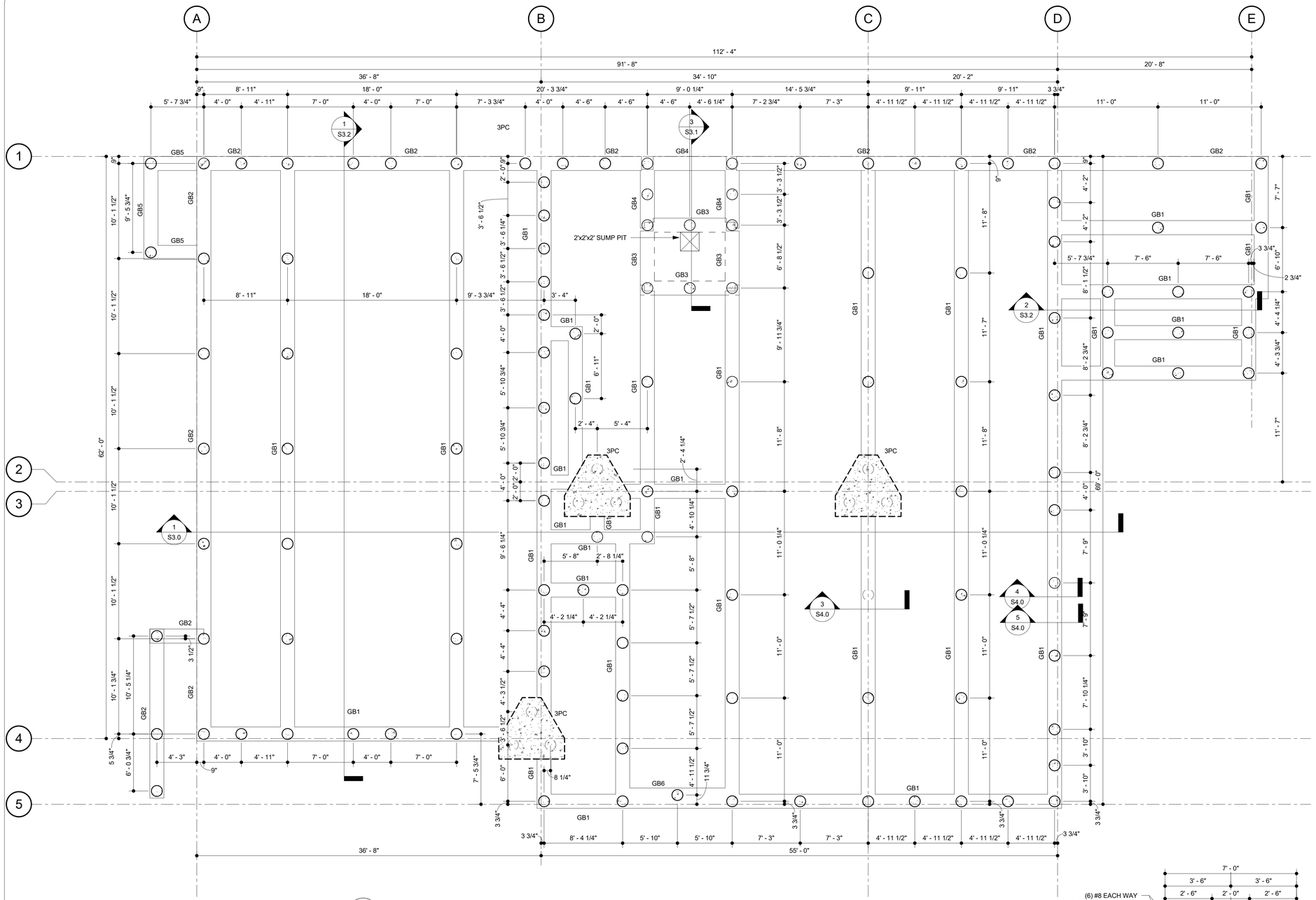
NO.	DATE	BY	CHK'D	DESCRIPTION

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
SCHEDULES
3211 NE 32nd STREET, FORT LAUDERDALE

100% CDs

SHEET NO. S1.2 | 16
TOTAL: 103
REVIT FILE: 10914-S.RVT
DRAWING FILE NO. 4-130-07

160628



1 PILE AND GRADE BEAM PLAN
3/16" = 1'-0"

PILE AND GRADE BEAM NOTES:

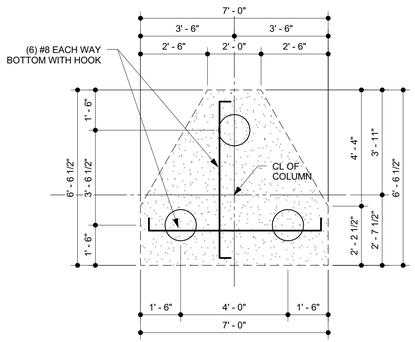
1. SEE BEAM SCHEDULE ON S1.1 FOR GRADE BEAM SIZES AND REINFORCEMENT. PROVIDE MINIMUM 3" CLEAR COVER TO GRADE BEAM TIES.
2. TOP OF GRADE BEAM ELEVATIONS ARE REFERENCED FROM EL+0'-0" = EL 7.00 NAVD
3. TOP OF GRADE BEAMS EL -2'-0" TYP EXCEPT FOR GB3 (EL -5'-0"), GB4 (EL-2'-8"), AND GB5 (-2'-11")
4. ALL GRADE BEAMS ARE CENTERED ON PILES.
5. ALL WALLS ARE CENTERED ON GRADE BEAMS EXCEPT AT GB2 AND GB4 ON GRID 1 WHERE THE EXTERIOR FACE OF THE GRADE BEAM = EXTERIOR FACE OF WALL.
6. PILES PERMITTED TO BE MAX 3" OUT OF PLAN LOCATION UNLESS ADDITIONAL EVALUATION IS DONE BY THE ENGINEER OF RECORD. PILE LAYOUT (OUT OF PLAN GEOMETRY) MUST BE EVALUATED BY THE ENGINEER OF RECORD IF IT EXCEEDS 3" FOR ALL PILES WHERE THE GRADE BEAM IS CENTERED ON THE PILE AND FOR ALL PILE CAPS. EVALUATION OF THE PILES UNDER GRADE BEAMS GB2 AND GB4 NEED TO BE REVIEWED BY THE EOR IF THE DEVIATION EXCEEDS 1".
7. DO NOT DEMOBILIZE THE PILE RIG UNTIL THE FINAL AS-BUILT PILE SURVEY HAS BEEN APPROVED BY THE EOR. DEVIATIONS OF THE PILE LOCATION COULD RESULT IN ADDITIONAL PILES AND OR CHANGES TO THE GRADE BEAM DESIGNS. THE GC SHALL ABSORB ANY ASSOCIATED COSTS FOR SUCH DEVIATIONS.
8. GRADE BEAM REINFORCEMENT TO BE CONTINUOUS IF APPLICABLE. IF THE GRADE BEAM STOPS AT THE PILE CAP, EXTEND GRADE BEAM TOP AND BOTTOM BARS TO CENTER OF PILE CAP.

EXISTING PILE NOTE:

1. INITIAL SURVEY OF THE PROPERTY HAS FOUND EXISTING 12" SQUARE PILES LOCATED WITHIN THE BUILDING FOOTPRINT.
2. ALL EXISTING PILES ARE TO BE ABANDONED AND NOT TO BE USED IN ANY MANOR FOR THIS PROJECT.
3. GC IS TO LOCATE THE NEW AND EXISTING PILES ON THE PROPERTY TO DETERMINE ANY INTERFERENCES AND CONFLICTS.
4. GC TO REFER TO TERRACON'S LETTER DATED MAY 15, 2016 REFERENCING HOW TO DEAL WITH THE EXISTING PILES. OPTIONS 1 AND 2 ARE VIABLE FOR PILES THAT CONFLICT WITH THE NEW PILES. OPTION 3 SHALL NOT BE USED.

PILE CONSTRUCTION NOTES:

1. PILES TO BE 14" DIAMETER AUGER CAST PILES REINFORCED WITH (5) #6 VERTICAL BARS FULL DEPTH AND (1) #7 CENTRAL BAR WITH CENTRALIZERS. PROVIDE #3 TIES SPACED AT 12" O.C. THROUGHOUT THE DEPTH.
2. PILE GROUT TO BE 5000 PSI MINIMUM
3. GROUTING OF PILES TO BE VISUALLY OBSERVED BY A NODARSE REPRESENTATIVE. FINAL PILE LOGS TO BE APPROVED AND SEALED BY A NODARSE ENGINEER WITH A FINAL CERTIFICATION OF THE INSTALLED PILE CAPACITY.
4. PER NODARSE GEOTECHNICAL REPORT, ESTIMATED MINIMUM PILE DEPTHS ARE 50 FEET WITH 5 FEET EMBEDMENT IN LOWER LIMESTONE FORMATION. ACTUAL PILE DEPTHS TO BE DETERMINED DURING INSTALLATION.
5. SERVICE PILE CAPACITIES ARE: 37 TONS COMPRESSION, 28 TONS TENSION WITH A FACTOR OF SAFETY OF 2.0



2 3PC DETAIL
3/8" = 1'-0"

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PROFESSIONAL SEAL:

DRAWN BY: JSG	DATE: 10/27/2016
DESIGNED BY: EB/MJ	SCALE:
CHECKED BY: JSG	
FIELD BOOK:	

REVISIONS

NO.	DATE	BY	CHK'D	DESCRIPTION

CONSULTANT ARCHITECT

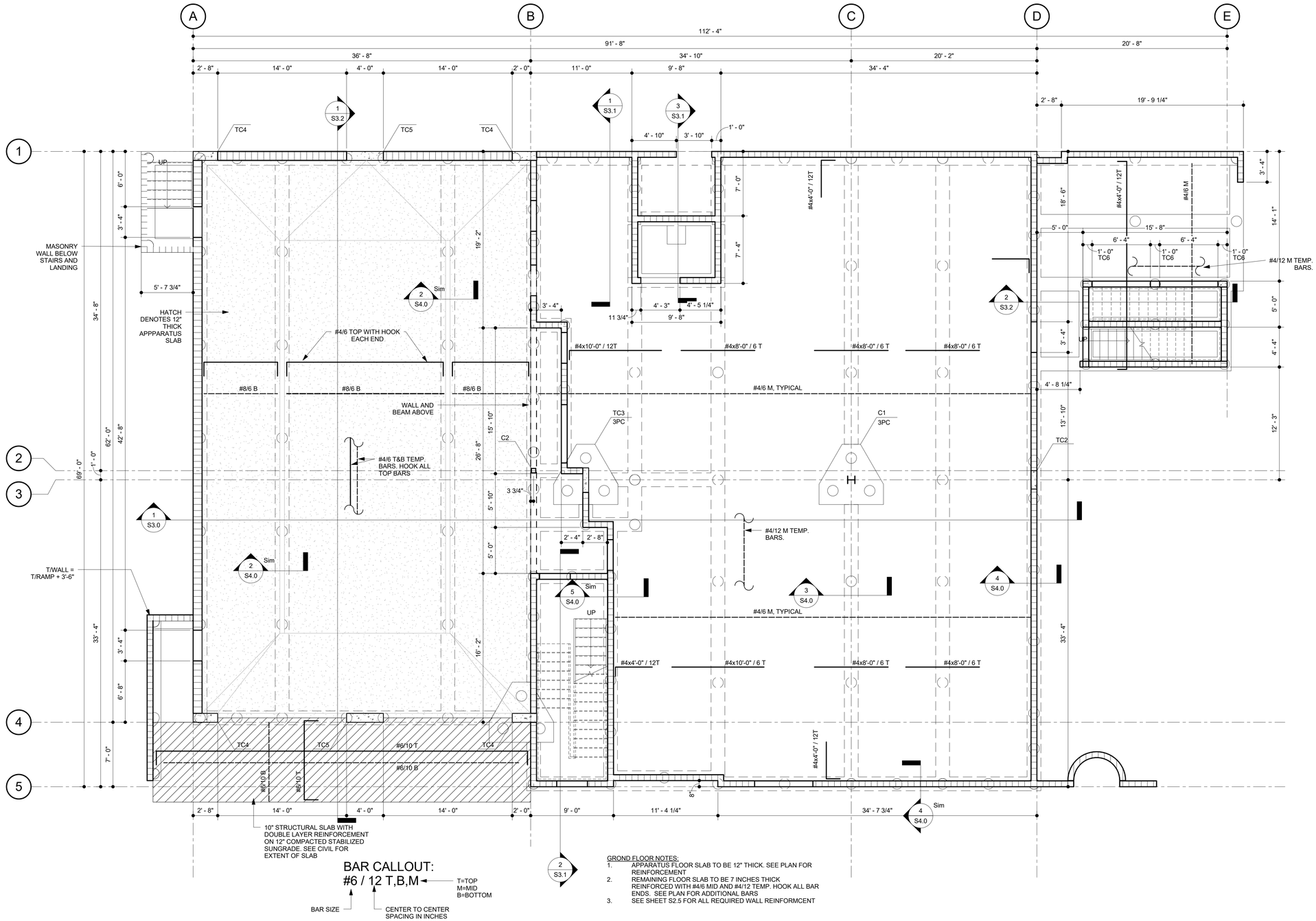
CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
PILE AND GRADE BEAM PLAN
3211 NE 32nd STREET, FORT LAUDERDALE

100% CDs

SHEET NO.	
S2.0	16
TOTAL:	103
REVIT FILE:	10914-S.RVT
DRAWING FILE NO.	4-130-07

160628



BAR CALLOUT:
#6 / 12 T,B,M
T=TOP
M=MID
B=BOTTOM
BAR SIZE
CENTER TO CENTER SPACING IN INCHES

GROUND FLOOR NOTES:
1. APPARATUS FLOOR SLAB TO BE 12" THICK. SEE PLAN FOR REINFORCEMENT
   REMAINING FLOOR SLAB TO BE 7 INCHES THICK REINFORCED WITH #4/6 MID AND #4/12 TEMP. HOOK ALL BAR ENDS. SEE PLAN FOR ADDITIONAL BARS
2. SEE SHEET S2.5 FOR ALL REQUIRED WALL REINFORMCENT

1 GROUND FLOOR PLAN
3/16" = 1'-0"

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

CONSULTANT ARCHITECT

PROFESSIONAL SEAL:

DRAWN BY: JSG
DESIGNED BY: EB/MJ
CHECKED BY: JSG
DATE: 10/27/2016
SCALE:
FIELD BOOK:

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS

NO.	DATE	BY	CHK'D	DESCRIPTION

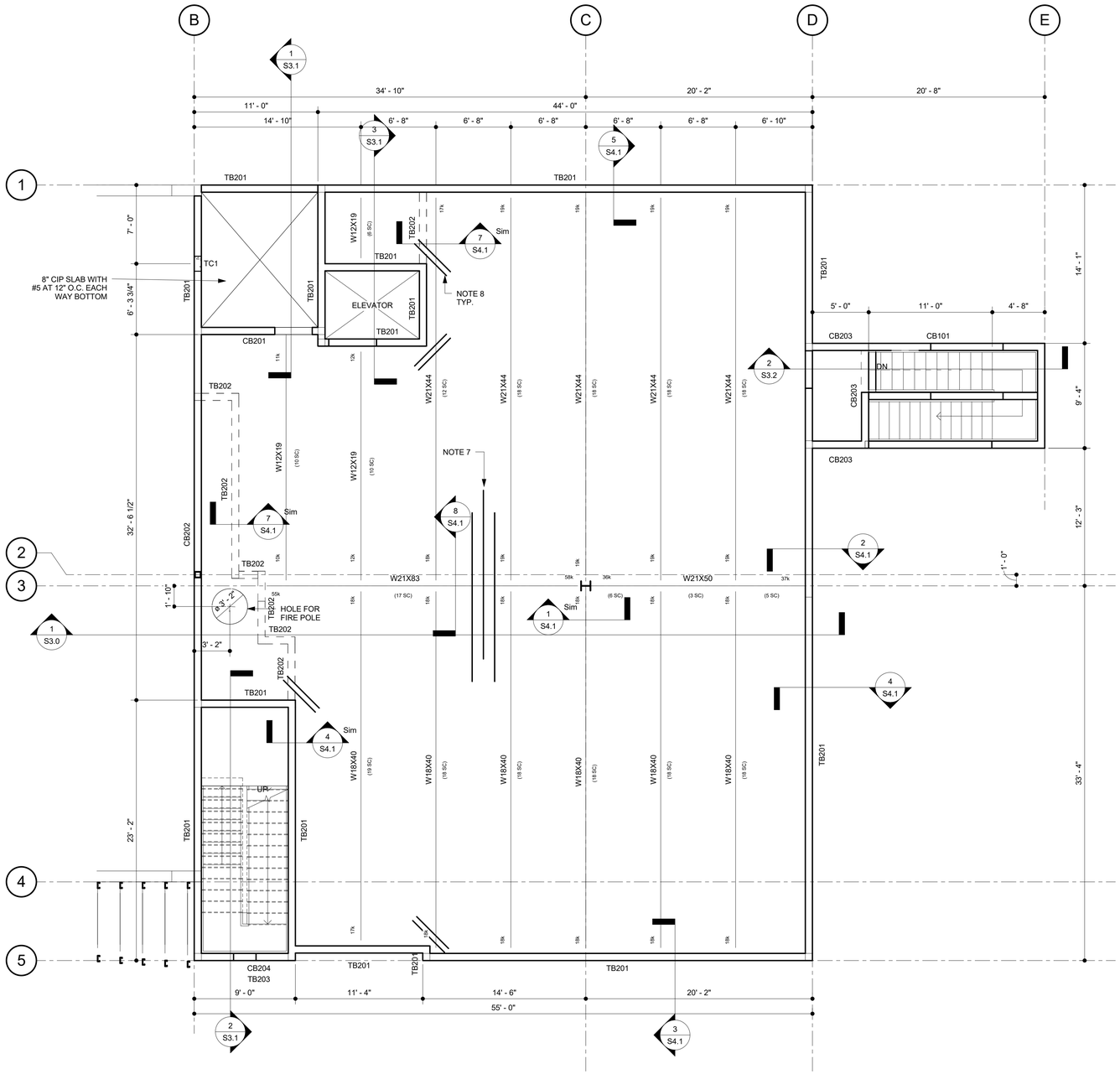
PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
GROUND FLOOR PLAN
3211 NE 32nd STREET, FORT LAUDERDALE

100% CDs

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO. S2.1
16
TOTAL: 103
REVIT FILE: 10914-S.RVT
DRAWING FILE NO. 4-130-07

160628



1 SECOND FLOOR FRAMING PLAN
3/16" = 1'-0"

SECOND FLOOR FRAMING NOTES:

1. FLOOR SYSTEM SHALL BE 3" NORMAL WEIGHT CONCRETE ON 2", 20GA GALVANIZED G60 VULCRAFT VLI COMPOSITE METAL DECK. (5" TOTAL THICKNESS).
2. T/FINISHED FLOOR EL +14'-0"
3. T/BEAM EL +13'-7"
4. REINFORCE DECK WITH 6x6 W2.1xW2.1 WELDED WIRE FABRIC CHAIRED 1.5" BELOW TOP OF SLAB.
5. FLOOR IS DESIGNED AS AN UNSHORED COMPOSITE BEAM SYSTEM. ATTACH METAL DECK TO TOP FLANGE OF BEAMS USING 5/8" DIA. PUDDLE WELDS OR HEADED STUDS IN ACCORDANCE WITH SDI 36/4 PATTERN WITH (4) #12 TEK SIDELAP SCREWS. PROVIDE 5/8" DIA PUDDLE WELDS AT 12" O.C. ALONG PERIMETER ANGLE.
6. ALL STEEL BEAMS TO BE A992, Fy = 50 KSI
7. #4x15'-0" SPACED AT 12" O.C. STAGGERED 2 FEET AND CHAIRED 1" BELOW TOP OF SLAB AT ALL GIRDER LOCATIONS.
8. PROVIDE (2) #5x4'-0" DIAGONAL CRACK BARS SPACED AT 6" O.C. AND CHAIRED 1" BELOW TOP OF SLAB AT ALL RE-ENTRANT CORNERS.
9. IF BEAM REACTION IS NOT SHOWN ON PLAN, ASSUME A MINIMUM 10 KIP REACTION

2nd FLOOR DESIGN LOADS

LIVE LOAD THROUGHOUT:	80 PSF
LIVE LOAD AT STAIRS: OR CONCENTRATED LOAD ON TREADS:	100 PSF 300 #
MISC. DEAD LOAD:	20 PSF
SYSTEM WEIGHT (3" CONCRETE & 2" DECK):	51 PSF

STEEL BEAM LEGEND

BEAM REACTION — 63.8K
STEEL BEAM SHAPE & SIZE — W24x78 (0.8)"
BEAM CAMBER (LESS THAN 1/2" IF NOT SHOWN)
BEAM REACTION — 63.8K
(18 SC) — # OF SHEAR CONNECTORS

NOTE: SERVICE REACTIONS SHOWN ON PLAN
IF NO REACTION SHOW ON PLAN USE 10K

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

CONSULTANT | ARCHITECT

PROFESSIONAL SEAL:

DRAWN BY: JSG
DESIGNED BY: EB/MJ
CHECKED BY: JSG
TEILD HOOK:
DATE: 10/27/2016
SCALE:

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

NO.	DATE	BY	CHK'D	DESCRIPTION

REVISIONS

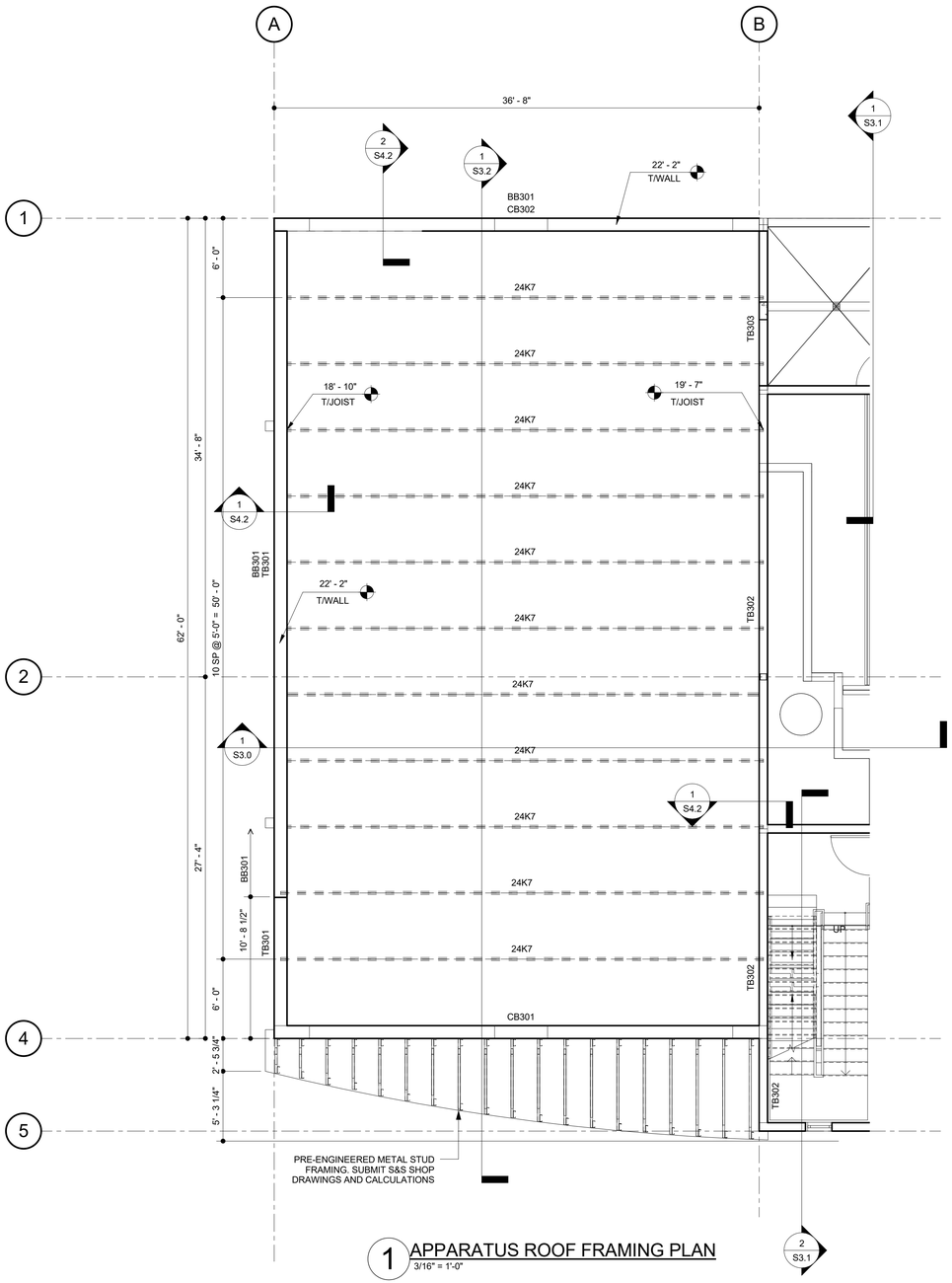
100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
SECOND FLOOR FRAMING PLAN
3211 NE 32nd STREET, FORT LAUDERDALE

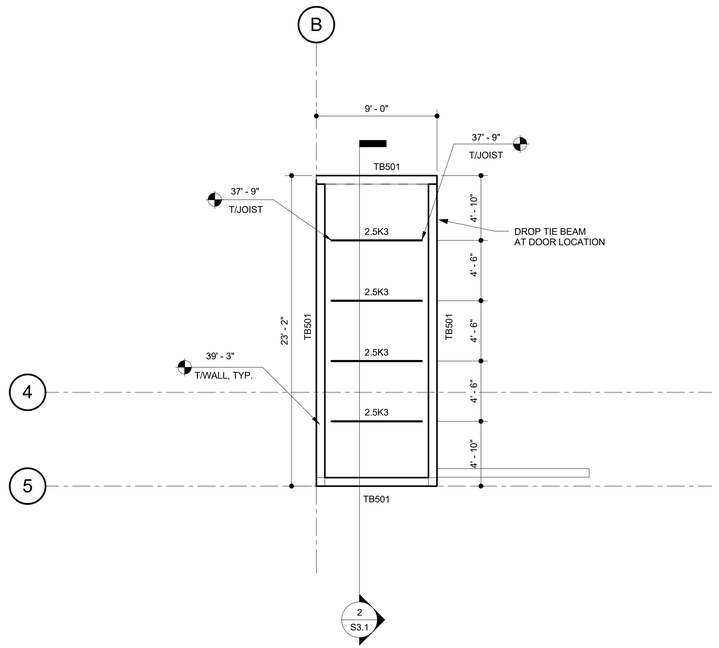
JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO. S2.2 | 16
TOTAL: 103
REVIT FILE: 10914-S.RVT
DRAWING FILE NO. 4-130-07

160628



1 APPARATUS ROOF FRAMING PLAN
3/16" = 1'-0"



2 STAIR TOWER ROOF
3/16" = 1'-0"

ROOF DESIGN LOADS		
TOP CHORD LIVE LOAD	TOP CHORD DEAD LOAD	BOTTOM CHORD DEAD LOAD
30 PSF	25 PSF	5 PSF

ROOF FRAMING NOTES:

1. ROOF SYSTEM TO BE TPO ROOF OVER LIGHTWEIGHT INSULATING CONCRETE (F'c = 300 PSI) OVER 1.5" TYPE "B", 20ga GALVANIZED G90 METAL ROOF DECK CONTINUOUS OVER 3 OR MORE SPANS.
2. METAL ROOF DECK TO BE NOMINALLY VENTED.
3. ATTACH DECK PER SDI 36/7 ATTACHMENT PATTERN. PROVIDE (6) #10 TEK SIDELAP SCREWS.
4. SEE PLANS FOR TOP OF JOIST AND TOP OF PARAPET ELEVATIONS.
5. SEE SHEET S1.1 FOR BRIDGING NOTES, DETAILS, AND ROOF UPLIFT PLAN.

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

CONSULTANT ARCHITECT

PROFESSIONAL SEAL:

DRAWN BY: JSG	DATE: 10/27/2016
DESIGNED BY: EB/MJ	SCALE:
CHECKED BY: JSG	
FIELD BOOK:	

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS			
NO.	DATE	BY	DESCRIPTION

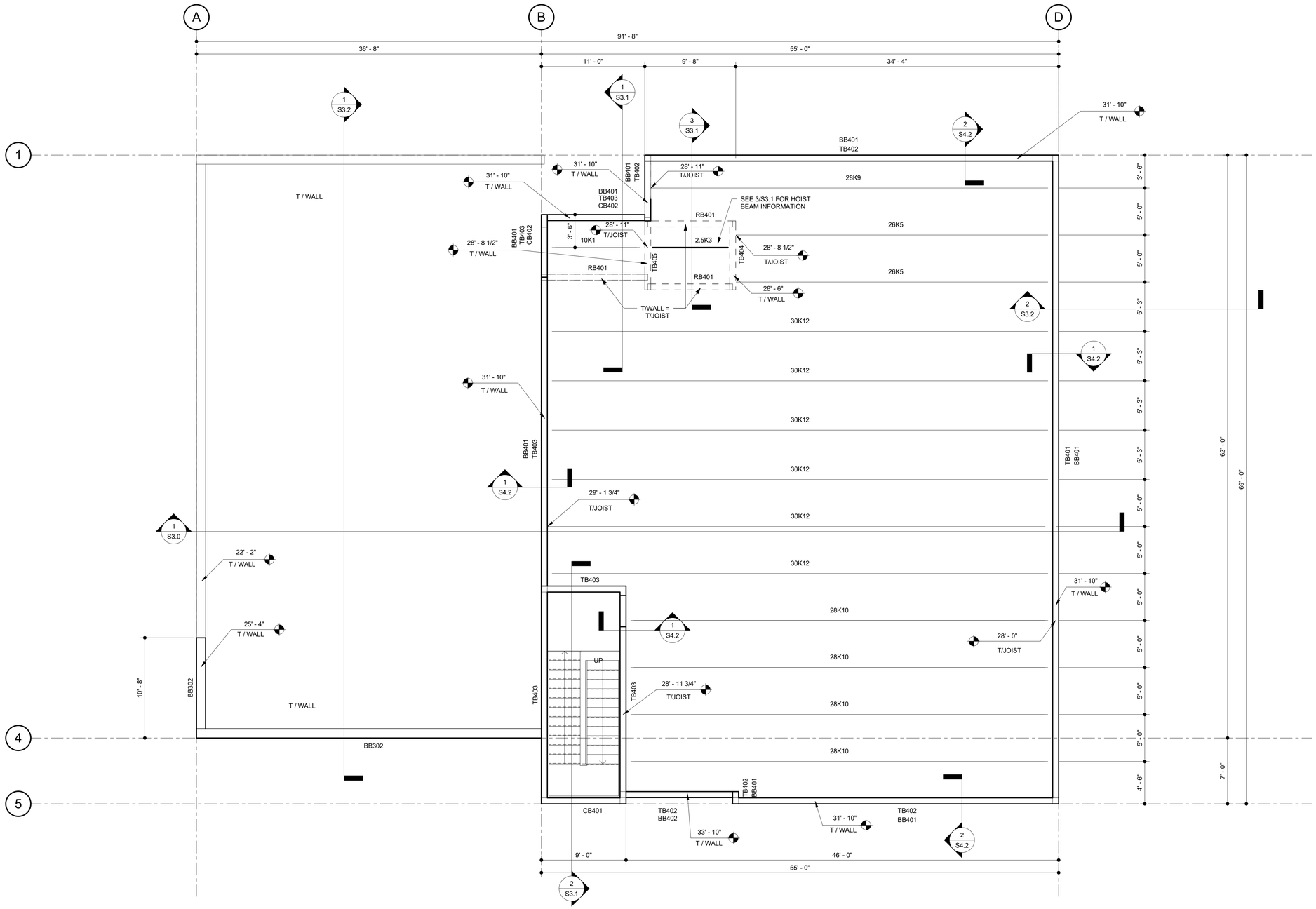
100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
APPARATUS AND STAIRS ROOF FRAMING
3211 NE 32nd STREET, FORT LAUDERDALE

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO.	
S2.3	16
TOTAL:	103
REVIT FILE: 10914-S.RVT	
DRAWING FILE NO. 4-130-07	

160628



1 HIGH ROOF FRAMING PLAN
3/16" = 1'-0"

ROOF DESIGN LOADS		
TOP CHORD LIVE LOAD	TOP CHORD DEAD LOAD	BOTTOM CHORD DEAD LOAD
30 PSF	25 PSF	5 PSF

ROOF FRAMING NOTES:
1. ROOF SYSTEM TO BE TPO ROOF OVER LIGHTWEIGHT INSULATING CONCRETE (F'c = 300 PSI) OVER 1.5" TYPE "B", 20ga GALVANIZED G90 METAL ROOF DECK CONTINUOUS OVER 3 OR MORE SPANS.
2. METAL ROOF DECK TO BE NOMINALLY VENTED.
3. ATTACH DECK PER SDI 36/7 ATTACHMENT PATTERN. PROVIDE (6) #10 TEK SIDELAP SCREWS.
4. SEE PLANS FOR TOP OF JOIST AND TOP OF PARAPET ELEVATIONS.
5. SEE SHEET S1.1 FOR BRIDGING NOTES, DETAILS, AND ROOF UPLIFT PLAN.

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PROFESSIONAL SEAL:

DRAWN BY	DATE
JSG	10/27/2016
DESIGNED BY	SCALE:
EB / MJ	
CHECKED BY	
JSG	
TIELD HOOK	

CONSULTANT | ARCHITECT

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS			
NO.	DATE	BY	CHK'D

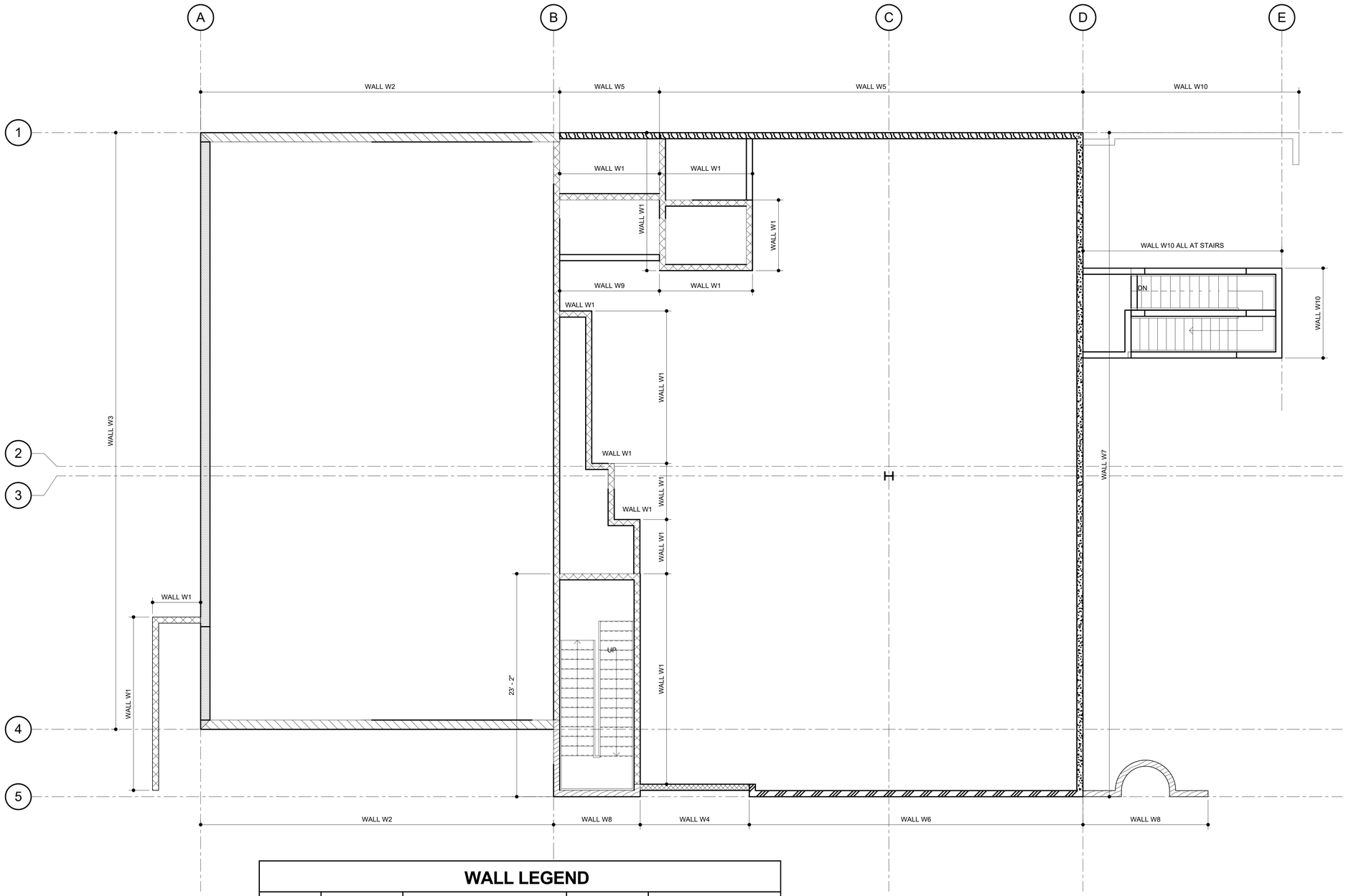
PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
HIGH ROOF FRAMING PLAN
3211 NE 32nd STREET, FORT LAUDERDALE

100% CDs

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO.	
S2.4	16
TOTAL:	103
REVIT FILE: 10914-S.RVT	
DRAWING FILE NO. 4-130-07	

160628



WALL LEGEND

WALL MARK	BLOCK SIZE	WALL REINFORCEMENT	FULLY GROUTED	CAST-CRETE LINTELS
WALL W1	8" MASONRY	#5 AT 40" O.C. FROM BASE TO T/WALL	FROM GB TO EL +0'-0"	8F8-1B MAN DOORS; 8F16-1B WIDER
WALL W2	12" MASONRY	#6 AT 40" O.C. ABOVE APPARATUS DOORS	YES AT GRID 4 AT SILL AT GRID 1	N/A
WALL W3	12" MASONRY	#7 AT 16" O.C. IN THE FIELD #6 AT 32" O.C. ABOVE/BELOW OPENINGS	YES	12F8-1B
WALL W4	8" MASONRY	#6 AT 40" O.C. FROM BASE TO T/WALL (8) #3 HORIZONTAL NEXT TO WINDOWS	FROM GB TO EL +0'-0"	8F16-1B/1T
WALL W5 AND WALL W6	8" MASONRY	GROUND TO 2nd FLOOR: #7 AT 8" O.C. IN THE FIELD #6 AT 40" O.C. BELOW OPENINGS #6 AT 8" O.C. ABOVE OPENINGS 2nd FLOOR TO TOP OF WALL: #7 AT 8" O.C. IN THE FIELD #6 AT 8" O.C. BELOW OPENINGS #6 AT 40" O.C. ABOVE OPENINGS	YES	8F16-1B/1T
WALL W7	8" MASONRY	#6 AT 32" O.C. FROM BASE TO T/WALL	FROM GB TO EL +0'-0"	8F16-1B/1T
WALL W8	8" MASONRY	#6 AT 8" O.C. FROM BASE TO T/WALL	YES	8F8-1B OR DTB
WALL W9	8" MASONRY	#6 AT 24" O.C. FROM BASE TO T/WALL	YES	8F16-1B
WALL W10	8" MASONRY	#5 AT 32" O.C. FROM BASE TO T/WALL	FROM GB TO EL +0'-0"	8F16-1B

1 MASONRY WALL LEGEND
3/16" = 1'-0"

791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PGAL

PROFESSIONAL SEAL:

DRAWN BY: JSG
DESIGNED BY: EB/AMJ
CHECKED BY: JSG
FIELD BOOK:
DATE: 10/27/2016
SCALE:

CONSULTANT | ARCHITECT

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS

NO.	DATE	BY	CHK'D	DESCRIPTION

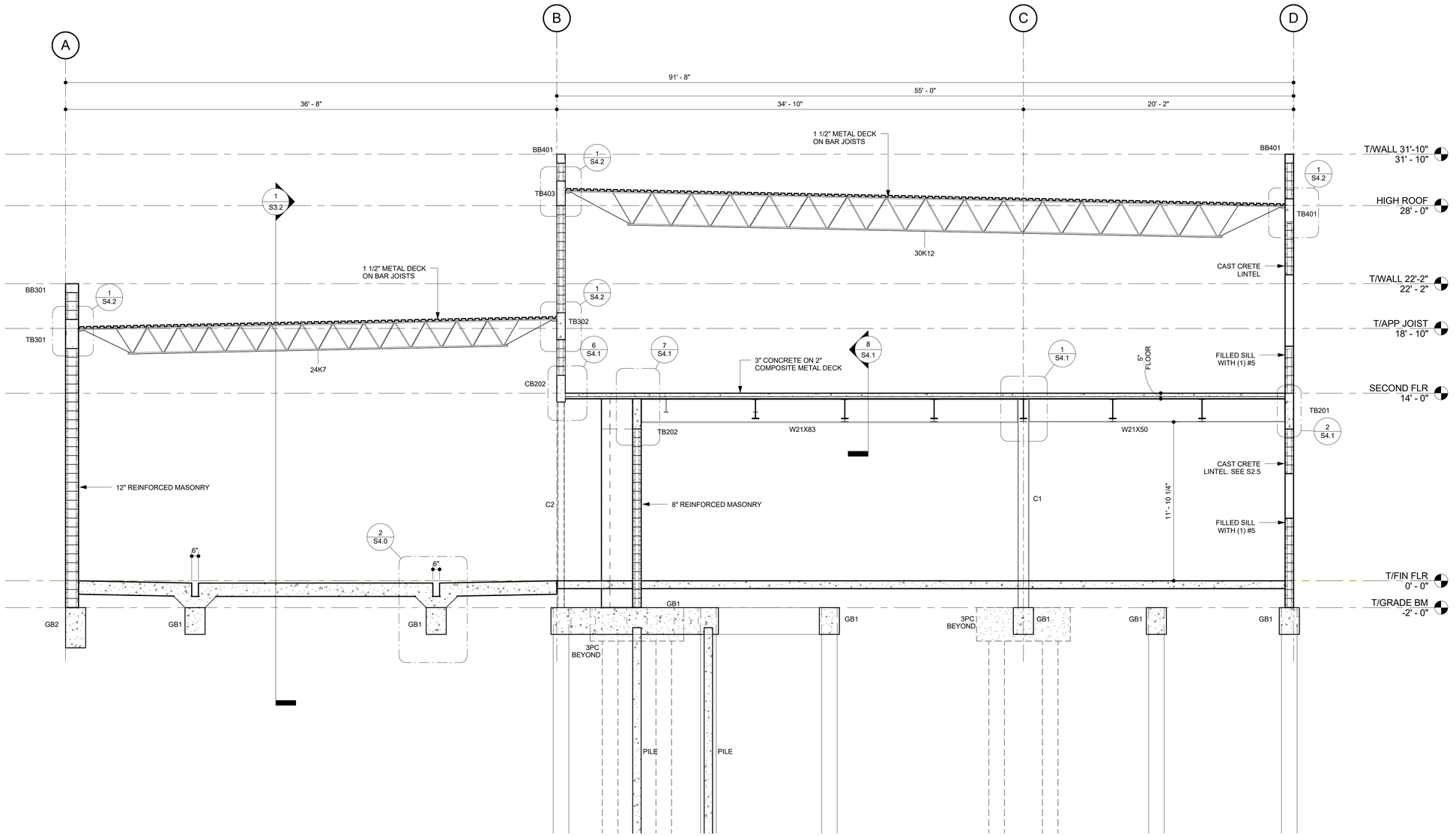
100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
MASONRY WALL LEGEND
3211 NE 32nd STREET, FORT LAUDERDALE

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO. S2.5 | 16
TOTAL: 103
REVIT FILE: 10914-S.RVT
DRAWING FILE NO. 4-130-07

160628



1 BUILDING LONGITUDINAL SECTION
1/4" = 1'-0"

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PROFESSIONAL SEAL:

DRAWN BY	DATE
JSG	10/27/2016
DESIGNED BY	SCALE
EB / MJ	
CHECKED BY	
JSG	
TIELD HOOK	

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

CONSULTANT ARCHITECT

NO.	DATE	BY	CHK'D	DESCRIPTION

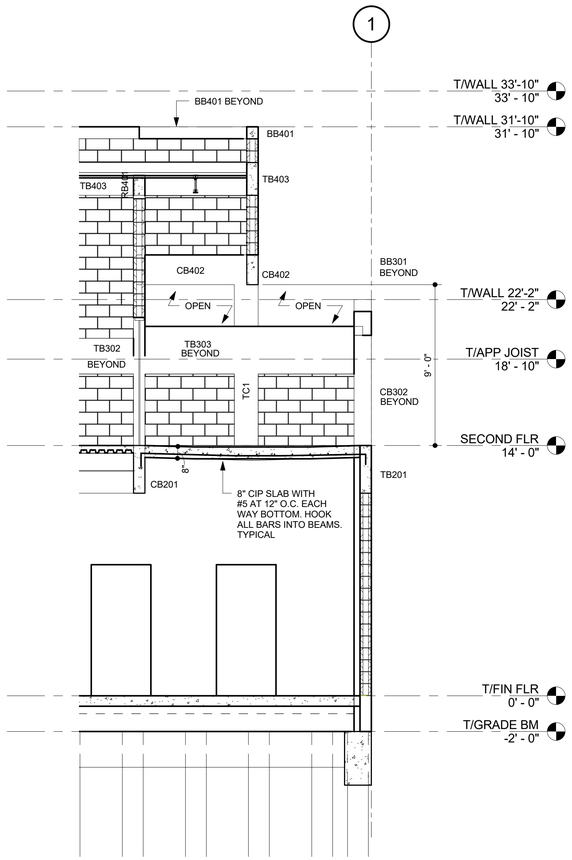
100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
BUILDING SECTION
3211 NE 32nd STREET, FORT LAUDERDALE

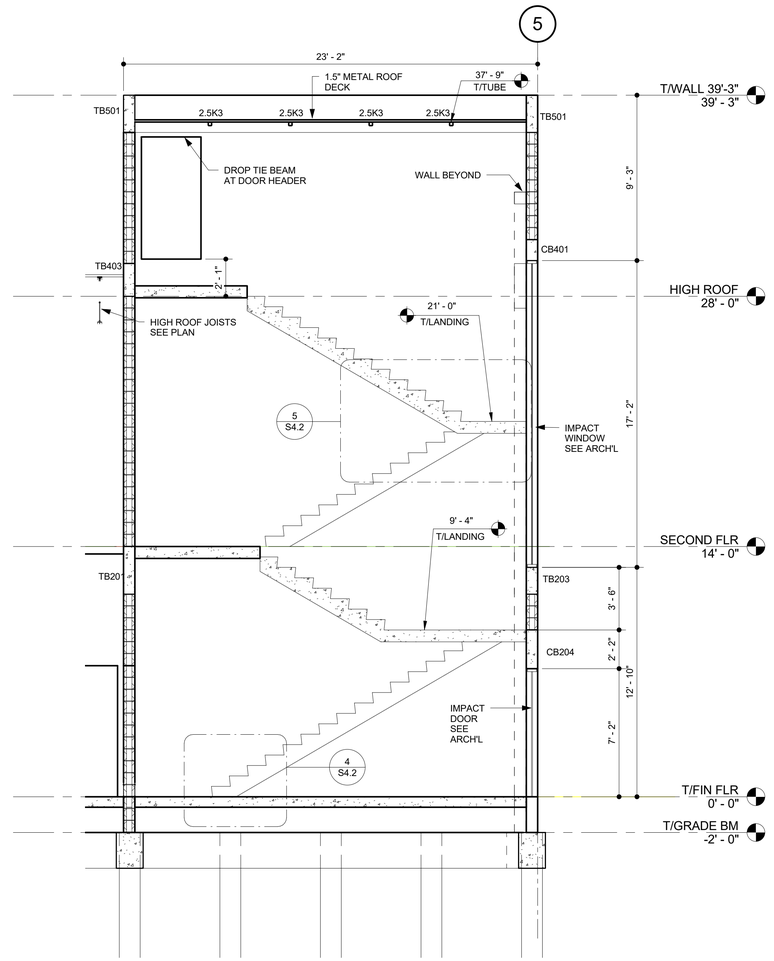
JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO.	
S3.0	16
TOTAL:	103
REVIT FILE: 10914-S.RVT	
DRAWING FILE NO. 4-130-07	

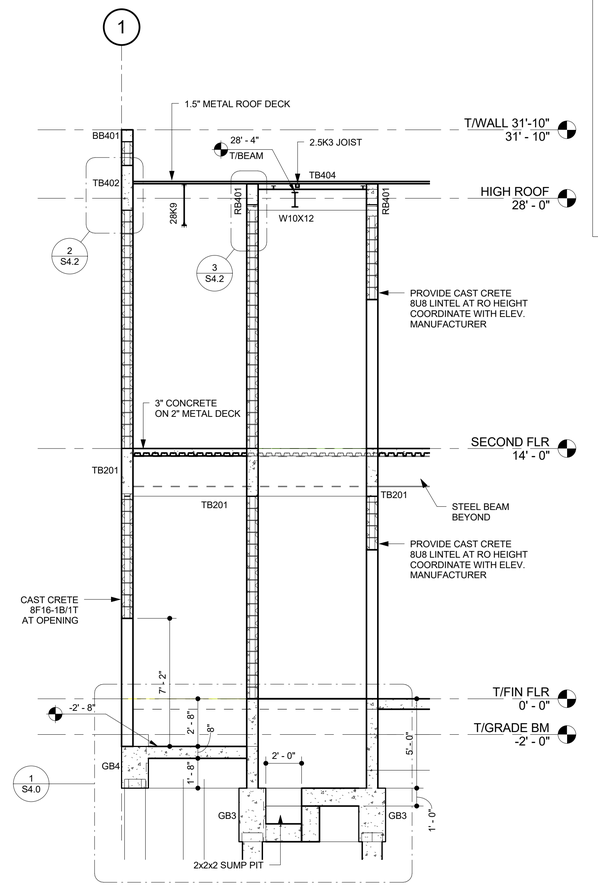
160628



1 BUILDING SECTION AT PORCH
1/4" = 1'-0"



2 BUILDING SECTION THROUGH STAIR
1/4" = 1'-0"



3 SECTION THROUGH ELEVATOR AND BACK WALL
1/4" = 1'-0"

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

CONSULTANT ARCHITECT

PROFESSIONAL SEAL:

DRAWN BY: JSG
DESIGNED BY: EB / MJ
CHECKED BY: JSG
FIELD BOOK:
DATE: 10/27/2016
SCALE:

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

NO.	DATE	BY	CHK'D	DESCRIPTION

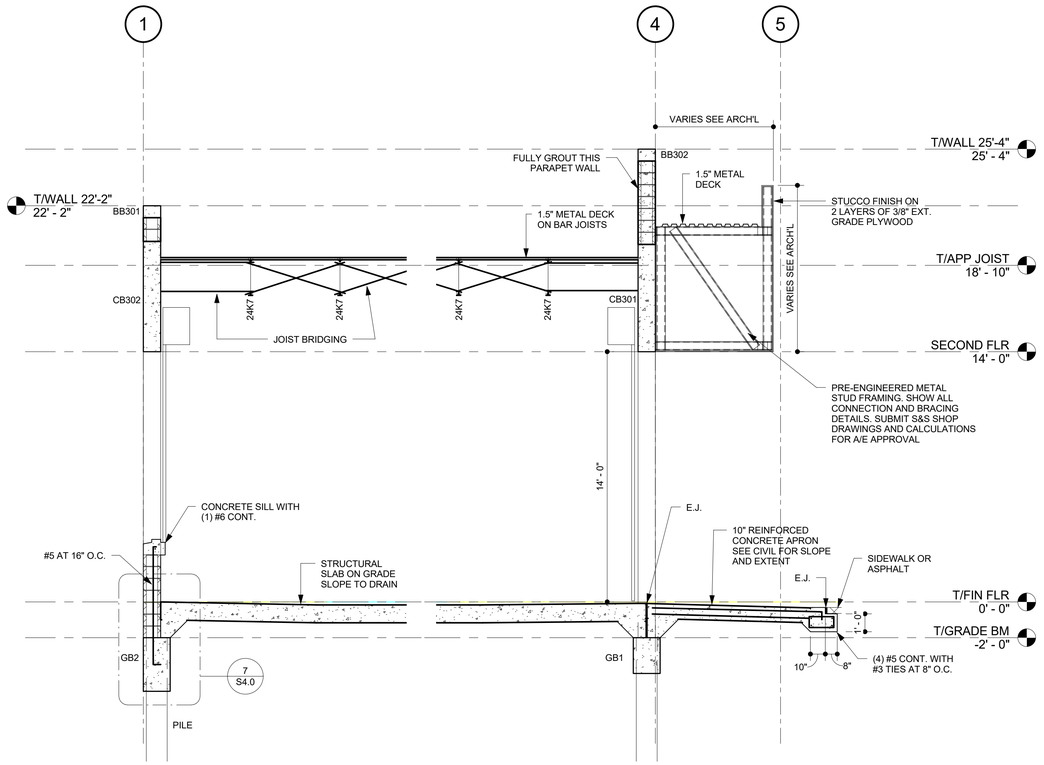
100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
BUILDING SECTIONS
3211 NE 32nd STREET, FORT LAUDERDALE

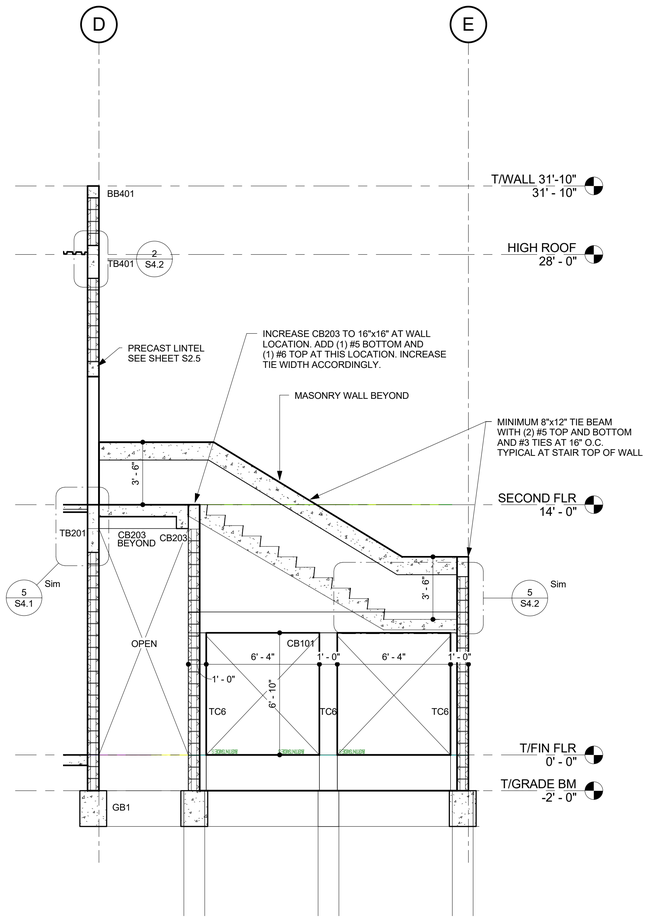
JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO.	
S3.1	16
TOTAL:	103
REVIT FILE:	10914-S.RVT
DRAWING FILE NO.	4-130-07

160628



1 SECTION THROUGH APPARATUS BAY
1/4" = 1'-0"



2 SECTION AT EXTERIOR STAIR
1/4" = 1'-0"

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PROFESSIONAL SEAL:

DRAWN BY	DATE
JSG	10/27/2016
DESIGNED BY	SCALE
EB / AMJ	
CHECKED BY	
JSG	
FIELD BOOK	

CONSULTANT ARCHITECT

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

NO.	DATE	BY (CHK'D)	DESCRIPTION

REVISIONS

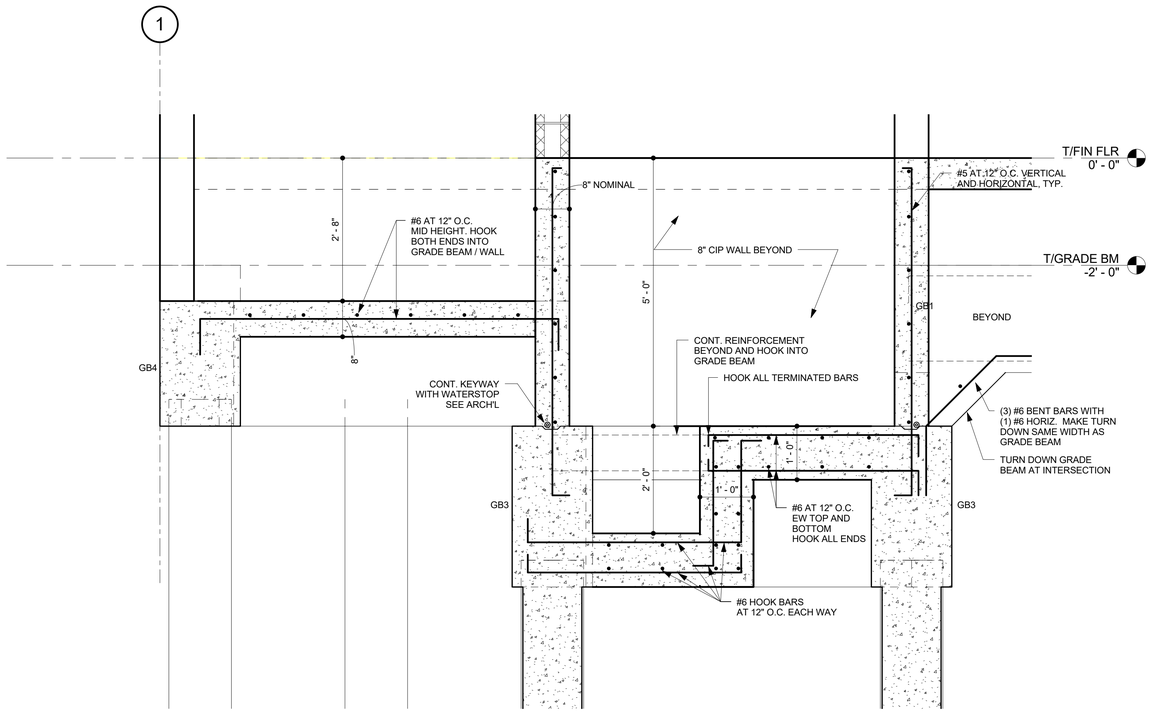
100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
BUILDING SECTIONS
3211 NE 32nd STREET, FORT LAUDERDALE

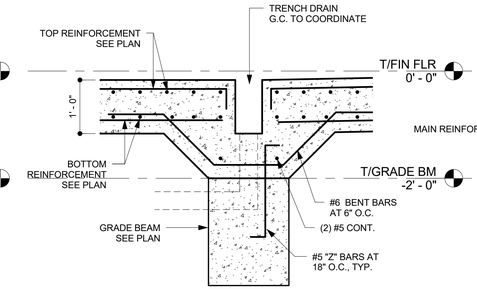
JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO.	
S3.2	16
TOTAL:	103
REVIT FILE: 10914-S.RVT	
DRAWING FILE NO. 4-130-07	

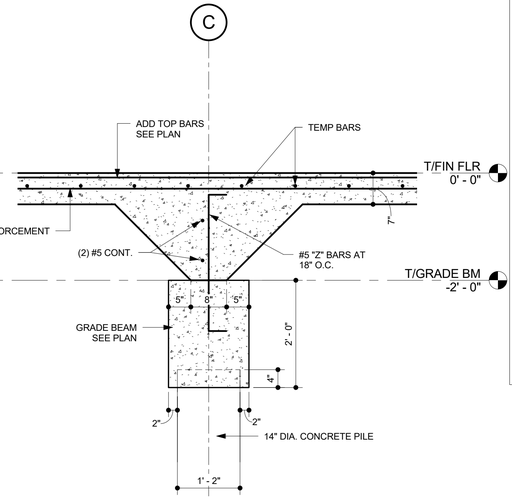
160628



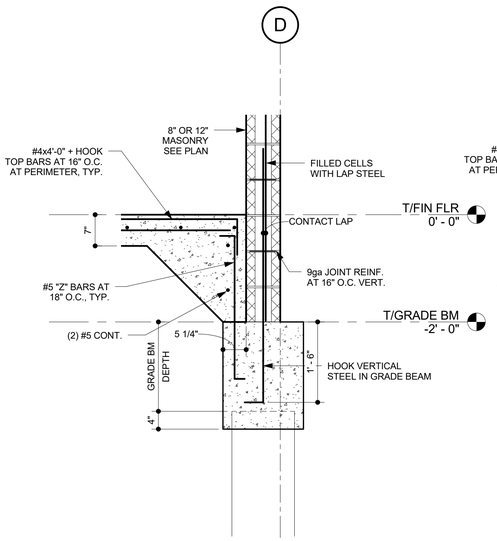
1 SECTION AT ELEVATOR PIT
3/4" = 1'-0"



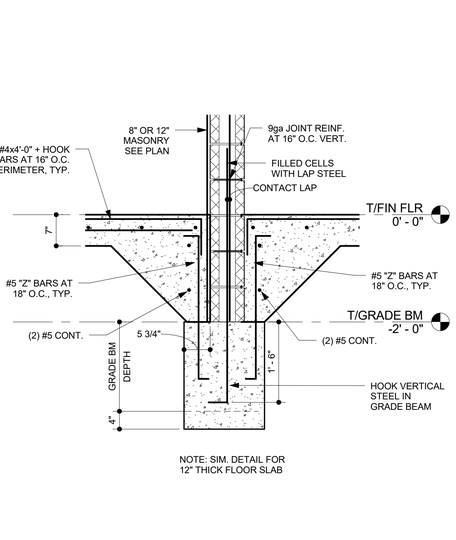
2 SECTION AT TRENCH DRAIN
3/4" = 1'-0"



3 SECTION AT GRADE BEAM
3/4" = 1'-0"



4 SECTION AT EXTERIOR WALL
3/4" = 1'-0"



NOTE: SIM. DETAIL FOR 12" THICK FLOOR SLAB

5 SECTION AT INTERIOR WALL
3/4" = 1'-0"

6 ELEVATION AT GRADE BEAM
3/4" = 1'-0"

7 FOUNDATION AT APPARATUS BAY
3/4" = 1'-0"

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PROFESSIONAL SEAL:

DRAWN BY: JSG
DESIGNED BY: EB / MJ
CHECKED BY: JSG
FIELD HOOK:
DATE: 10/27/2016
SCALE:

CONSULTANT ARCHITECT

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS

NO.	DATE	BY	CHK'D	DESCRIPTION

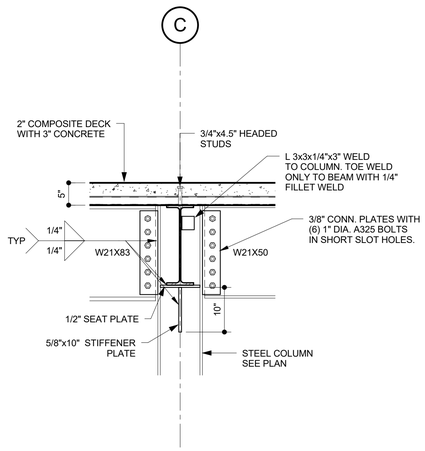
100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
FOUNDATION DETAILS
3211 NE 32nd STREET, FORT LAUDERDALE

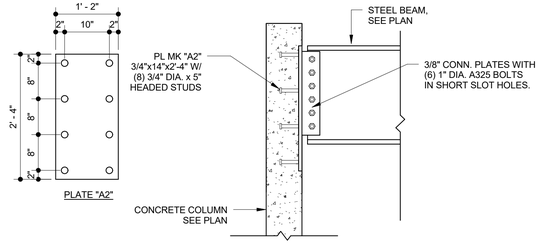
JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO. S4.0
16
TOTAL: 103
REVIT FILE: 10914-S.RVT
DRAWING FILE NO. 4-130-07

160628

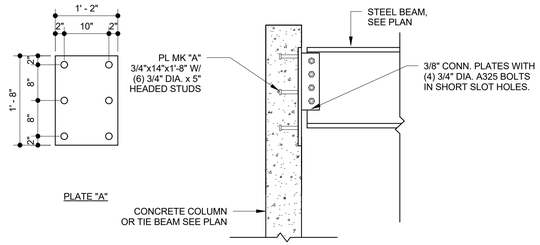


1 SECTION AT BEAMS TO COLUMN
3/4" = 1'-0"



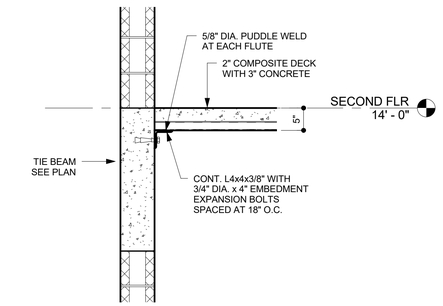
NOTE: USE THIS CONNECTION FOR REACTIONS IN EXCESS OF 25 KIPS

2 SECTION AT PRIMARY BEAM TO WALL
3/4" = 1'-0"

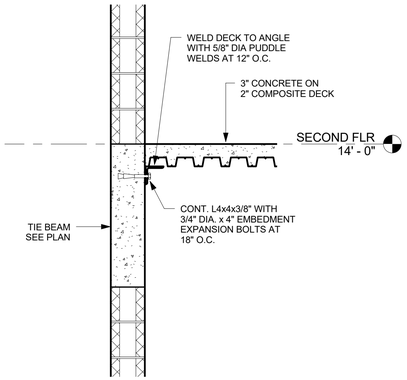


NOTE: USE THIS CONNECTION FOR REACTIONS EQUAL TO OR LESS THAN 25 KIPS

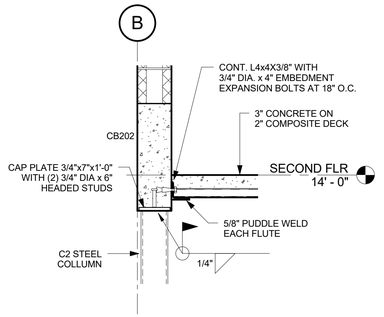
3 SECTION AT SECONDARY BEAM TO WALL
3/4" = 1'-0"



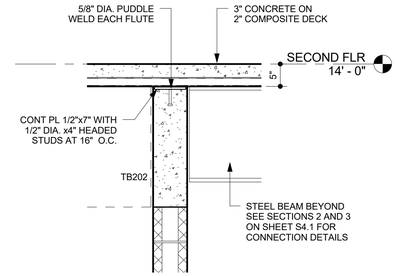
4 SECTION AT 2ND FLOOR DECK BEARING
3/4" = 1'-0"



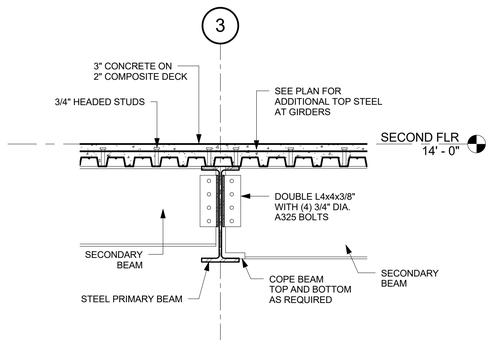
5 SECTION AT PARALLEL DECK
3/4" = 1'-0"



6 SECTION AT COLUMN TO BEAM
3/4" = 1'-0"



7 SECTION AT LOW WALL
3/4" = 1'-0"



8 SECTION AT BEAM TO BEAM
3/4" = 1'-0"

PGAL
791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PROFESSIONAL SEAL:

DRAWN BY: JSG	DATE: 10/27/2016
DESIGNED BY: EB/MJ	SCALE:
CHECKED BY: JSG	
FIELD BOOK:	

CONSULTANT ARCHITECT

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

NO.	DATE:	BY	DESCRIPTION

REVISIONS

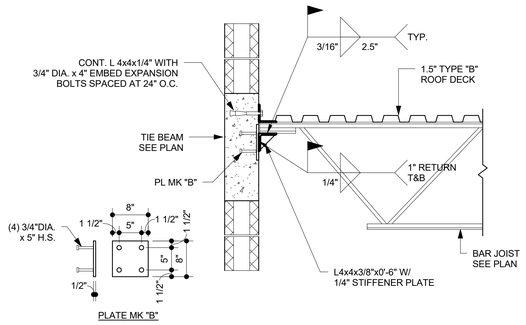
100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
FRAMING DETAILS
3211 NE 32nd STREET, FORT LAUDERDALE

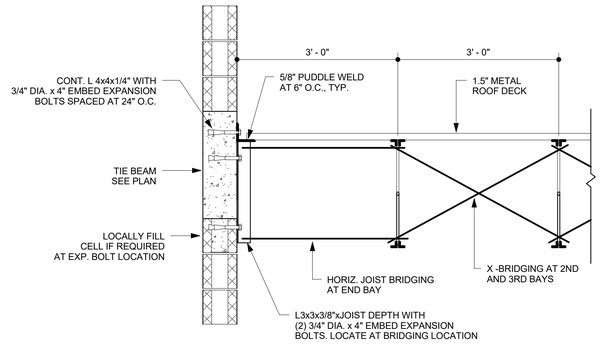
JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO.	
S4.1	16
TOTAL:	103
REVIT FILE: 10914-S.RVT	
DRAWING FILE NO. 4-130-07	

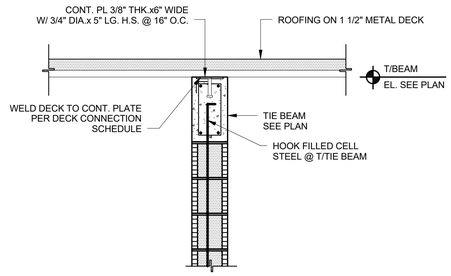
160628



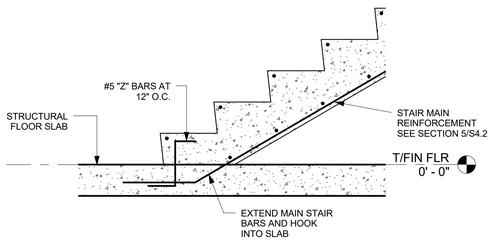
1 SECTION AT JOIST BEARING
3/4" = 1'-0"



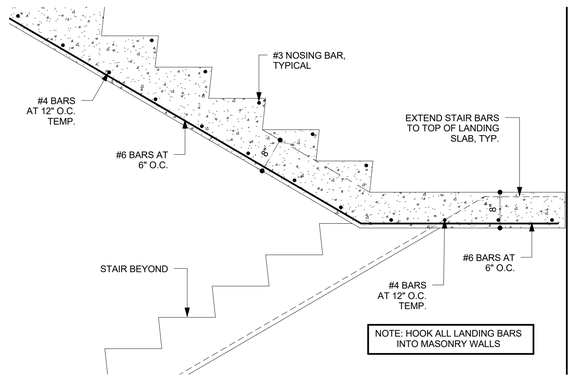
2 SECTION AT BRIDGING
3/4" = 1'-0"



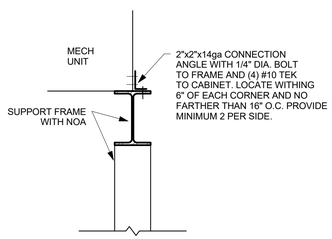
3 SECTION AT DECK TO CMU
3/4" = 1'-0"



4 SECTION AT STAIR BASE
3/4" = 1'-0"

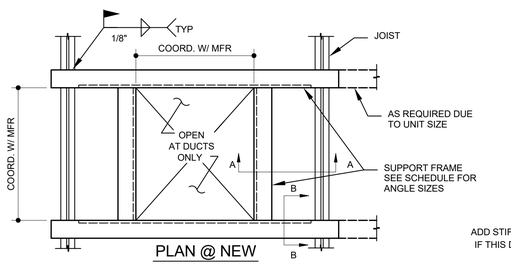


5 TYPICAL STAIR DETAIL
3/4" = 1'-0"



AT CONDENSER FRAME

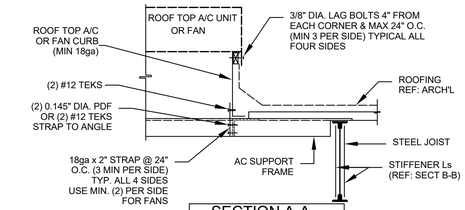
ROOF TOP UNIT FRAME SCHEDULE		
UNIT WEIGHT	ANGLE SIZE	
0 - 675 lbs	L4x3x1/4	LLH
676 - 1500 lbs	L4x3 1/2x5/16	LLH
1501 - 3000 lbs	L6x4x3/8	LLH
3001 - 6000 lbs	L6x6x3/8	



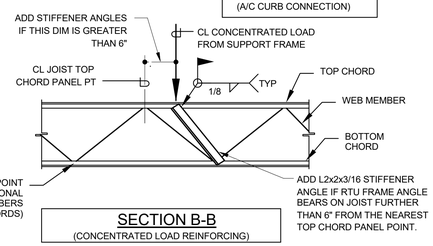
PLAN @ NEW

NOTES:
1. VERIFY ALL DIM'S & DETAILS W/ MECH CONTR BEFORE FABRICATION.
2. A/C UNIT TOTAL WEIGHT-SEE PLAN FOR WEIGHT AND FRAME SCHEDULE FOR ANGLE FRAME SIZE.
3. PROVIDE L3x3x1/4 FRAME AT ALL OPNGS GREATER THAN 12" ON ANY SIDE.
4. THE ANGLE FRAME SHALL BE PROVIDED SO THAT THE ENTIRE PERIMETER OF THE RTU CURB IS SUPPORTED.

A DET. MECH ROOF SUPPORT



SECTION A-A
(A/C CURB CONNECTION)



SECTION B-B
(CONCENTRATED LOAD REINFORCING)

791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PGAL

CONSULTANT ARCHITECT

PROFESSIONAL SEAL:

DRAWN BY: JSG
DESIGNED BY: EB / MJ
CHECKED BY: JSG
DATE: 10/27/2016
SCALE:
FIELD HOOK:

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

REVISIONS			
NO.	DATE	BY	CHK'D	DESCRIPTION
2	02/20/2017	MJ		PERMIT COMMENTS

100% CDs

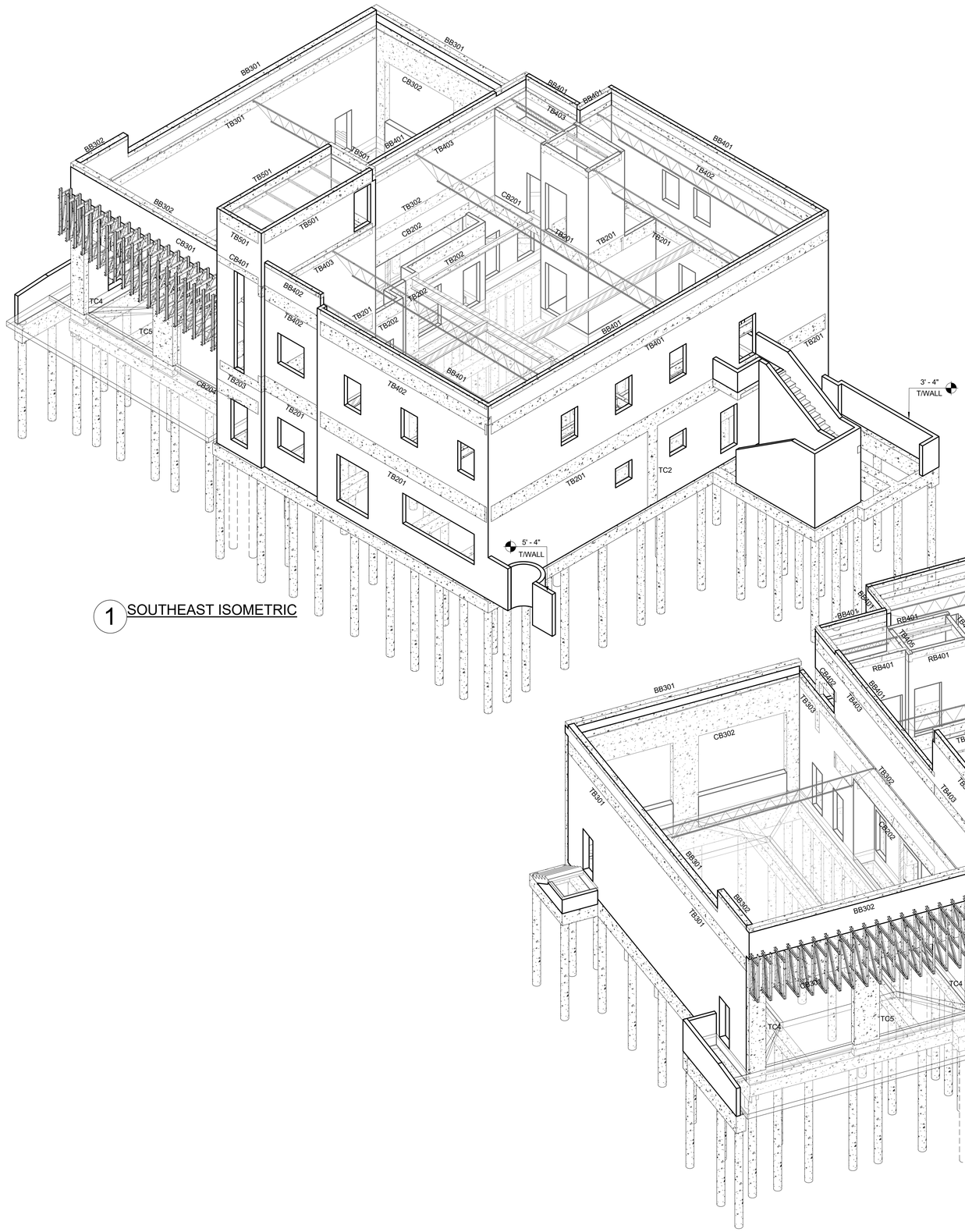
PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
FRAMING DETAILS
3211 NE 32nd STREET, FORT LAUDERDALE

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

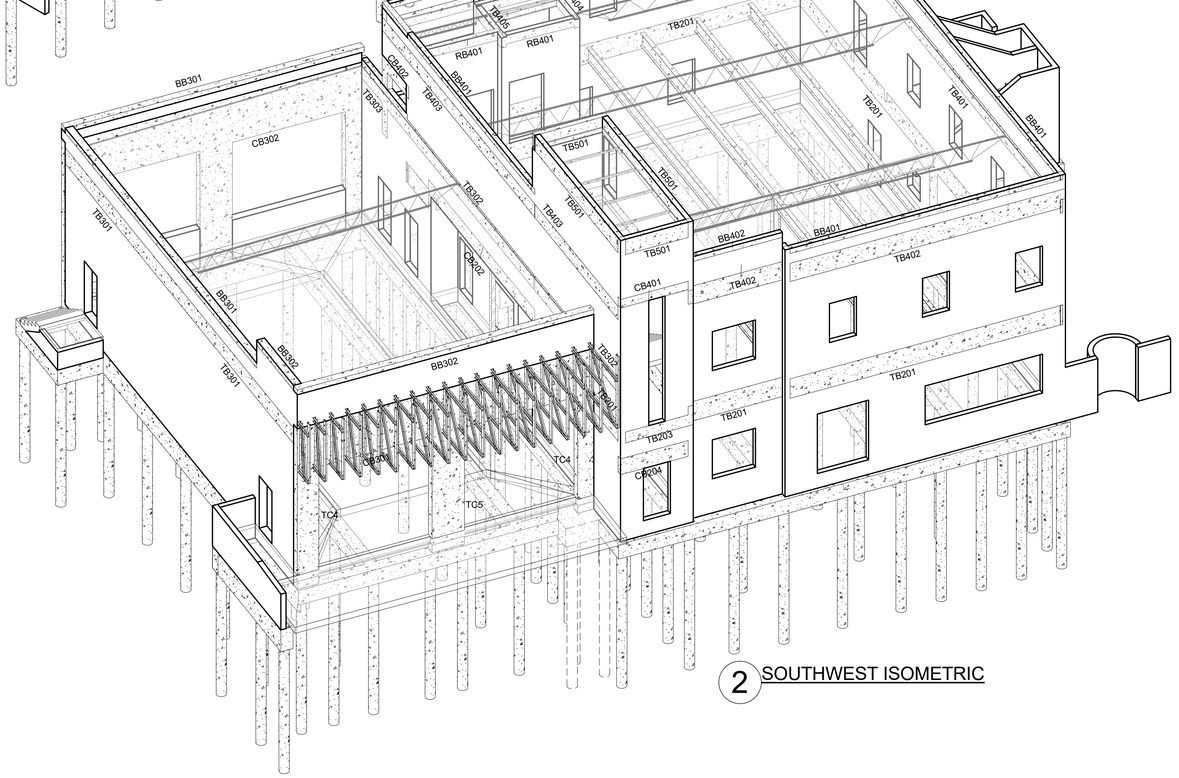
SHEET NO. S4.2
16
TOTAL: 103
REVIT FILE: 10914-S.RVT
DRAWING FILE NO. 4-130-07

160628

NOTE: THE PURPOSE OF THESE ISOMETRICS IS TO ASSIST THE BUILDER IN VISUALIZING THE CONSTRUCTION OF THE BUILDING. GRAPHICALLY THE BUILDING MAY NOT BE PERFECT WITH RESPECT TO BEAM INTERSECTIONS, WRAPS, ETC. REFER TO PLANS AND SCHEDULES FOR DETAILED INFORMATION



1 SOUTHEAST ISOMETRIC



2 SOUTHWEST ISOMETRIC

PGAL

791 PARK OF COMMERCE
SUITE 400
BOCA RATON, FL 33487
[T] 561 988 4002
[F] 561 988 3002
WWW.PGAL.COM
PGAL Lic. No. - AA 0003337

PROFESSIONAL SEAL:

DRAWN BY: JSG	DATE: 10/27/2016
DESIGNED BY: EB/MJ	SCALE:
CHECKED BY: JSG	
TIELD BOOK:	

CONSULTANT | ARCHITECT

CITY OF FORT LAUDERDALE
PUBLIC WORKS DEPARTMENT
ENGINEERING & ARCHITECTURE
100 North Andrews Avenue, Fort Lauderdale, Florida 33301

NO.	DATE	BY	CHK'D	DESCRIPTION

100% CDs

PROJECT # P10914
FIRE STATION #54
BUILDING REPLACEMENT
BUILDING ISOMETRICS
3211 NE 32nd STREET, FORT LAUDERDALE

JOHNSON STRUCTURAL GROUP
E.B. #00008893
MARK JOHNSON, P.E. #51983, SECB
3500 N.W. Boca Raton Blvd., Suite 618
Boca Raton, FL 33431
(P)(561) 982-8999 (F)(561) 982-8899
EMAIL: mark@johnsonstructural.com
WWW.JOHNSONSTRUCTURAL.COM

SHEET NO.	
S5.0	16
TOTAL:	103
REVIT FILE: 10914-S.RVT	
DRAWING FILE NO. 4-130-07	

160628

Submittal

Trane U.S. Inc.

Prepared For:
<customer>
<company>

Sold To:

Date: 5/3/2022

Customer P.O. Number:
Customer Project Number:

Job Number:
Job Name: Ft Lauderdale Fire Stn 54

Trane is pleased to provide the enclosed submittal for your review and approval.

Product Summary

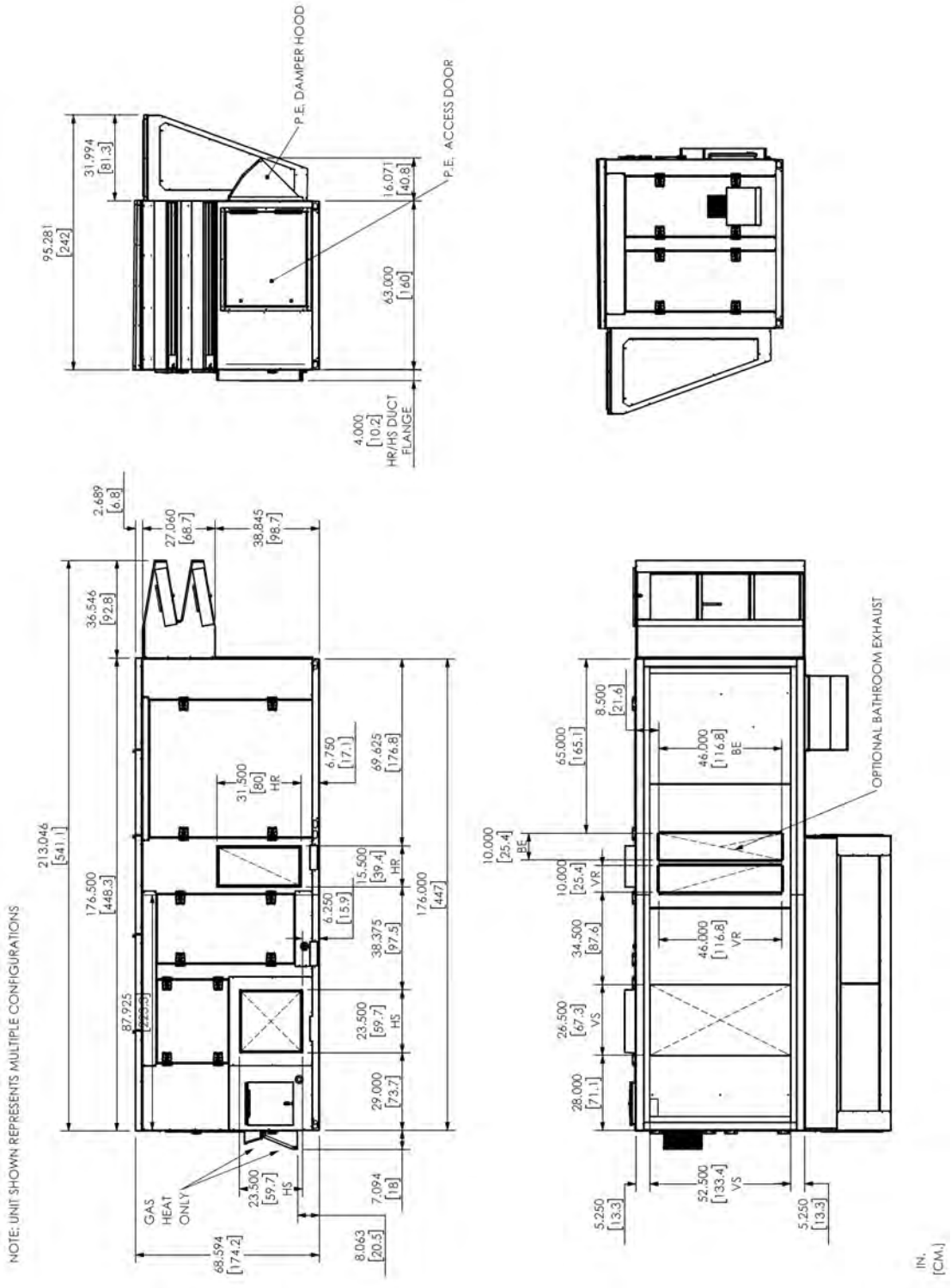
Qty	Model Description
1	Horizon™ (OAD/N Rev6 - OADG/OANG) - Horizon™ - Outdoor Air Unit (Revision 6)

The attached information describes the equipment we propose to furnish for this project and is submitted for your approval.

Ft Lauderdale Fire Stn 54 May 3, 2022

Unit Dimensions - 10-20 Ton R-410A PKGD Unitary Cooling Rooftop with Powered Exhaust and Energy Recovery Wheel

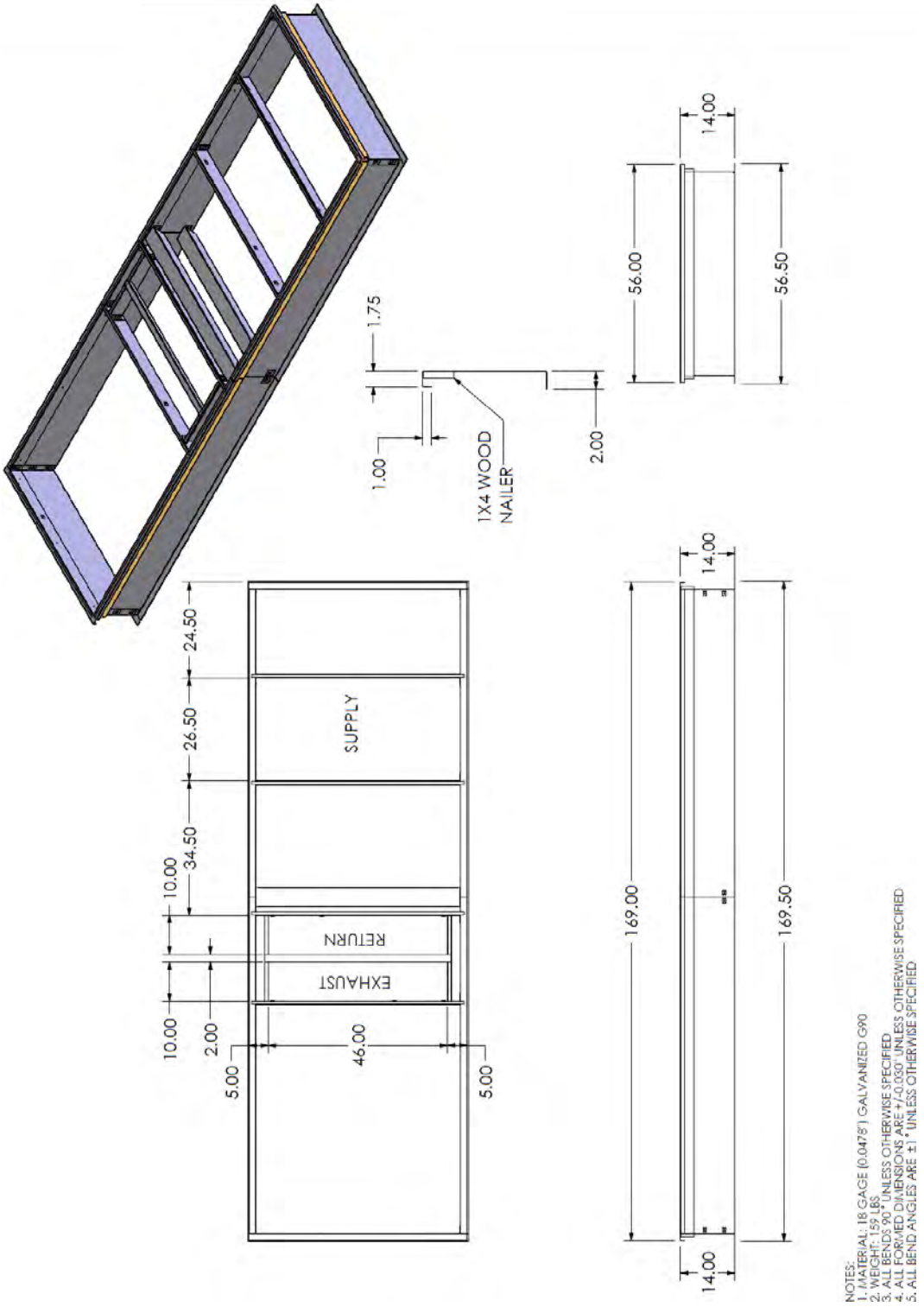
Qty: 1 Tags: curb



Ft Lauderdale Fire Stn 54 May 3, 2022

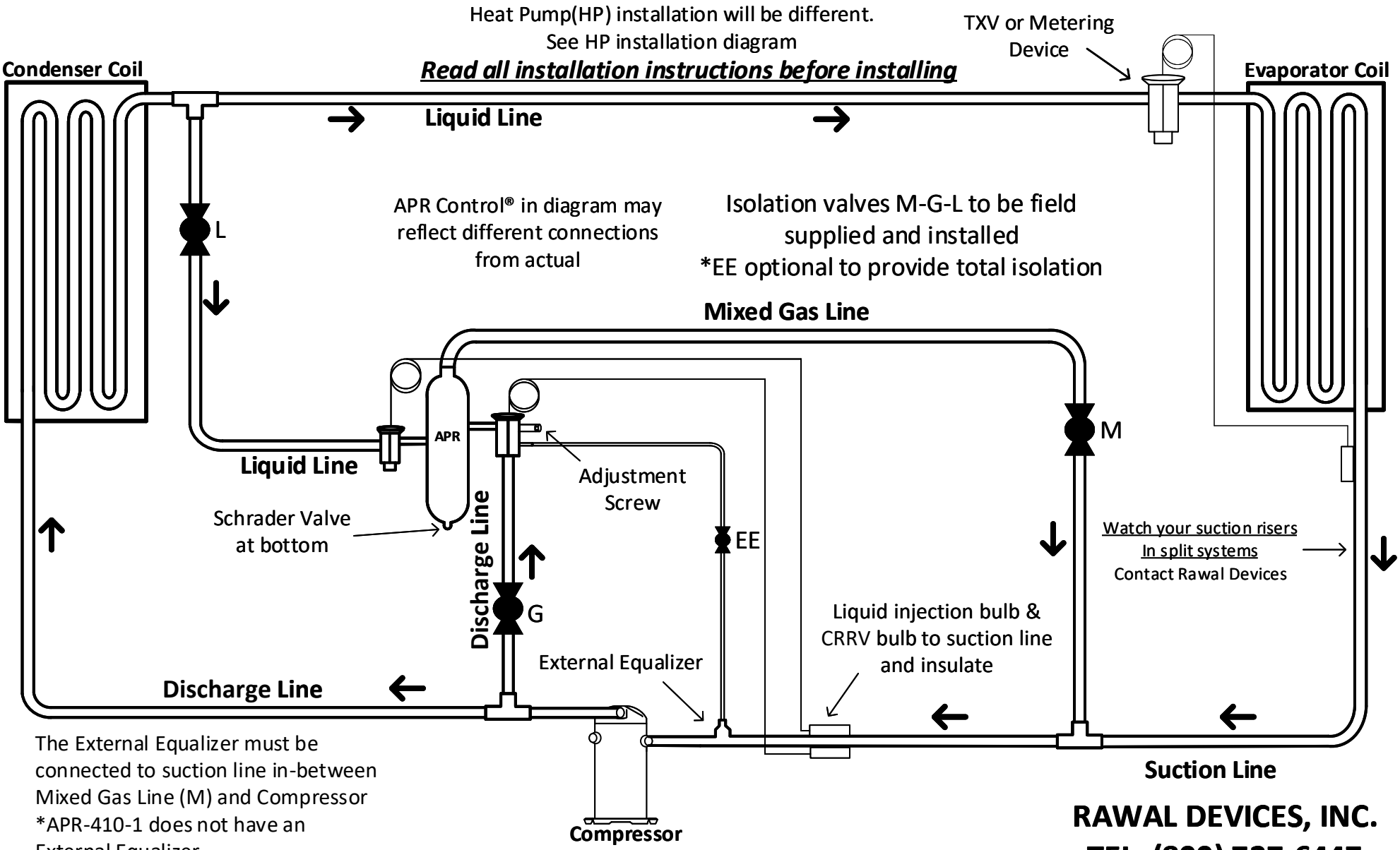
Roof Curb - 10-20 Ton PKGD Rooftop Knockdown Curb

Qty: 1 Tags: curb



FREE 20-MINUTE ONLINE PRE-INSTALLATION TRAINING AVAILABLE

APR CONTROL® FOR R-410A IN SINGLE EVAPORATOR MODE



RAWAL DEVICES, INC.
TEL. (800) 727-6447
www.Rawal.com
techsupport@rawal.com

*Drawing for illustrative purposes only
Please call for assistance

APR CONTROL - R-410A - SPEC. & DIMENSION SHEET

			Unit Dimensions			Connection Dimensions (OD)				
Model #	Modulation Capacity		X	Y	Z	EE	L	M	G	Application
APR-410-1	1.5 tons		8.5"	8"	4"	N/A	3/8"	5/8"	3/8"	G - BOTTOM CONNECTION
APR-410-2	2.5 tons		8.5"	8"	4"	1/4"	3/8"	5/8"	3/8"	G - BOTTOM CONNECTION
APR-410-3	3.5 tons		8.5"	8"	4"	1/4"	3/8"	5/8"	3/8"	G - BOTTOM CONNECTION
APR-410-6	6.5 tons		9.5"	10"	4.5"	1/4"	3/8"	5/8"	5/8"	G - SIDE CONNECTION
APR-410-10	10 tons		12"	11"	5.5"	1/4"	3/8"	7/8"	7/8"	G - SIDE CONNECTION

The APR Control Compression Ratio Reduction (CRR) Valve should be set to begin opening at approximately *118 PSI* ~40°F

- SUPPLY BALL SHUT-OFF VALVES FOR ALL CONNECTIONS
- SUPPLY TEE FOR SUCTION LINE CONNECTION
- SUPPLY TEE FOR DISCHARGE LINE CONNECTION
- SUPPLY TEE FOR LIQUID LINE CONNECTION

APR Control Selection:

System or Stage size is reduced by the Modulation Capacity listed above

Oil entrainment in suction line must be addressed

Please refer to Rawal Devices Fast Selection Chart or Consult with Rawal Devices Engineers

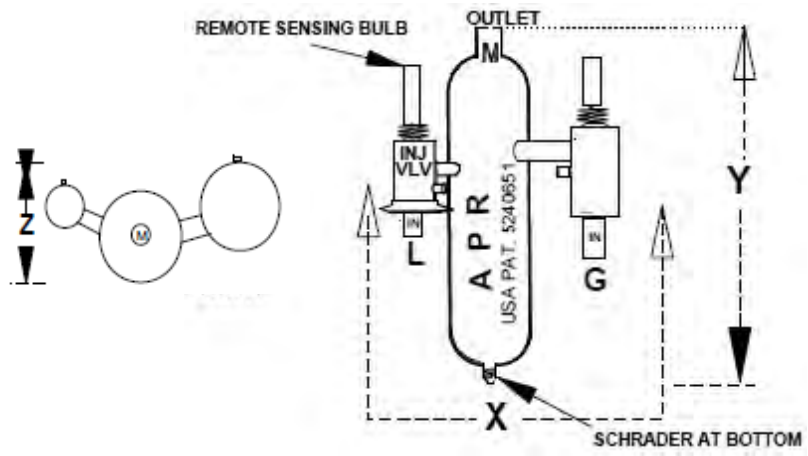
WHEN REQUIRED, SUPPLY TEE FOR EE CONNECTIONS EXTERNAL EQUILIZERS - EE - HAVE 1/4" SWEAT CONNECTION TEE EE CONNECTIONS INTO SUCTION LINE

BOTH SENSING BULBS ON LIQ INJ VALVE AND CRR VALVE MUST BE ATTACHED AND INSULATED TO SUCTION LINE BETWEEN TEE TO APR CONTROL DISCHARGE COMING FROM TOP OF THE CHAMBER AND COMPRESSOR

ONLY WHEN NECESSARY:

REMOVE CAPS FROM ADJUSTMENT STEMS PRIOR TO ADJUSTING

TO ADJUST VALVES WHEN FACING ADJUSTING STEM CLOCKWISE DECREASES PRESSURE / TEMPERATURE. COUNTER-CLOCKWISE INCREASES PRESSURE / TEMPERATURE.

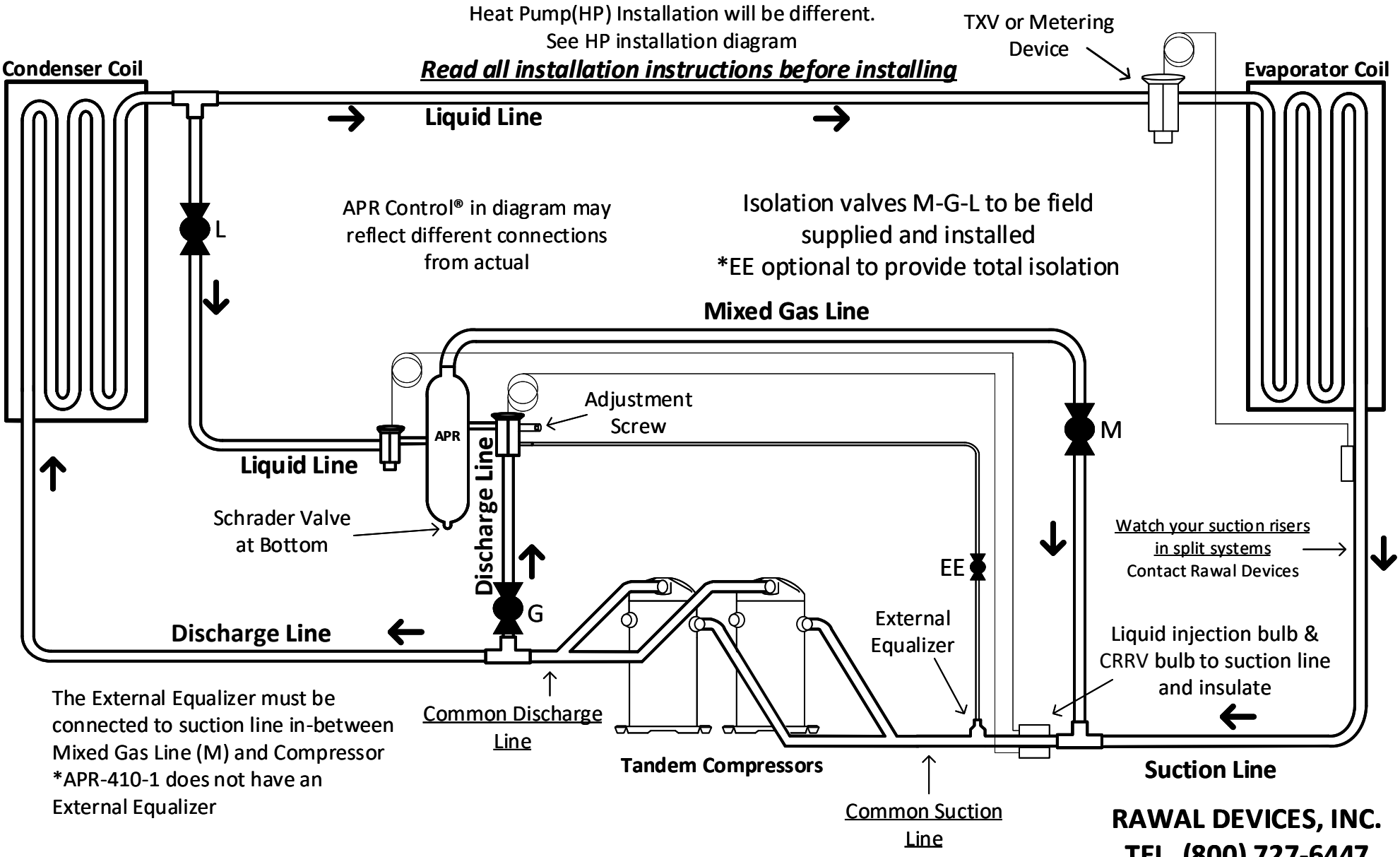


RAWAL DEVICES, INC.

Call Tech Support: (800) 727-6447 WWW.RAWAL.COM

FREE 20-MINUTE ONLINE PRE-INSTALLATION TRAINING AVAILABLE

APR CONTROL® FOR R-410A IN TANDEM COMPRESSOR CONFIGURATION



RAWAL DEVICES, INC.
TEL. (800) 727-6447
www.Rawal.com
techsupport@rawal.com

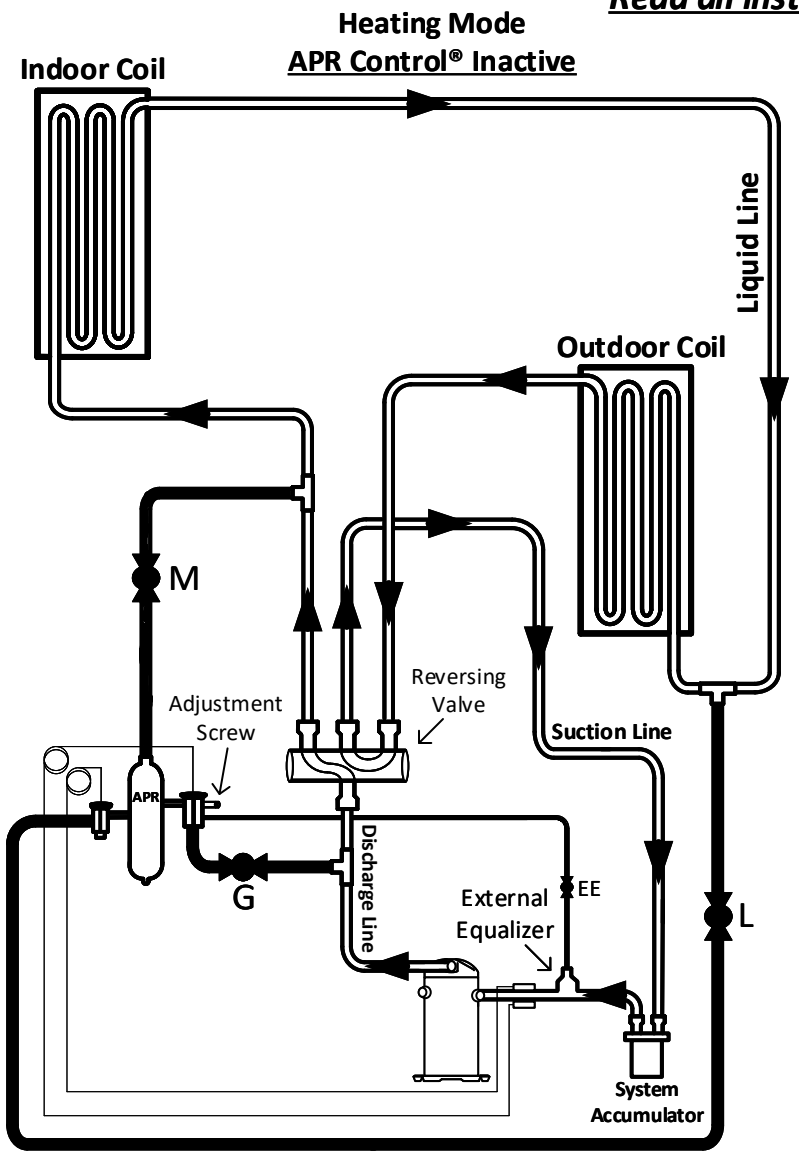
*Drawing for illustrative purposes only
Please call for assistance

 DOC#410A-TCD

FREE 20-MINUTE ONLINE PRE-INSTALLATION TRAINING AVAILABLE

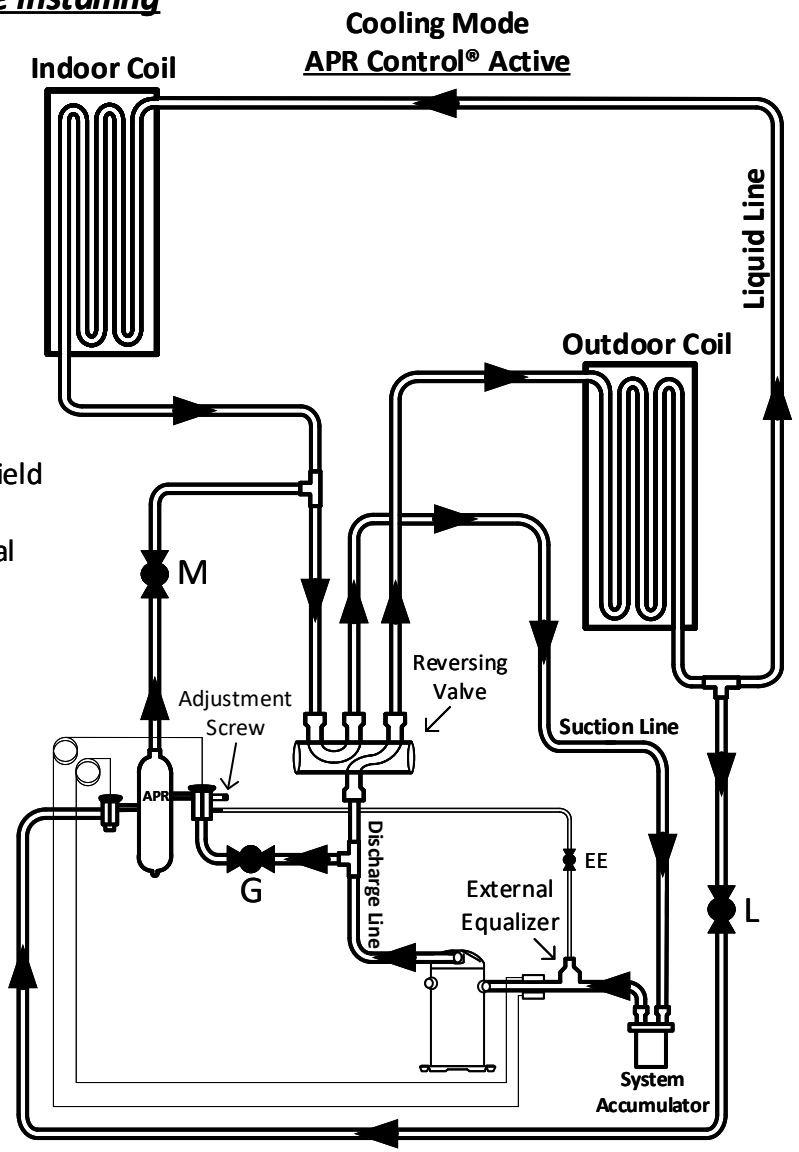
APR CONTROL® FOR R-410A IN A HEAT PUMP SYSTEM

Read all installation instructions before installing



Isolation valves M-G-L to be field supplied and installed
*EE optional to provide total isolation

APR Control® active in cooling mode only



RAWAL DEVICES, INC.
TEL. (800) 727-6447
www.Rawal.com
techsupport@rawal.com

*Drawing for illustrative purposes only
Please call for assistance

APR Control Installation Instructions APR-410A

If possible pump down system and lock existing refrigerant in the receiver or condenser. If you cannot secure existing system charge, use proper refrigerant recovery methods to save and store the refrigerant charge. Before installing the APR Control, make sure your system is clean –if not, or in doubt a new filter / strainer must be used to protect the APR Control to isolate and remove the system contaminants. Particles of dirt can settle on the valve seat of the Compression Ratio Reduction (CRR) Valve and prevent it from closing, leading to possible compressor overheating and system damage.

After you install the APR Control, use standard evacuation procedures and follow the directions listed below. All connections between the system and the APR Control can be made in the condensing section. The APR Control may be mounted outside the condensing unit housing if space or access are a problem. The APR Control should be mounted vertical, with discharge from the desuperheating chamber UP or an orientation so chamber discharge is above Schrader valve at bottom. Manual Shut off valves to isolate the APR Control connections to liquid, discharge and suction lines ***are to be field supplied and installed***. Functionally, isolation valves will assist in charging the systems and troubleshooting should difficulty with set-up arise.

Connections to the refrigerant circuit can be on horizontal or vertical pipes, but discharge from the APR Control desuperheating chamber to the suction line must be into the top of the suction line to prevent oil from draining into the APR Control chamber.

All connections to the APR Control should be made with Stay-Silv® 15 or equivalent Brazing Alloy. Keep in mind when brazing that the exterior of the APR Control is stainless while the interior is copper clad.

Always use plenty of wet rags or heat absorbing paste on the valves and aim your flame away from valve bodies to prevent possible damage.

1) Tee in a line shut off valve (G) at the compressor discharge line, (size to APR hot gas valve inlet) where strainer is supplied, install it in the APR hot gas inlet only.
2) Tee in a line shut off valve (M) at the suction line prior to compressor, (size to APR mixed gas discharge outlet at top of desuperheating chamber).
3) Tee in a line shut off valve (L) at the liquid line near the condenser coil or receiver outlet, size to APR injection valve inlet.
4) Mount APR Control securely in the condensing unit.
5) Connect discharge line from valve (G) to the inlet on CRR Valve connected to APR Control. CRR valve inlet marked with Red Discharge Line sticker.
6) Connect suction from the line valve (M) to the mixed gas outlet on top of APR Control desuperheating chamber.
7) Connect liquid from the line valve (L) to the liquid injection valve (TXV) inlet on APR Control.
8) External equalizers on sides of APR Control Compression Ratio Reduction valve should be connected to the suction line between mixed gas discharge connection from the APR Control and compressor inlet.
9) The injection valve bulb and CRR Valve bulb *must* be mounted, and insulated, to the suction line between compressor and mixed gas discharge connection from the APR Control.
10) Leak test system and evacuate. Before charging system close all APR Control line valves, do not leave the APR Control open when charging the system. No additional charge is required for the APR Control to operate.
11) For R-410a High Temperature Systems – **Compression Ratio Reduction Valve of the APR Control has been set to open at about 118 psig (40° F)**. See adjustment sheet if you require further instructions.
12) **APR Control Liquid Injection valve is set to open at around 65° F (or 20° superheat) to protect the compressor from overheating**.

***Please refer to the Spec. & Dimension sheet for connection sizes for specific model APR Control.**

***Adjustment settings to all APR-410A valves need to be confirmed in the field.**

DOC#410A-INST

Rawal Devices, Inc. * 800.727.6447 * 781.933.3304 * Fax: 781.933.3306 * sales@rawal.com * www.rawal.com

APR Control Operation and Adjustment (R-410A)

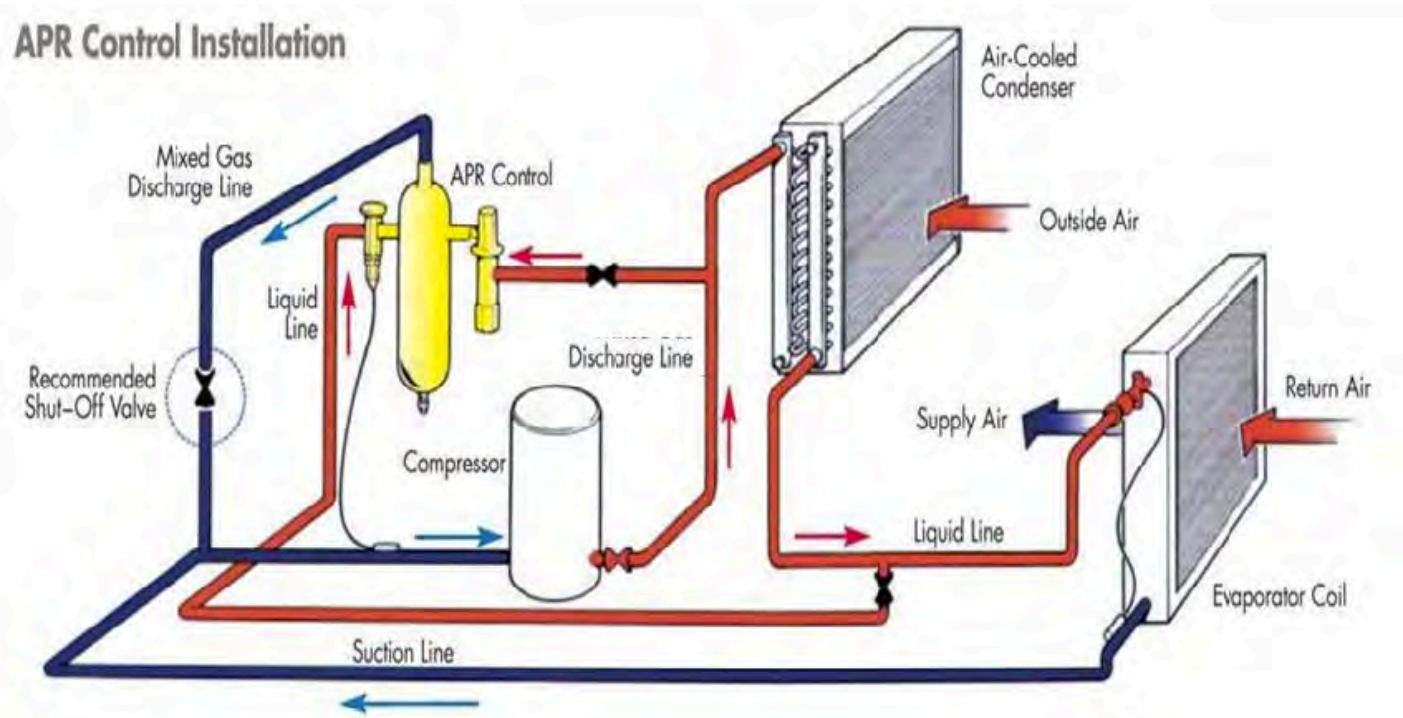
The APR Control® valve is a capacity modulation and dehumidification device that modulates the air conditioning system's refrigeration (circuit capacity to match the varying load conditions of the space. Often utilized to minimize the challenges of oversized air conditioning systems, the APR Control is a device that operates in response to suction pressure of an active air conditioning system. As the heat load (including occupancy, ventilation and solar loads, for example of the conditioned space drops, your suction pressure drops to the point the APR Control begins to open. A portion of discharge gets sent through the desuperheating chamber, then back to the suction line. A liquid injection valve mixes liquid with the discharge gas in the desuperheating chamber when the mixed gas temperature reaches approximately 20°superheat returning to the compressor.

The APR Control externally unloads the compressor, keeping the evaporator coil at a constant temperature below dew point, thereby dehumidifying during the extended run time achieved. Extended run time is achieved by keeping the thermostat from being satisfied too quickly (a standard cause of short cycling.

The APR Control comes factory set at approximately 120psig[1] and typically does not require adjustment. During part-load conditions, as the heat content of the return air (including the sensible temperature drops, the saturated suction temperature will drop, resulting in a drop in suction pressure. As the suction pressure falls to 120psig the APR Control will begin to open and attempt to stabilize the system suction pressure at approximately 120psig.

However, if the runtime is inadequate or low load operation fails to cause suction pressure to fall low enough (the point at which the APR Control starts to open), you may need to adjust the APR Control® Compression Ratio Reduction valve. The adjustment port can be found on the side or the bottom of the CRR valve. Remove the cap to access the set screw. A standard hex wrench can be used to turn the screw and adjust the pressure setting. The pressure setting will adjust in the range of 5 lbs per 360° turn[2]. Turning the wrench counter-clockwise (out will increase the pressure setting and turning the wrench clockwise (in will lower the pressure setting. The maximum pressure setting that most APR Controls can be adjusted to is approximately 130psig and the minimum is 95psig. As you adjust the APR Control, it will to reduce system capacity in order to match capacity to changing load conditions beginning at the new setting.

1: The factory setting for the **APR-410-5** is **105psig**, with an **adjustment range of 95 - 115psig**.
2: The pressure setting of the **APR-410-5** will **adjust 2.5 lbs per 360° turn**. Also note that turning the adjustment screw counter-clockwise (out will ***decrease*** the pressure setting while turning it ***clockwise*** (in will increase the pressure setting.



DOC#410A-ADJ

Technical Specifications

Exhibit 2 - Manuals

TRANE

Installation, Operation, and Maintenance

Blower Coil Air Handler
Air Terminal Devices - 400 cfm to 3000 cfm

Models BCHD and BCVD
"AO" and later design sequence

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

October 2013

BCX-SVX001A-EN

TS-236 of 389

Ingersoll Rand

CAM 23-0060
Exhibit 1A
236 of 389

TRANE

Warnings, Cautions and Notices

Warnings, Cautions and Notices. Note that warnings, cautions and notices appear at appropriate intervals throughout this manual. Warnings are provided to alert installing contractors to potential hazards that could result in death or personal injury. Cautions are designed to alert personnel to hazardous situations that could result in personal injury, while notices indicate a situation that could result in equipment or property-damage-only accidents.

Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

Read this manual thoroughly before operating or servicing this unit.

ATTENTION: Warnings, Cautions, and Notices appear at appropriate sections throughout this literature. Read these carefully:

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE: Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns!

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

Responsible Refrigerant Practices!

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

⚠WARNING

Personal Protective Equipment (PPE) Required!

Installing/servicing this unit could result in exposure to electrical, mechanical and chemical hazards.

- **Before installing/servicing this unit, technicians MUST put on all Personal Protective Equipment (PPE) recommended for the work being undertaken. ALWAYS refer to appropriate MSDS sheets and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS sheets and OSHA guidelines for information on allowable personal exposure levels, proper respiratory protection and handling recommendations.**
- **If there is a risk of arc or flash, technicians MUST put on all Personal Protective Equipment (PPE) in accordance with NFPA 70E or other country-specific requirements for arc flash protection, PRIOR to servicing the unit.**

Failure to follow recommendations could result in death or serious injury.

Table of Contents

Model Number Descriptions

Following is a complete description of the blower coil model number. Each digit in the model number has a corresponding code that identifies specific unit options.

Digits 1, 2, 3, 4 — Unit Model

BCHD = Horizontal Blower Coil
BCVD = Vertical Blower Coil

Digits 5, 6, 7 — Unit Size

012 = Unit size 12 - 1 ton
018 = Unit size 18 - 1 1/2 ton
024 = Unit size 24 - 2 ton
036 = Unit size 36 - 3 ton
054 = Unit size 54 - 4 1/2 ton
072 = Unit size 72 - 6 ton
090 = Unit size 90 - 7 1/2 ton

Digit 8 — Unit Voltage

A = 115/60/1
B = 208/60/1
C = 230/60/1
D = 277/60/1
J = 220/50/1
K = 240/50/1

Digit 9 —Insulation Type

1 = 1 inch Matte-faced insulation
2 = 1 inch Foil-faced insulation

Digits 10, 11 — Design Sequence

** = Factory sets the design sequence

Digit 12 — Motor and Control Box Location

A = Same side as coil connections, horizontal or counterswirl options only
B = Opposite side from coil connections, horizontal or counterswirl options only
C = Same side as coil connections, preswirl option only
D = Opposite side from coil connections, preswirl only

Digit 13 — Coil Connection Side

1 = PVC drain pan right-hand coil and drain connections
2 = PVC drain pan left-hand coil and drain connections
3 = Stainless steel drain pan right-hand coil and drain connections
4 = Stainless steel drain pan left-hand coil and drain connections
0 = None

Digit 14 — Coil #1 First in Airstream

Note: All coils are hydronic unless stated otherwise.
0 = No coil 1
A = 1-row preheat
F = 4-row
G = 6-row
J = 4-row with autochangeover
K = 6-row with autochangeover
L = 2-row high capacity preheat
M = 4-row high capacity
N = 6-row high capacity
R = 4-row high capacity with autochangeover
T = 6-row high capacity with autochangeover
1 = 3-row DX coil 3/16-inch (0.032) dist
2 = 4-row DX coil 3/16-inch (0.032) dist
3 = 6-row DX coil 3/16-inch (0.032) dist
4 = 3-row DX coil 3/16-inch (0.049) dist
5 = 4-row DX coil 3/16-inch (0.049) dist
6 = 6-row DX coil 3/16-inch (0.049) dist
7 = 4-row DX coil 3/16-inch (0.049) dist, heat pump
8 = 6-row DX coil, 3/16-inch (0.049) dist, heat pump

Digit 15 — Unit Coil #2

Note: All coils are hydronic unless stated otherwise.
0 = No coil 2
A = 1-row reheat
F = 4-row
G = 6-row
J = 4-row with autochangeover
K = 6-row with autochangeover
L = 2-row high capacity reheat
M = 4-row high capacity
N = 6-row high capacity
R = 4-row high capacity with autochangeover
T = 6-row high capacity with autochangeover
1 = 3-row DX coil 3/16-inch (0.032) dist
2 = 4-row DX coil 3/16-inch (0.032) dist
3 = 6-row DX coil 3/16-inch (0.032) dist
4 = 3-row DX coil 3/16-inch (0.049) dist
5 = 4-row DX coil 3/16-inch (0.049) dist
6 = 6-row DX coil 3/16-inch (0.049) dist
7 = 4-row DX coil 3/16-inch (0.049) dist, heat pump
8 = 6-row DX coil, 3/16-inch (0.049) dist, heat pump

Digit 16 — Motor Horsepower

2 = 1/2 hp
4 = 1 hp

Model Number Descriptions

Digit 17 — RPM

A = 500 rpm
B = 600 rpm
C = 700 rpm
D = 800 rpm
E = 900 rpm
F = 1000 rpm
G = 1100 rpm
H = 1200 rpm
J = 1300 rpm
K = 1400 rpm
L = 1500 rpm
M = 1600 rpm
N = 1700 rpm
P = 1800 rpm
R = 1900 rpm
T = 2000 rpm
U = 2100 rpm
V = 2200 rpm
W = 2300 rpm
Z = TOPSS base performance

Digit 18 — Electric Heat Stages

1 = 1-stage
2 = 2-stage
0 = none

Digits 19, 20, 21 — Electric Heat

010 = 1.0 kW
015 = 1.5 kW
020 = 2.0 kW
025 = 2.5 kW
030 = 3.0 kW
035 = 3.5 kW
040 = 4.0 kW
045 = 4.5 kW
050 = 5.0 kW
055 = 5.5 kW
060 = 6.0 kW
065 = 6.5 kW
070 = 7.0 kW
075 = 7.5 kW
080 = 8.0 kW
090 = 9.0 kW
100 = 10.0 kW
110 = 11.0 kW
000 = None

Digit 22 — Electric Heat Controls

0 = None
A = 24 volt magnetic contactors
B = 24 volt mercury contactors

Digit 23 — Electric Heat Options

0 = None
A = Line fuse
B = Door interlocking disconnect switch
C = A and B

Digit 24 — Filters

0 = None
A = 1-in. throwaway
B = 2-in. MERV 8 throwaway
C = 2-in. MERV 13 throwaway

Digit 25 — Accessory Section

0 = None
A = Mixing box only
B = Angle filter box
C = Angle filter/mixing box
D = Top access filter module
E = Bottom access filter module
F = A and D
G = A and E
H = Steam coil module
J = A and H
K = B and H
L = C and H
M = D and H
N = E and H
P = A, D and H
R = A, E and H

Digit 26 — Control Type

1 = CSTI
2 = Tracer ZN010
3 = Tracer ZN510
4 = Tracer ZN520
5 = UC400
6 = No controls (FSS)

Digit 27 — Coil #1 Control Valve Type

0 = None
A = 2-way, 2-position, N.C.
B = 2-way, 2-position, N.O.
C = 3-way, 2-position, N.C.
D = 3-way, 2-position, N.O.
E = 2-way modulating
F = 3-way, modulating
G = Field-supplied valve, 2-position, N.C.
H = Field-supplied valve, 2-position, N.O.
J = Field-supplied modulating valve
K = Field-supplied analog valve

Digit 28 — Coil #1 Control Valve Cv

0 = None
A = 3.3 Cv, 1/2-in. valve and pipe
B = 3.3 Cv, 1/2-in. valve, 3/4-in. pipe
C = 3.8 Cv, 1/2-in. valve, 3/4-in. pipe
D = 6.6 Cv, 1-in. valve and pipe
E = 7.4 Cv, 1-in. valve and pipe
F = 8.3 Cv, 1 1/4-in. valve and pipe
G = 3.5 Cv, 1/2-in. valve and pipe
H = 4.4 Cv, 1/2-in. valve and pipe
K = 8.0 Cv, 1-in. valve and pipe
Q = 1.3 Cv, 1/2-in. valve, 3/4-in. pipe
R = 1.8 Cv, 1/2-in. valve, 3/4-inc. pipe
T = 2.3 Cv, 1/2-in. valve, 3/4-in. pipe
U = 2.7 Cv, 1/2-in. valve, 3/4-in. pipe

Digit 29 — Coil #1 Piping Package

0 = None
1 = Basic piping package
2 = Deluxe piping package

Digit 30 — Coil #2 Control Valve

0 = None
A = 2-way, 2-position, N.C.
B = 2-way, 2-position, N.O.
C = 3-way, 2-position, N.C.
D = 3-way, 2-position, N.O.
E = 2-way modulating
F = 3-way modulating
G = Field-supplied valve, 2-position N.C.
H = Field-supplied valve, 2-position N.O.
J = Field-supplied modulating valve
K = Field-supplied analog valve

Digit 31— Coil #2 Control Valve Cv

0 = None
A = 3.3 Cv, 1/2-in. valve and pipe
B = 3.3 Cv, 1/2-in. valve, 3/4-in. pipe
C = 3.8 Cv, 1/2-in. valve, 3/4-in. pipe
D = 6.6 Cv, 1-in. valve and pipe
E = 7.4 Cv, 1-in. valve and pipe
F = 8.3 Cv, 1 1/4-in. valve and pipe
G = 3.5 Cv, 1/2-in. valve and pipe
H = 4.4 Cv, 1/2-in. valve and pipe
K = 8.0 Cv, 1-in. valve and pipe
Q = 1.3 Cv, 1/2-in. valve, 3/4-in. pipe
R = 1.8 Cv, 1/2-in. valve, 3/4-in. pipe
T = 2.3 Cv, 1/2-in. valve, 3/4-in. pipe
U = 2.7 Cv, 1/2-in. valve, 3/4-in. pipe

Digit 32 — Coil #2 Piping Package

0 = None
1 = Basic piping package
2 = Deluxe piping package

Digit 33 — Remote Heat Options

0 = No remote heat
1 = Remote staged electric heat
2 = Remote 2-position hot water, N.C.

Digit 34 — Mixing Box Damper Actuator

Note: The back damper is the control damper when actuators are ordered. The back damper is N.C. or N.O. as selected.

0 = None
1 = 2-position, N.O., ship loose
2 = Modulating, N.C.
3 = Modulating, N.O.
4 = Modulating, ship loose
5 = Field-supplied 2-position, N.O.
6 = Field-supplied 2-position, N.C.
7 = Field-supplied modulating

Digit 35 — Factory Mounted Control Options

0 = None
C = Condensate overflow
D = Low Limit
K = Condensate overflow and low limit

Model Number Descriptions

Digit 36 — Control Options 2

0 = None
A = Outside air sensor, field-mounted
B = Discharge air sensor
C = Outside air and discharge air sensor

Digit 37 — Control Options 3

0 = None
A = Dehumidification with communicated value
B = Dehumidification with local humidity sensor

Digit 38 — Zone Sensors

0 = None
1 = Wall-mounted temp sensor (SP, OA, OCC/UNCOCC, COMM)
3 = Wall-mounted temp sensor (SP, OCC/UNOCC, COMM)
4 = Wall-mounted temp sensor (OCC/UNOCC, COMM
C = Wireless temp sensor, unit-mounted receiver
E = Wall-mounted temp sensor (SP, OALMH, OCC/UNOCC, COMM)
F = Wall-mounted display sensor (SP, OALMH, COMM)
G = Wireless display sensor, unit-mounted receiver (SP, OALMH)
H = Wall-mounted FSS

Digit 39 — Seismic Certification

0 = None

Digit 40 — Extra Filter

0 = None
1 = Ship loose extra 1-in. Throwaway
2 = Ship loose extra 2-in. MERV 8 throwaway
3 = Ship loose extra 2-in. MERV 13 throwaway

Introduction

Overview of Manual

Use this manual to install, startup, operate, and maintain Trane commercial blower coil models BCHD and BCVD. It provides specific instructions for “AO” and later design sequences.

For previous design sequence information, contact your local Trane representative.

Trademarks

Frostat, VelociTach, Integrated Comfort, Rover, Tracer, Tracer Summit, Trane, and the Trane logo are trademarks of Trane in the United States and other countries. All trademarks referenced in this document are the trademarks of their respective owners.

BACnet is a registered trademark of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE); Echelon, LonTalk, and LONWORKS are registered trademarks of Echelon Corporation.

TRANE

General Information

Blower coil units are draw-thru air handlers for cooling load conditions of 400–3000 cfm. Units are available in either horizontal (model BCHD) or vertical (model BCVD) configurations. Horizontal units are typically ceiling suspended via threaded rods. Knockouts are provided in all four corners to pass the rods through the unit. Horizontal units can also be floor mounted. Vertical units are typically floor mounted. They have a side inlet for easy duct connection, and do not require a field fabricated inlet plenum. Vertical units ship in two pieces and can be set up in either a pre-swirl or counter-swirl configuration.

Basic unit components consist of a water coil, condensate drain pan, filter, duct collars, one fan wheel, and motor with drive. See Figure 1.

Figure 1. Blower coil air handler unit components (model BCHD, horizontal unit)

Two, four, or six-row main coils are available for either hydronic cooling or heating. Three, four, or six-row direct expansion (DX) coils are also available for cooling. An optional one, two, four, or six-row heating coil is available factory-installed in either the preheat or reheat position. Also, a one-row preheat steam is available.

All units have an internal flat filter frame for one or two-inch filters. An optional angle filter box (two inch only), mixing box, bottom/top filter access box, or combination angle filter mixing box is available.

In addition, all units are available with either a basic or deluxe piping package option that includes a variety of control valve sizes in two or three-way configurations. The basic package consists of a control valve and stop (ball) valves. The deluxe package consists of a control valve, a stop (ball) valve, a circuit setter, and strainer.

Direct-drive motors range from 1/2 to 1 horsepower in a wide range of voltages. All motors have internal current overload protection, permanently sealed ball bearings, and rubber grommets on the mounting brackets to reduce noise and vibration transmission.

Motors come factory programmed for specific job requirements or can be programed based on standardized motor speeds. Field adjustment of motor speeds can be adjusted through the Velocitach™ motor control board. This enables the unit to be balanced for changes to design static pressures fast and easy. Refer to the original sales order and Table 40, p. 55 for drive information.

Units may have no controls (fan speed switch - FSS), or any of five different control types:

1. Customer Supplied Terminal Interface (CSTI)
2. Tracer ZN010
3. Tracer ZN510
4. Tracer ZN520
5. Tracer UC400

All control options are factory-installed and tested.

Pre-Installation

Receiving and Handling

Inspection

Upon delivery, thoroughly inspect all components for any shipping damage that may have occurred, and confirm that the shipment is complete. See "Receiving Checklist" section for detailed instructions.

Note: Delivery cannot be refused. All units are shipped F.O.B. factory. Trane is not responsible for shipping damage.

Packaging/Shipping

Blower coil units ship assembled on skids with protective coverings over the coil and discharge openings.

Field-installed sensors ship separately inside the unit's main control panel. Piping packages and mixing boxes are packaged separately and ship on the same skid as the unit.

Identification

Each air handler includes a nameplate identifying the customer tagging information, unit serial number, unit order number, and the unit model number.

Handling

The unit ships on skids that provide forklift locations from the front or rear. The skid allows easy maneuverability of the unit during storage and transportation. Trane recommends leaving units and accessories in their shipping packages/skids for protection and handling ease until installation. Remove the skids before placing the unit in its permanent location.

Remove the skids using a forklift or jack. Lift one end of the unit off of the skids. Vibration isolators for external isolation are field supplied.

Receiving Checklist

Complete the following checklist immediately after receiving shipment to detect possible shipping damage.

- ☐ Check to ensure that the shipment is complete. Small components may ship inside the unit or ship separately. Check the parts list to ensure all materials are present.
- ☐ Check all units, components, connections, and piping. Check fan wheel for free rotation by spinning manually. Check all doors, latches and hinges. Inspect interior of each unit or section. Inspect coils for damage to fin surface and coil connections. Check for rattles, bent corners, or other visible indications of shipping damage. Tighten loose connections.
- ☐ If a unit is damaged, make specific notations concerning the damage on the freight bill. Do not refuse delivery.
- ☐ Notify the carrier's terminal of the damage immediately by phone and mail. Request an immediate joint inspection of the damage by the carrier and consignee.
- ☐ Notify your Trane sales representative of the damage and arrange for repair. Do not attempt to repair the unit without consulting the Trane representative.
- ☐ Inspect the unit for concealed damage as soon as possible after delivery. Report concealed damage to the freight line. It is the receiver's responsibility to provide reasonable evidence that concealed damage did not occur after delivery. Take photos of damaged material if possible.

  Note: Concealed damage must be reported within 15 days of receipt.

Jobsite Storage

This unit is intended for indoor use only. It is the sole responsibility of the customer to provide the necessary protection to prevent vandalism and weather protection of the equipment. Under no circumstance should the unit be left unprotected from the elements.

NOTICE:

Microbial Growth!

Wet interior unit insulation can become an amplification site for microbial growth (mold), which could result in odors and damage to the equipment and building materials. If there is evidence of microbial growth on the interior insulation, it should be removed and replaced prior to operating the system.

If indoor storage is not possible, Trane makes the following recommendations to prevent damage:

Note: Keep the equipment on the original wooden blocks/ skid for protection and ease of handling.

- Select a well-drained area, preferably a concrete pad or blacktop surface.
- Place the unit on a dry surface or raised off the ground to assure adequate air circulation beneath the unit and to assure no portion of the unit will contact standing water at any time.
- Cover the unit securely with a canvas tarp.

NOTICE:

Corrosion!

Use only canvas tarps to cover air handlers. Plastic tarps can cause condensation to form in and on the equipment, which could result in corrosion damage or wet storage stains.

- Do not stack units.
- Do not pile other material on the unit.

Site Preparation

- Ensure the installation site can support the total weight of the unit (see "Unit Dimensions and Weights" on page 13 for approximate section weights; refer to the unit submittals for actual weights).
- Allow sufficient space for adequate free air and necessary service access (see "Service Clearances" on page 13). Refer to submittals for specific minimums.
- Allow room for supply and return piping, ductwork, electrical connections, and coil removal. Support all piping and ductwork independently of the unit to prevent excess noise and vibration.
- Ensure there is adequate height for coil piping and condensate drain requirements. See "Condensate Drain Connections," page 28.
- Confirm the floor or foundation is level. For proper unit operation, the unit must be level (zero tolerance) in both horizontal axis.

NOTICE:

Microbial Growth!

The floor or foundation must be level and the condensate drain at the proper height for proper coil drainage and condensate flow. Standing water and wet surfaces inside the equipment can become an amplification site for microbial growth (mold), which could cause odors and damage to the equipment and building materials.

- If the unit is to be ceiling mounted, the installer/contractor must provide threaded suspension rods. All units must be installed level.

Dimensions and Weights

Service Clearances

Figure 2. Top view of blower coil showing recommended service and code clearances

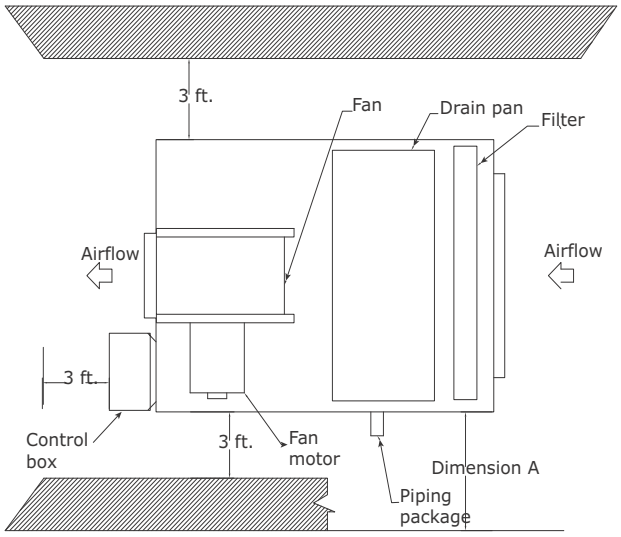


Figure 3. Top view of blower coil showing recommended service and code clearances

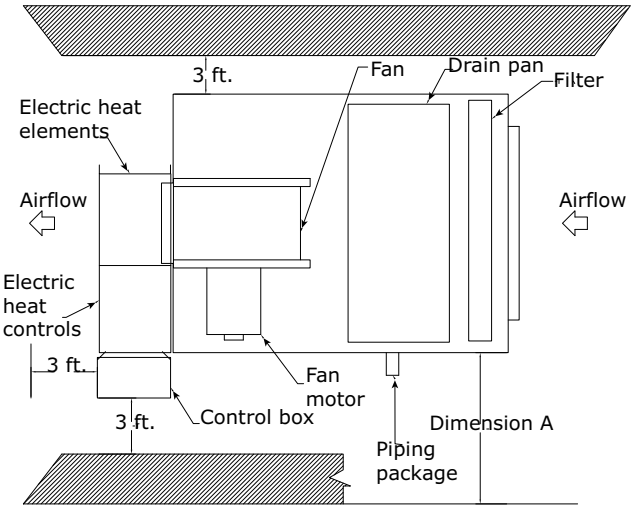


Table 1. Service requirements (inches)

Unit size	Dimension A
12	20
18	25
24	25
36	37
54	37
72	45
90	45

TRANE

Dimensions and Weights

Horizontal Blower Coil

Figure 4. Horizontal blower coil

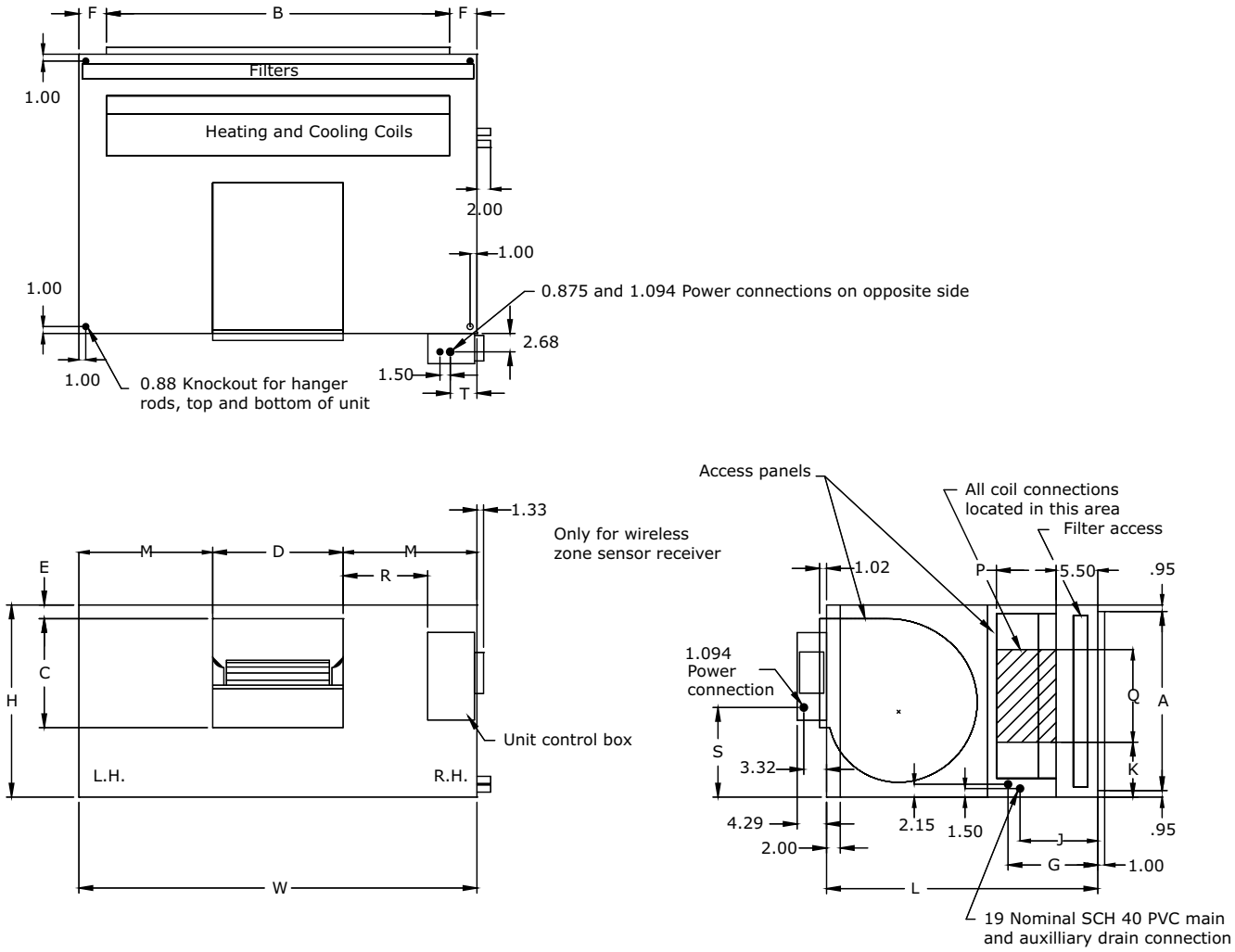


Table 2. Horizontal blower coil dimensions (in.) and weights (lb)

Unit Size	H	W	L	A	B	C	D	E	F	G (RH)	G (LH)	J (RH)	J (LH)	K	M	P	Q	R	S	T	Basic Unit Weight
12	14.00	24.00	31.15	12.09	18.00	10.56	7.47	0.55	3.00	11.42	13.42	9.42	11.42	4.20	8.24	9.00	5.75	1.35	2.91	4.01	64.0
18	14.00	28.00	31.15	12.09	22.00	10.56	7.47	0.55	3.00	11.42	13.42	9.42	11.42	4.20	10.24	9.00	5.75	3.42	2.93	3.94	69.0
24	18.00	28.00	33.72	16.09	22.00	13.57	9.04	1.30	3.00	11.42	13.42	9.42	11.42	6.20	9.68	9.00	5.75	2.73	3.09	3.84	89.6
36	18.00	40.00	33.72	16.09	34.00	13.57	9.04	1.30	3.00	11.42	13.42	9.42	11.42	6.20	15.68	9.00	5.75	8.64	2.93	3.94	104.5
54	22.00	40.00	41.57	20.09	34.00	13.58	12.57	0.72	3.00	11.42	13.42	9.42	11.42	7.43	13.72	11.00	7.27	6.87	6.93	3.94	129.0
72	22.00	48.00	41.57	20.09	40.00	13.58	12.57	0.72	4.00	11.42	13.42	9.42	11.42	7.43	17.72	11.00	7.27	10.87	6.93	3.94	142.0
90	28.00	48.00	43.94	26.09	40.00	13.58	12.57	1.66	4.00	12.79	14.79	10.79	12.79	8.24	17.72	11.25	11.64	10.92	13.06	3.89	162.8

Note:

- All coil connections are sweat style.
- Weight of basic unit includes cabinet, fan, wiring and average filter. It does not include coil, motor or shipping package. Please refer to Table 48 for motor weights. Add to basic unit weight seven pounds for weight of control box.
- Control box factory-mounted on drive side.

Vertical Blower Coil

Figure 5. Vertical blower coil

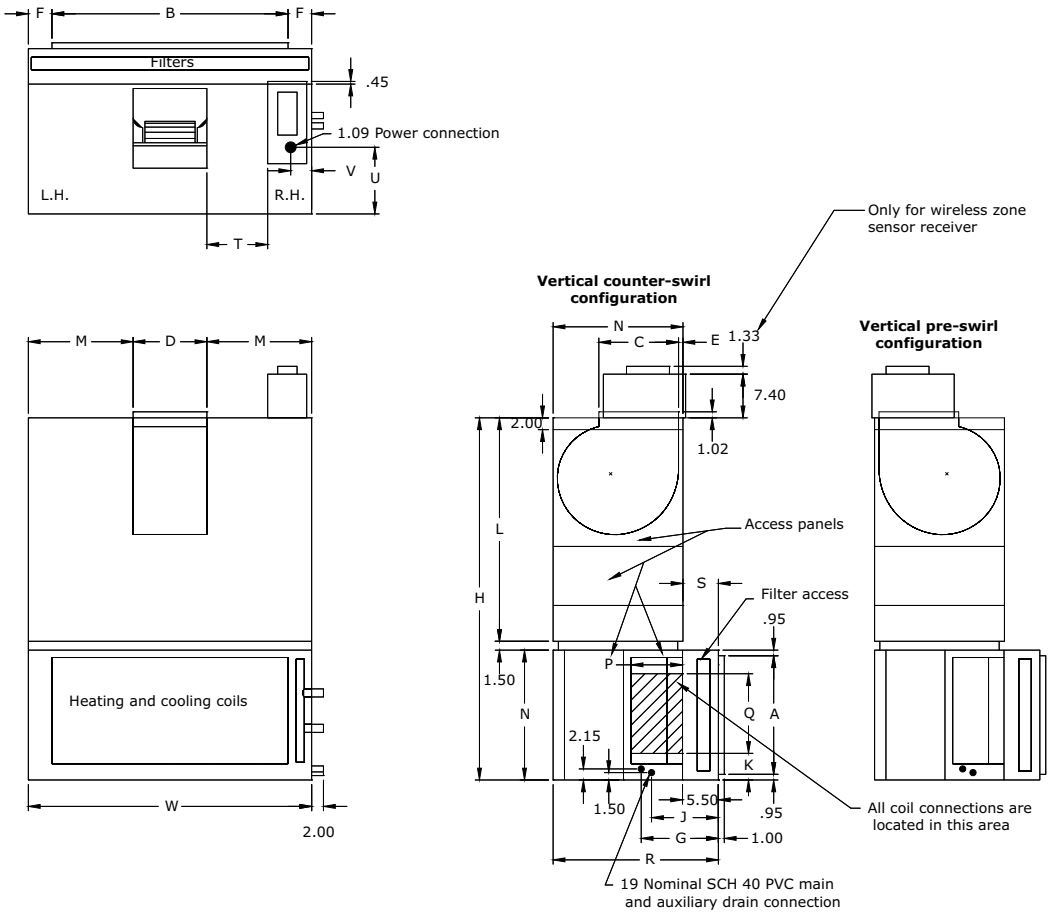


Table 3. Vertical blower coil dimensions (in.) and weights (lb)

Unit Size	H	W	L	A	B	C	D	E	F	G (RH)	G (LH)	J (RH)	J (LH)
24	51.72	28.00	32.22	16.09	22.00	13.57	9.04	1.30	3.00	11.42	13.42	9.42	11.42
36	51.72	40.00	32.22	16.09	34.00	13.57	9.04	1.30	3.00	11.42	13.42	9.42	11.42
54	63.57	40.00	40.07	20.09	34.00	13.58	12.57	0.72	3.00	11.42	13.42	9.42	11.42
72	63.57	48.00	40.07	20.09	40.00	13.58	12.57	0.72	4.00	11.42	13.42	9.42	11.42
90	71.94	48.00	42.44	26.09	40.00	13.58	12.57	1.66	4.00	12.79	14.79	10.79	12.79

Unit Size	K	M	N	P	Q	R	S	T	U	V	Basic Unit Weight
24	6.20	9.68	18.00	9.00	5.50	28.00	10.00	1.96	6.78	3.71	141.1
36	6.20	15.68	18.00	9.00	5.50	28.00	10.00	8.63	6.78	3.04	168.80
54	4.21	13.72	22.00	11.00	7.27	30.00	8.00	6.87	10.78	3.04	197.4
72	4.18	17.72	22.00	11.00	7.27	30.00	8.00	5.83	10.78	8.08	246.4
90	4.81	17.72	28.00	11.25	11.64	30.00	2.00	7.84	16.78	6.07	258.40

Notes:
- All coil connections are sweat style.
- Weight of basic unit includes cabinet, fan, wiring and average filter. Add to basic unit weight seven pounds for weight of control box. Control box factory-mounted on motor side.
- Vertical coil and filter section ships separate for field installation. Refer to installation and maintenance manual for instructions.
- Vertical units provided with 4-inch to 6-inch high mounting legs. Legs are seismic rated.

TRANE

Dimensions and Weights

Angle Filter and Mixing Box

Figure 6. Angle filter and mixing box dimensions

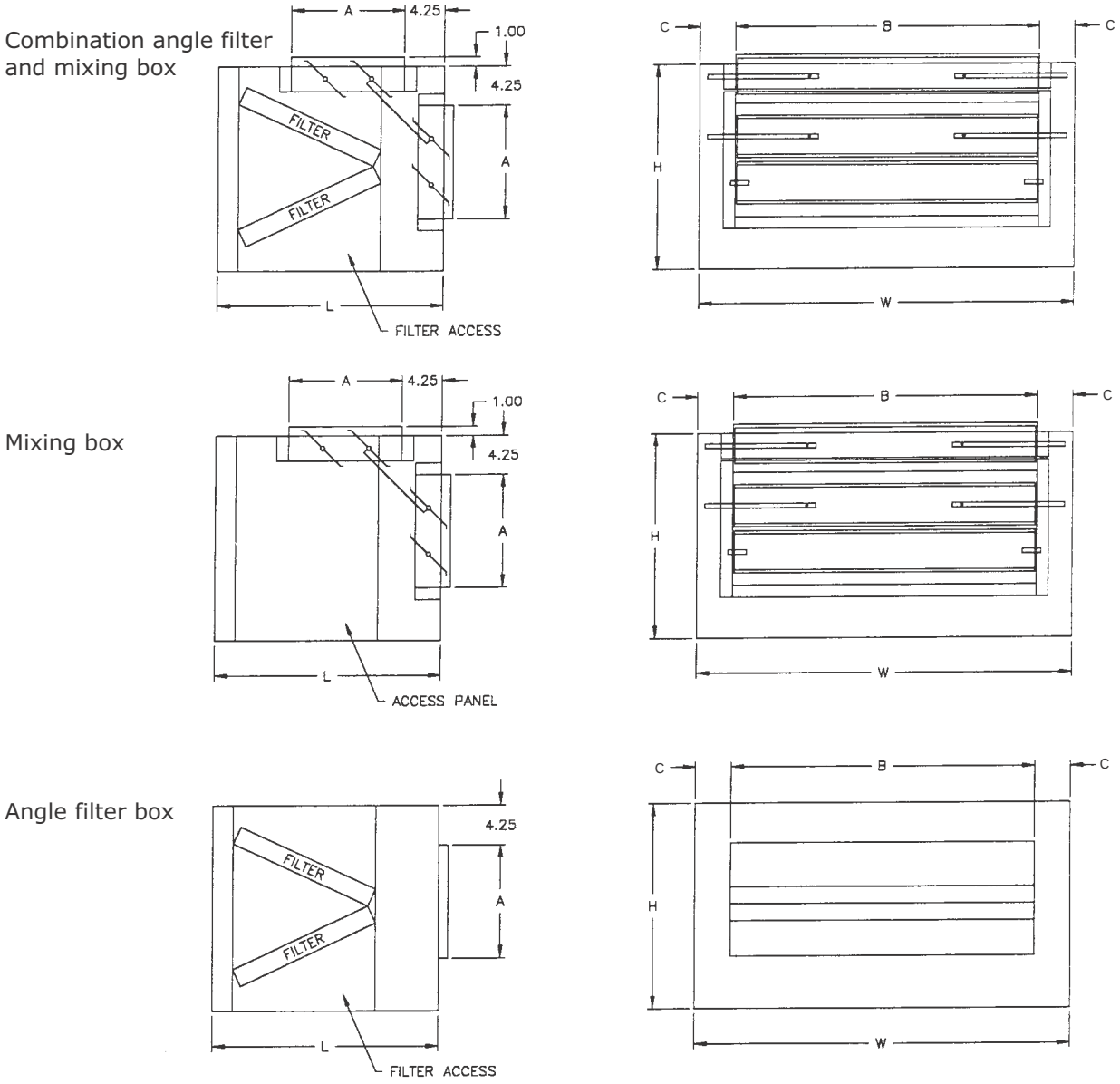


Table 4. Angle filter and mixing box dimensions (in.) and weights (lb)

Unit Size	H	L	W	A	B	C	Weight
12	14.12	22.00	24.11	7.06	15.56	4.28	36.0
16	14.12	22.00	28.11	7.06	19.56	4.28	41.0
24	18.12	19.50	28.11	7.06	19.56	4.28	43.0
36	18.12	24.50	40.11	7.06	31.56	4.28	56.0
54	22.12	23.50	40.11	12.81	31.56	4.28	72.0
72	22.00	23.50	48.00	12.81	31.56	8.22	72.5
90	27.90	27.56	48.00	12.85	31.56	8.22	84.1

Bottom or Top Access Filter Box

Figure 7. Bottom or top access filter box

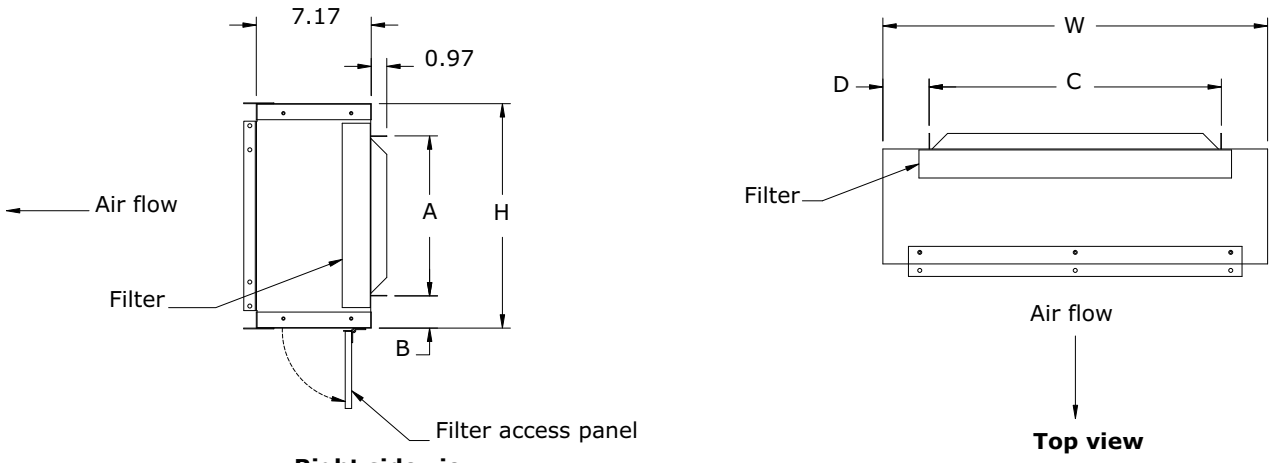


Table 5. Bottom or top access filter box dimensions (in.) and weights (lb)

Unit Size	H	W	A	B	C	D	Weight
12	14.00	24.00	9.98	2.01	18.23	2.88	15
18	14.00	28.00	9.98	2.01	21.98	3.01	17
24	18.00	28.00	14.23	1.89	23.23	2.38	18
36	18.00	40.00	14.23	1.89	33.73	3.13	25
54	22.00	40.00	18.23	1.89	33.73	3.13	28
72	22.00	48.00	18.23	1.89	42.73	2.63	32
90	28.00	48.00	23.23	1.89	41.23	3.38	37

TRANE

Dimensions and Weights

Electric Heat

Figure 8. Blower coils with electric heat

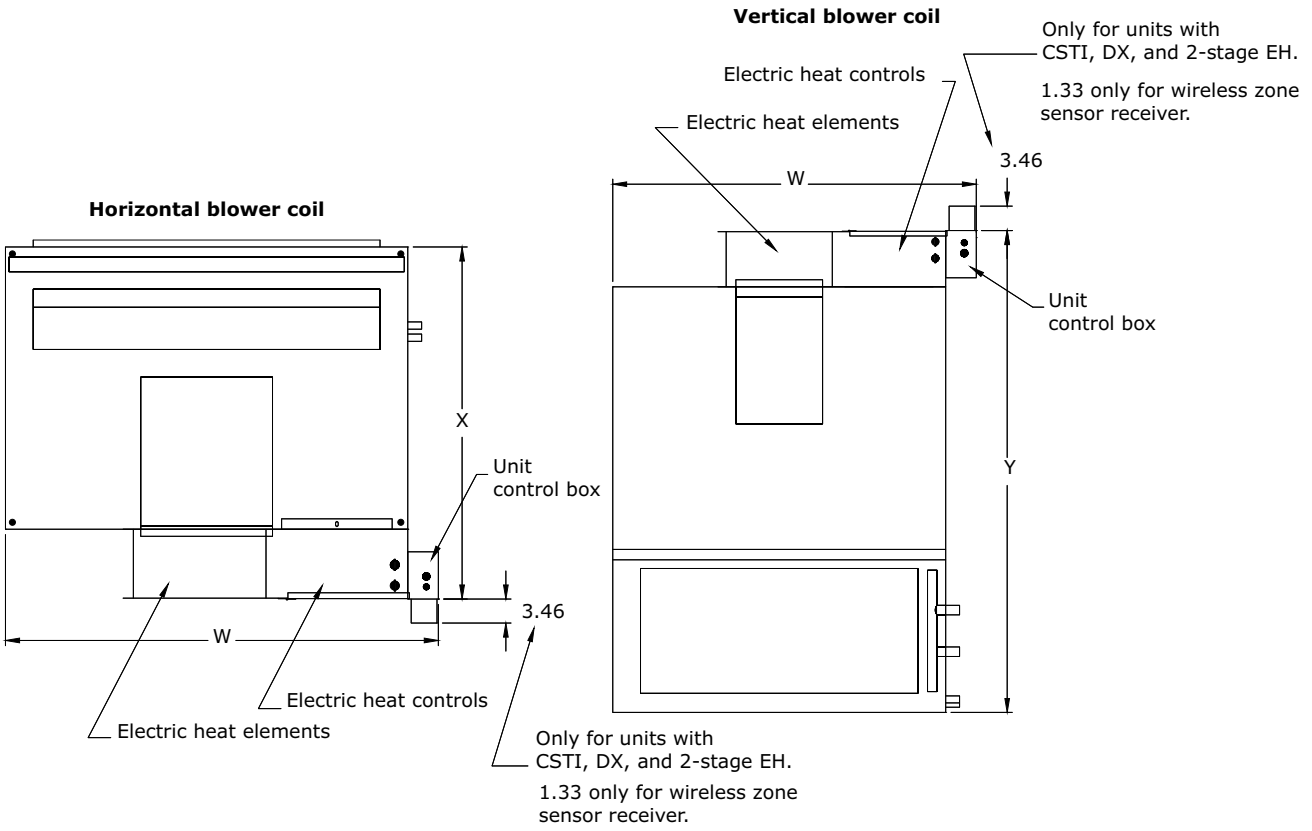


Table 6. Blower coils with electric heat dimensions (in.) and weights (lb)

Unit Size	W	X	Y
12	28.28	37.97	n/a
18	32.29	37.97	n/a
24	30.54	40.75	48.54
36	42.57	40.75	60.57
54	44.32	48.39	66.32
72	48.29	48.60	70.29
90	48.29	50.96	76.29

Figure 9. Electric heat dimensions

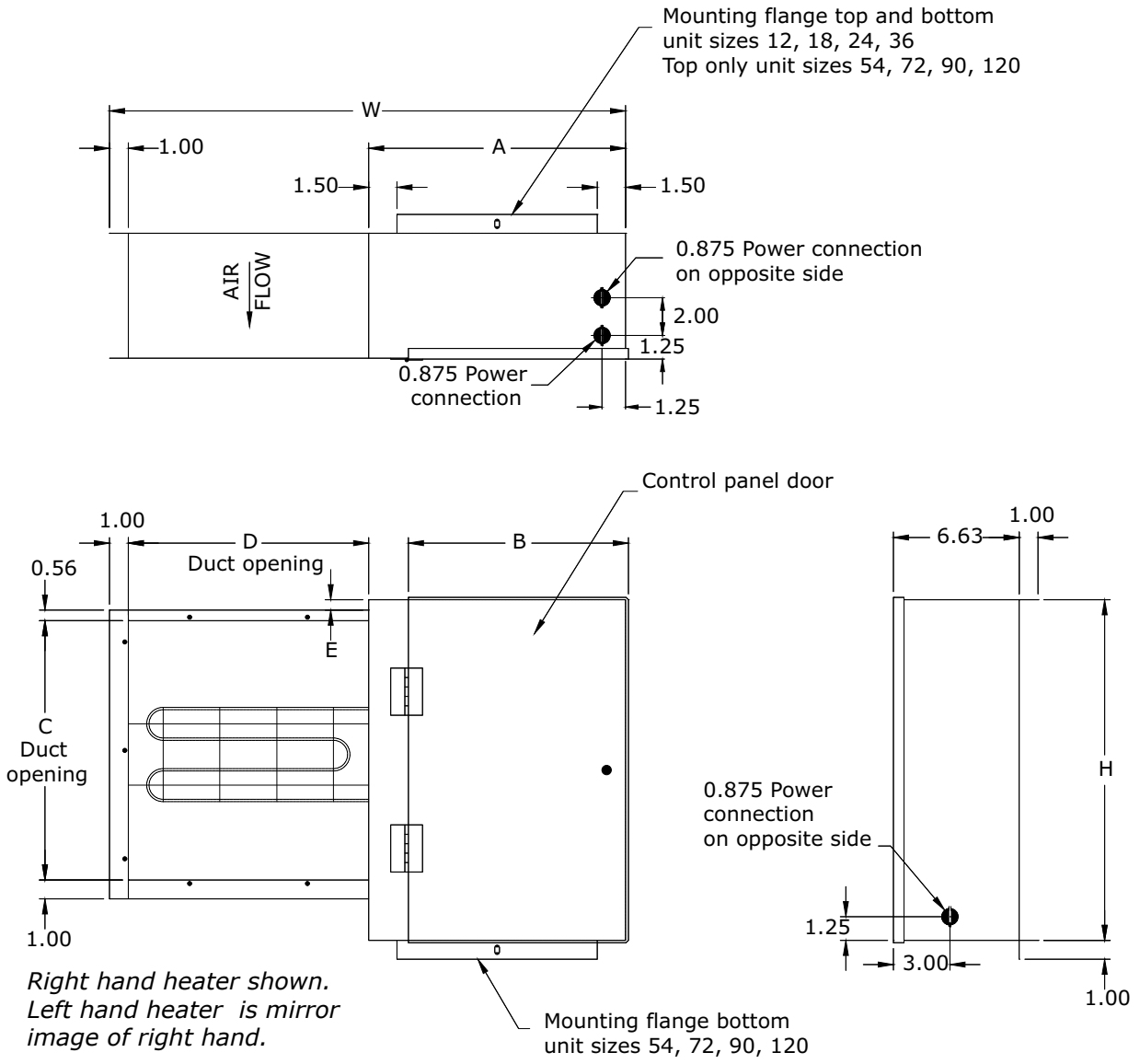


Table 7. Electric heat dimensions (in.) and weights (lb)

Unit Size	H	W	A	B	C	D	E	Weight
12	14.06	17.88	8.13	6.79	10.50	8.75	0.03	10.0
18	14.06	19.88	10.13	8.79	10.50	8.75	0.03	10.8
24	18.06	17.75	7.63	6.29	13.50	9.13	0.80	11.3
36	18.06	23.75	13.63	12.29	13.50	9.13	0.80	12.8
54	18.06	27.25	13.63	11.67	13.50	12.63	0.22	16.0
72	18.06	27.25	13.63	11.67	13.50	12.63	0.22	17.4
90	18.06	27.25	13.63	11.67	13.50	12.63	1.16	19.2

- Electric heater is factory mounted on unit discharge face and wired to unit control box.
- Heater may be mounted with horizontal or vertical up airflow.
- Optional mercury contactors cannot be used with vertical up airflow.
- Electric heat may need field-supplied externally-wrapped insulation if the unit is installed in an unconditioned space or if sweating is an issue.

TRANE

Dimensions and Weights

Steam Coil

Figure 10. Steam coil dimensions

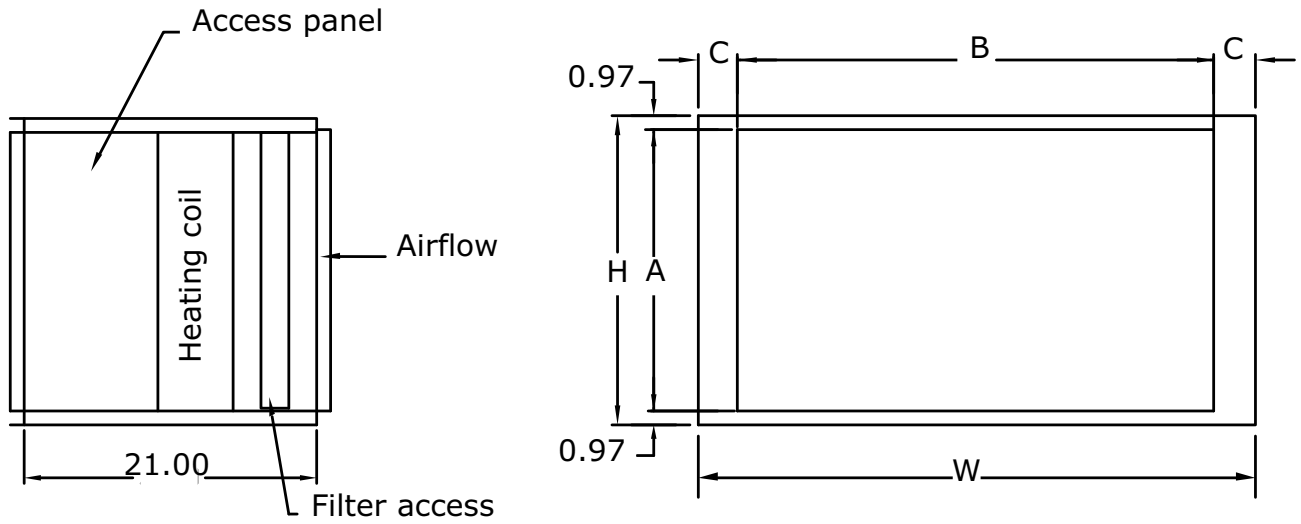


Table 8. Steam coil box dimensions (in.) and weights (lb)

Unit Size	H	W	A	B	C	Weight	Coil Connections, NPT	
							Supply	Return
12	14.00	24.00	12.06	18.04	2.98	34	1	3/4
18	14.00	28.00	12.06	22.04	2.98	37	1	3/4
24	18.00	28.00	16.06	22.04	2.98	40	1-1/2	1
36	18.00	40.00	16.06	34.04	2.98	48	1-1/2	1
54	22.00	40.00	20.06	34.04	2.98	50	2	1
72	22.00	48.00	20.06	42.04	2.98	56	2	1
90	28.00	48.00	26.06	40.04	3.98	63	2-1/2	1-1/4

Note:
- Filter access and access panel located on both sides.
- Weight includes cabinet with average filter, but does not include coil weight. See general data section for coil weights.

Coil Connections

Table 9. Hydronic coil connection sizes, OD (in.)

	Standard Capacity			High Capacity		
Unit Size	1-Row	4-Row	6-Row	2-Row	4-Row	6-Row
12	5/8	—	—	5/8	7/8	7/8
18	5/8	—	—	5/8	7/8	7/8
24	5/8	—	—	7/8	1-1/8	1-1/8
36	5/8	—	—	7/8	1-1/8	1-1/8
54	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-1/8
72	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-1/8
90	1-1/8	1-5/8	1-5/8	1-1/8	1-1/8	1-1/8

Table 10. DX coil connection sizes, OD (in.)

	3-Row and 4-Row		6-Row	
Unit Size	Suction	Liquid	Suction	Liquid
12	5/8	5/8	5/8	5/8
18	5/8	5/8	5/8	5/8
24	5/8	5/8	7/8	5/8
36	7/8	5/8	7/8	5/8
54	1-1/8	7/8	1-1/8	7/8
72	1-1/8	7/8	1-1/8	7/8
90	1-3/8	7/8	1-1/8	7/8

Table 11. Steam coil connection sizes, female connection, NPT (in.)

Unit Size	Supply	Return
12	1	3/4
18	1	3/4
24	1-1/2	1
36	1-1/2	1
54	2	1
72	2	1
90	2-1/2	1-1/4

TRANE

Dimensions and Weights

Piping Packages

Table 12. Piping package dimensions (in.)

Piping Package	Nominal Tube Size	Actual Size	A	B	C	D	E	F
2-way	1/2	5/8	12.025	2.650	12.625	5.650	n/a	n/a
	1	1-1/8	13.295	4.260	13.220	9.288	3.020	N/A
3-way	1/2	5/8	12.088	2.097	12.688	4.497	6.351	6.351
	3/4	7/8	15.623	1.750	15.313	6.290	6.701	6.701
	1	1-1/8	13.370	3.690	13.210	9.060	9.813	9.813
	1-1/4	1-3/8	16.885	3.738	16.410	10.023	3.052	10.520

Basic Piping

Figure 11. Two-way 1/2-in. and 1-in. valve basic piping package

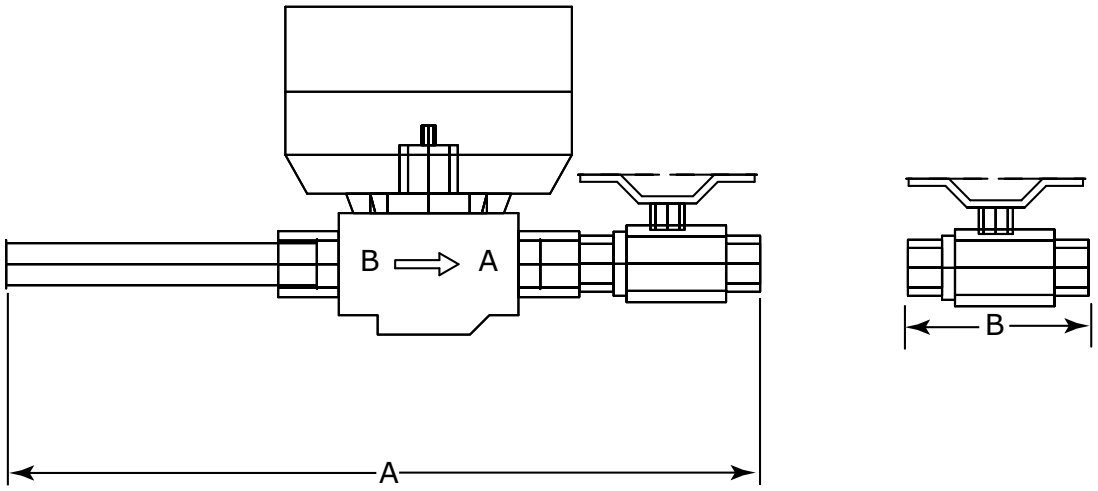


Figure 12. Two-way 1 1/4-in. valve basic piping package

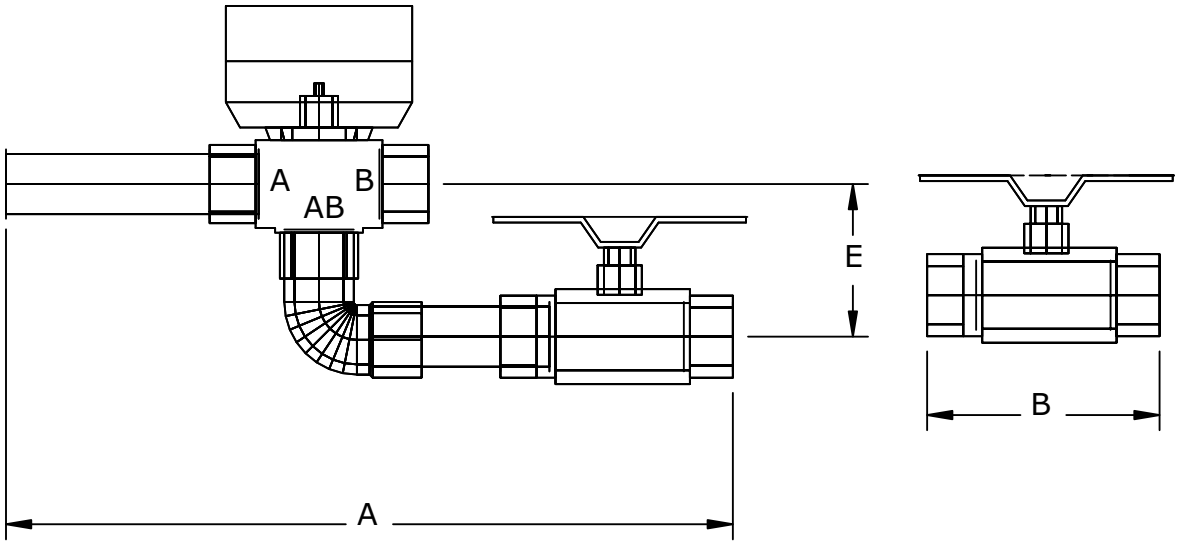
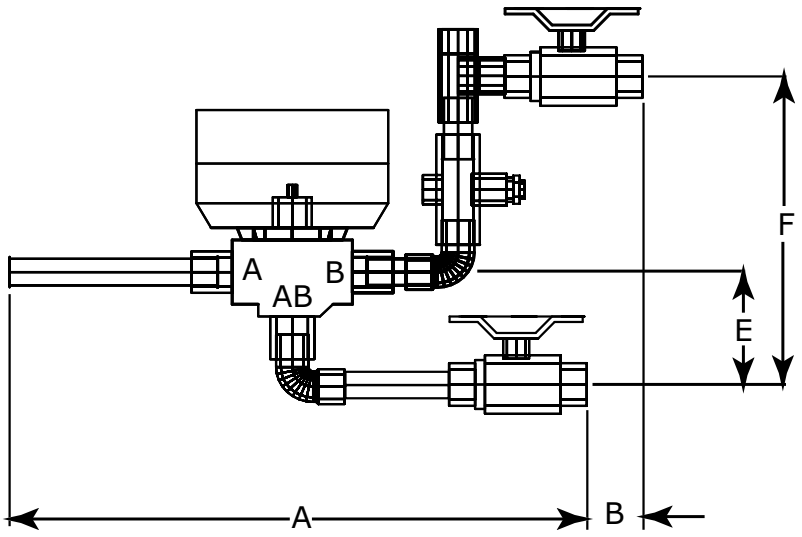
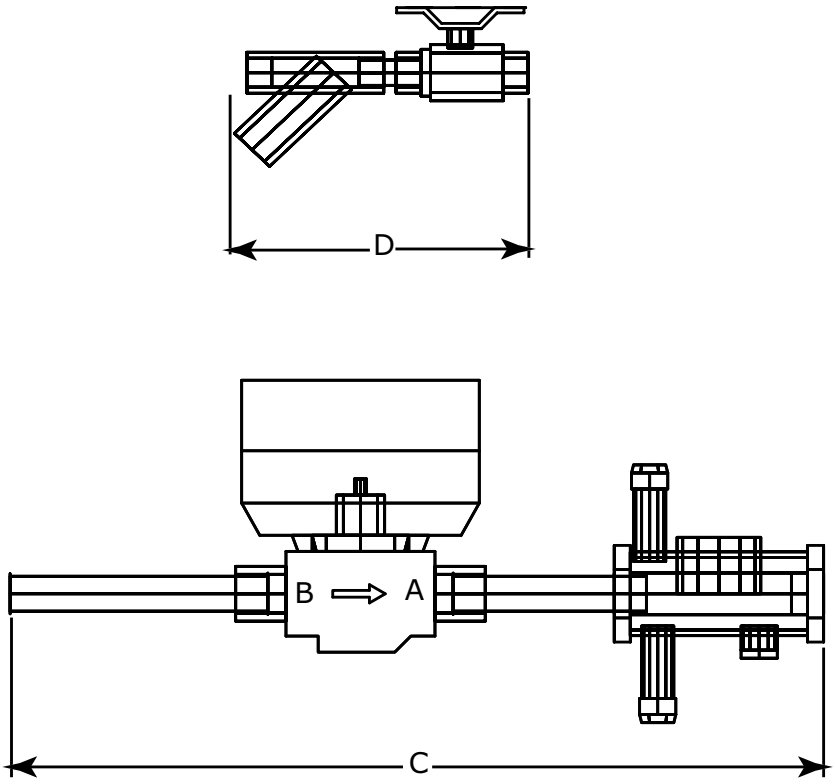


Figure 13. Three-way, 1/2 in. and 1-in. valve basic piping package



Deluxe Piping

Figure 14. Two-way 1/2-in. and 1-in. valve deluxe piping package



TRANE

Dimensions and Weights

Figure 15. Two-way 1 1/4-in. valve deluxe piping package

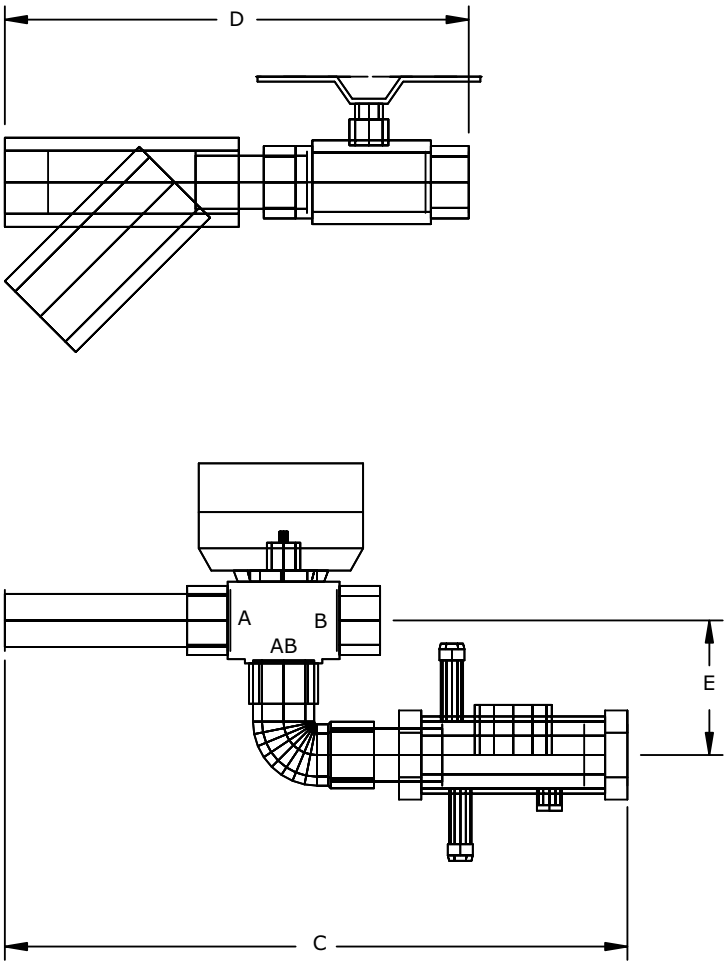
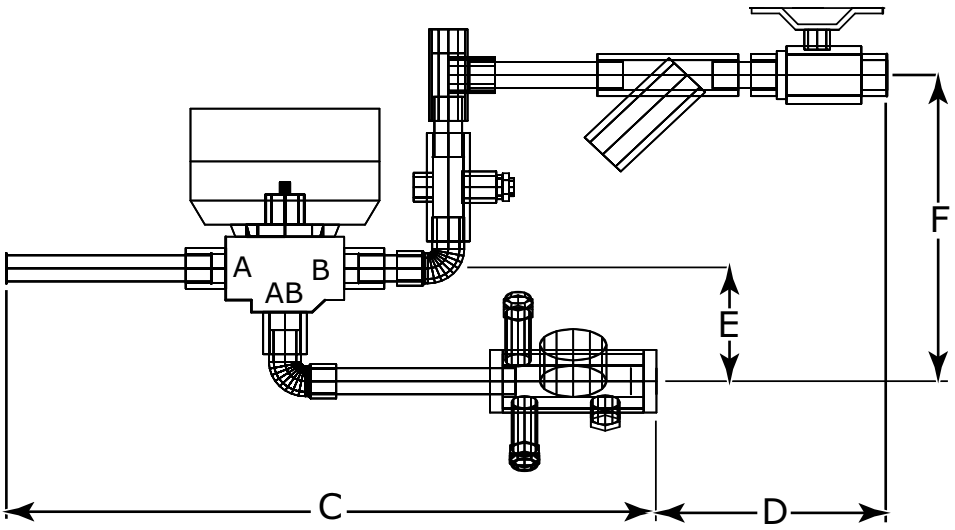


Figure 16. Three-way 1/2-in. and 1-in. valve deluxe piping package



Installation - Mechanical

Lifting and Rigging

⚠ WARNING

Improper Unit Lift!

Test lift unit approximately 24 inches to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury and possible equipment or property-only damage.

NOTICE:

Equipment Damage!

Keep skid in place until unit is ready to set. Do not move the unit or subassembly without the skid in place as shipped from the factory. Premature skid removal could result in equipment damage.

General Lifting Considerations

Before preparing the unit for lifting, estimate the approximate center of gravity for lifting safety. Because of placement of internal components, the unit weight may be unevenly distributed, with more weight in the coil and fan areas. Approximate unit weights are provided in "Dimensions and Weights" on page 13. Refer to the unit submittals for actual section weights. Test the unit for proper balance before lifting.

Before hoisting the unit into position, use a proper rigging method such as straps, slings, or spreader bars for protection and safety. Always test-lift the unit to determine the exact unit balance and stability before hoisting it to the installation location.

⚠ WARNING

Heavy Objects!

Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements could cause equipment or property damage. Failure to follow instructions above or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury.

1. Position rigging sling under wood skid using spreader bars to avoid unit damage.
2. Use a forklift with caution to prevent unit damage. The fork length must be at least 68 inches long to safely fork the unit from front or back.
3. The unit center of gravity will fall within the center of gravity block at various locations depending on unit options.
4. See unit nameplate for unit weight.

⚠ WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Installation Procedure

Follow the procedures below to install the blower coil unit.

Horizontal Unit Installation

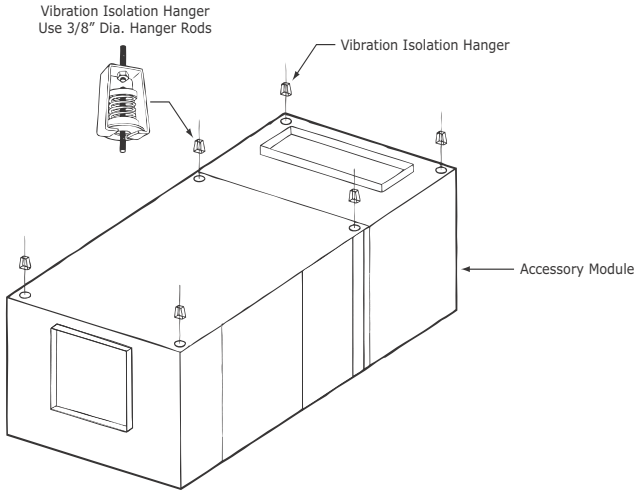
Install horizontal units suspended from the ceiling with 3/8-in. threaded rods that are field-provided. There are two knockouts in each corner of the unit for installation of the threaded rods. Ensure the ceiling opening is large enough for unit installation and maintenance requirements.

Materials needed:

- washers: 3/8-in., 1/2-in., and 3/4-in. (8 total)
- threaded rods, 3/8-in. (4 per unit and 2 per accessory section)
- nuts (8)
- flat washers or steel plates (8)
- vibration isolator hangers or turnbuckles (4 per unit and 2 per angle filter/mixing box/steam coil module)

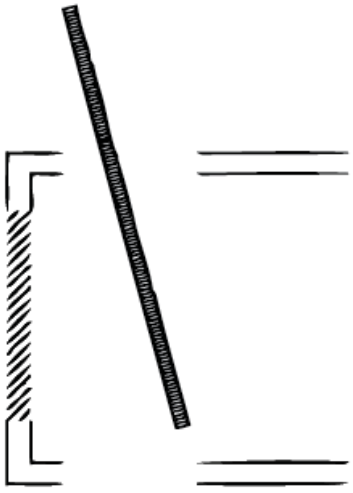
1. Determine the unit mounting hole dimensions. Prepare the hanger rod isolator assemblies, which are field-provided. Add a stack of 3/8-in., 1/2-in., and 3/4-in. washers to the top and bottom of the unit to hold it securely on the 3/8-in. rod, and install them in the ceiling. Trane recommends using threaded rods to level the unit. Consult the unit nameplate or "Dimensions and Weights," page 13 in this manual for the unit weight. See Figure 4 for proper horizontal unit installation.

Figure 17. Ceiling mounted horizontal unit



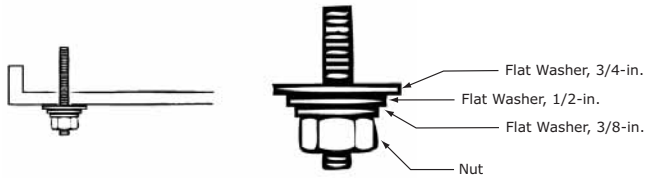
2. Remove motor access panels and filter access panels.
3. Punch out the eight knockouts in the top and bottom panels.
4. Guide the threaded rod through the unit from the top, careful not to damage insulation or wiring. See Figure 18. Insert the threaded rod at an angle to help prevent internal unit damage.

Figure 18. Angle threaded rod through knockouts



5. Put a nut and flat washers or steel plate on the bottom of the threaded rod (see Figure 19).

Figure 19. Add nut and flat washers to threaded rod



6. Put a nut and flat washer or steel plate on the top to prevent air leakage.
7. Thread the top of the rod into the isolator or turnbuckle.
8. Hoist the unit to the suspension rods and attach with washers and lock–nuts (see Figure 19 for details).
9. Level the unit for proper coil drainage and condensate removal from the drain pan. Refer to "Condensate Drain Connections," page 28.
10. Connect the ductwork to the unit. Refer to "Duct Connections," page 28.

Vertical Unit Installation

Materials needed:

- 1/4-inch 20 grade 8 screws, lockwashers, and nuts (8 per mounting leg = 32 per unit, and 16 per accessory section)
- Flat washers (12 per mounting leg = 48 per unit, and 24 per accessory section)

Install vertical units on the floor. Units are provided with legs that are field-installed to help accommodate a U-trap on the drain connection, if necessary. For mounting leg installation, use 1/4-in.-20 grade 8 screws as shown in Figure 22, p. 27. A field-fabricated inlet plenum is not required. The unit is shipped in two pieces, and can be arranged in either a pre-swirl or counter-swirl inlet configuration (see Figure 20).

Figure 20. Typical vertical unit installation

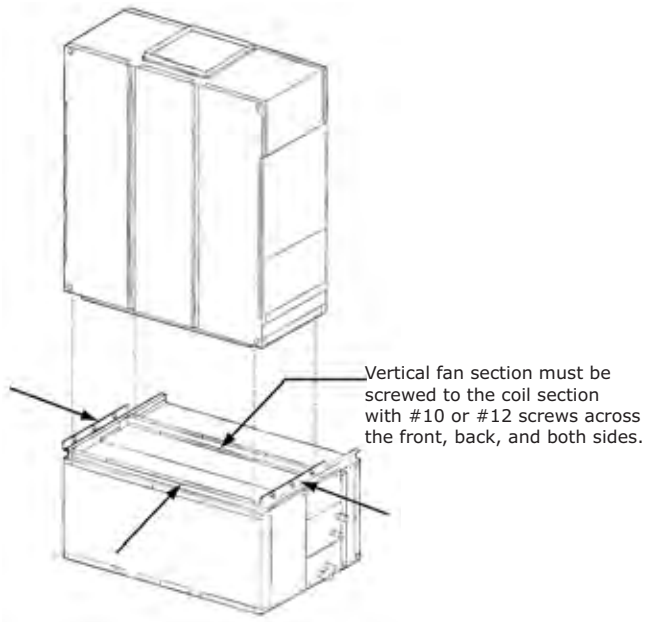


Figure 21. Mounting feet installation for vertical fan kit and steam coil module

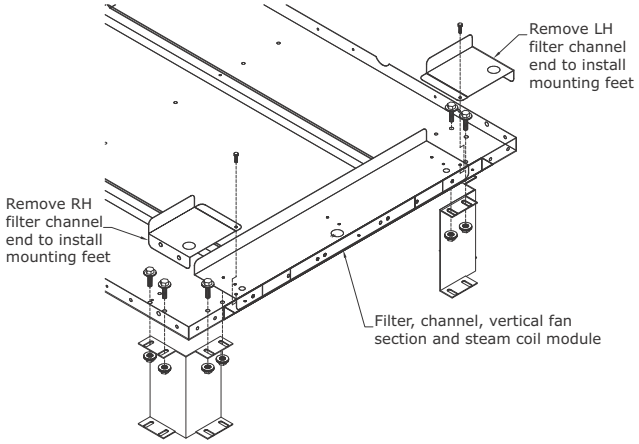
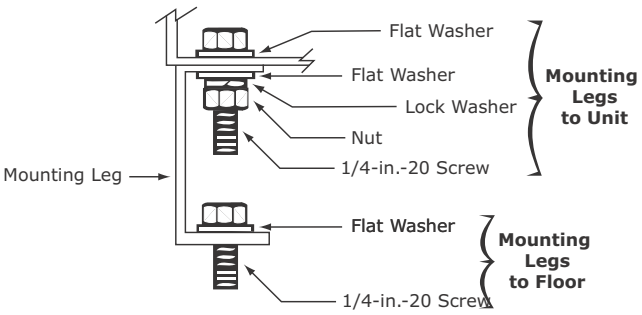


Figure 22. Mounting leg installation



* Quantity = 4 per mounting leg = 16 per unit + 8 per accessory item

Heating Coil Installation

Note: The hydronic heating coil option is factory installed in either the reheat or preheat position. Coils can be rotated for either right or left-hand connections.

If you need to rotate the hydronic heating coil option to change the coil connection side, follow the procedure below.

1. Remove both coil access panels.
2. Remove the coil and rotate to change connection position.
3. Exchange coil patch plates.
4. Knock out drain pipe connections on new coil hand access panel.
5. Plug old drain connections.

Mixing Box Installation

Materials provided:

- Mounting legs (2) for vertical units
- Interconnecting linkage, LH or RH attachment

Materials needed:

- Grooved and extendible drive rods, 1/2-inch O.D. grooved
- #10 screws, for mounting mixing box to unit, steam coil module, or top/bottom access
- 1/4-inch 20 grade 8 screws for mounting leg installation (see Figure 22)

The mixing box option ships separately for field installation. It has two low-leak, opposed blade dampers and all necessary interconnecting linkage components for left or right hand attachment onto 1/2-inch O.D. grooved, extendible drive rods. Also, mounting legs are provided for floor mounting on a vertical unit. Knockouts are provided to suspend the mixing box from the ceiling horizontally.

Installation Procedure

1. Support the mixing box independent of the unit in the horizontal position.
2. Install the mixing box as a sleeve around the duct collar of the filter frame. To attach the mixing box to the filter frame, insert screws through the matching the holes on all sides of the mixing box and filter frame.
3. Install the linkage, following the procedure below.

Linkage Installation Procedure

1. Attach the linkage on either the right or left side of the mixing box following the procedure below.
2. Open the damper blades fully. Locate drive rods on the LH or RH side for linkage attachment. Loosen drive rod set screw, without removing.

3. Remove knockouts on side access panel adjacent to the drive rods.
4. Pierce a hole through the insulation at the knockouts to allow the drive rod to extend freely through side of mixing box. Cut away insulation sufficiently to allow drive rod to turn smoothly.
5. Extend drive rod end at desired position beyond side of unit. Tighten drive rod set screws.
6. Attach linkage and tighten all set screws. Note that neither hand levers are provided. However, mixing box actuators are a factory-provided option that ship inside the mixing box when ordered.
7. Position linkage so both sets of dampers operate freely and so that when one damper is fully open, the other is fully closed.

Condensate Drain Connections

Note: It is the installer's responsibility to provide adequate condensate piping to prevent potential water damage to the equipment and/or building.

Size the main drain lines and trap them the same size as the drain connection, which is 3/4-inch schedule 40 PVC, 1.050 inch O.D. on blower coils.

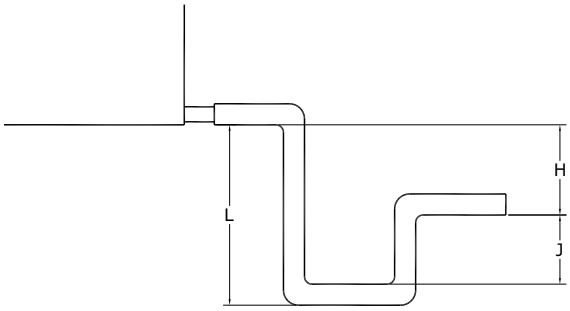
If drain pan removal is required, make the main and auxiliary drain connections with compression fittings. Follow the procedure below to remove the drain pan.

1. Remove the opposite side coil access panel.
2. Remove the drain pan clips.
3. Disconnect drain lines.
4. Remove the sheet metal screw.
5. Pull out drain pan through the opposite side.

Note: Prime drain traps to prevent the drain pan overflow.

Plug or trap the auxiliary connection to prevent air from being drawn in and causing carryover (see Figure 23, p. 28).

Figure 23. Recommended drain trap installation for draw-through units



Drain pan trapping for section under negative pressure

L = H + J + pipe diameter where:
H = 1 inch for each inch of negative pressure plus 1 inch
J = 1/2 H

Drain pan trapping for section under positive pressure

L = H + J + pipe diameter where:
H = 1/2 inch (minimum)
J = 1/2 inch plus the unit positive static pressure at coil discharge (loaded filters)

All drain lines downstream of the trap must flow continuously downhill. If segments of the line are routed uphill, this can cause the drain line to become pressurized. A pressurized drain line may cause the trap to back up into the drain pan, causing overflow.

Duct Connections

Install all air ducts according to the National Fire Protection Association standards for the "Installation of Air Conditioning and Ventilation Systems other than Residence Type (NFPA 90A) and Residence Type Warm Air Heating and Air Conditioning Systems (NFPA 90B).

Make duct connections to the unit with a flexible material such as heavy canvas to help minimize noise and vibration. If a fire hazard exists, Trane recommends using Flexweave 1000, type FW30 or equivalent canvas. Use *three inches* for the return duct and *three inches* for the discharge duct. Keep the material loose to absorb fan vibration.

Run the ductwork straight from the opening for a minimum of 1 1/2 fan diameters. Extend remaining ductwork as far as possible without changing size or direction. Do not make abrupt turns or transitions near the unit due to increased noise and excessive static losses. Avoid sharp turns and use elbows with splitters or turning vanes to minimize static losses.

Poorly constructed turning vanes may cause airflow generated noise. Align the fan outlet properly with the ductwork to decrease duct noise levels and increase fan performance. Check total external static pressures against fan characteristics to be sure the required airflow is available throughout the ductwork.

To achieve maximum acoustical performance, minimize the duct static pressure setpoint.

Coil Piping and Connections

NOTICE:

Connection Leaks!

Use a backup wrench when attaching piping to coils with copper headers to prevent damage to the coil header. Do not use brass connectors because they distort easily and could cause connection leaks.

NOTICE:

Over Tightening!

Do not use Teflon-based products for any field connections because their high lubricity could allow connections to be over-tightened, resulting in damage to the coil header.

NOTICE:

Leakage!

Properly seal all penetrations in unit casing. Failure to seal penetrations from inner panel to outer panel could result in unconditioned air entering the module, and water infiltrating the insulation, resulting in equipment damage.

General Recommendations

Proper installation, piping, and trapping is necessary to ensure satisfactory coil operation and to prevent operational damage:

- Support all piping independently of the coils.
- Provide swing joints or flexible fittings on all connections that are adjacent to heating coils to absorb thermal expansion and contraction strains.
- If the coil was ordered with factory-mounted controls, install the control valves. The valves ship separately.

Note: The contractor is responsible for supplying the installation hardware.

- For best results, use a short pipe nipple on the coil headers prior to making any welded flange or welded elbow type connections.
- Pipe coils counterflow to airflow.
- When attaching the piping to the coil header, make the connection only tight enough to prevent leaks. Maximum recommended torque is 200 foot-pounds.
- Use pipe sealer on all thread connections.
- After completing the piping connections, seal around pipe from inner panel to outer panel.

Note: Water coils and refrigerant coils have stubs for solder/braze connection. Steam coils have female NPT connections.

Steam Coil Piping

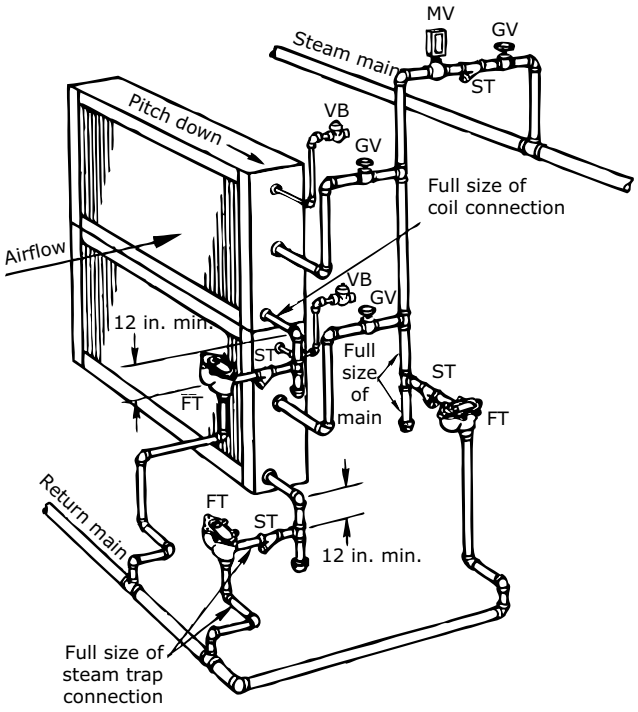
Air handlers fitted with steam coils have labeled holes for piping penetrations. Figure 24 illustrates a typical steam coil piping configuration. See Table 13 for the codes of system components in these figures.

The coil condensate return line must be piped full size of the condensate trap connection, except for a short nipple screwed directly into the coil header's condensate return tapping. Do not bush or reduce the coil return trapping size.

Table 13. Code of system components for piping figures

Code	System component
FT	Float and thermostatic steam trap
GV	Gate valve
OV	Automatic two-position (ON-OFF) control valve
VB	Vacuum breaker
ST	Strainer
AV	Automatic or manual air vent
MV	Modulating control valve

Figure 24. Typical piping for Type NS steam coils and horizontal tubes for horizontal airflow



TRANE

Coil Piping and Connections

To prevent coil damage, complete the following recommendations:

- Install a 1/2-inch NPT, 15 degree swing check valve vacuum breaker with cracking pressure of 0.25 inches Hg (3.4 inches water) or lower at the top of the coil. This vacuum breaker should be installed as close to the coil as possible.

NOTICE:

Breaker Cracking Pressure!

The 1/2-inch NPT, 15 degree swing check valve vacuum breaker is recommended because other vacuum breakers, such as spring-loaded ball-check breakers, have cracking pressures as high as 1.25 inches Hg (17 inches of water). Vacuum breakers with fitting sizes smaller than 1/2 inch NPT are too small to relieve vacuum quick enough to ensure complete condensate drainage. Other types of swing check valve vacuum breakers are acceptable if the fittings size is not smaller than 1/2-inch NPT and the cracking pressure is not larger than 0.25 inches HG (3.5 inches of water). Failure to follow these instructions could result in equipment damage.

- For coil type NS, install the vacuum breaker in the unused condensate return tapping at the top of the coil.
- Vent the vacuum breaker line to atmosphere or connect it into the return main at the discharge side of the steam trap

Note: Vacuum breaker relief is mandatory when the coil is controlled by a modulating steam supply or automatic two position (ON-OFF) steam supply valve. Vacuum breaker relief is also recommended when face-and-bypass control is used.

NOTICE:

Coil Condensate!

Condensate must flow freely from the coil at all times to prevent coil damage from water hammer, unequal thermal stresses, freeze-up and/or corrosion. In all steam coil installations, the condensate return connections must be at the low point of the coil. Failure to follow these instructions could result in equipment damage.

Proper steam trap installation is necessary for satisfactory coil performance and service life. For steam trap installation:

1. Install the steam trap discharge 12 inches below the condensate return connection. Twelve inches provides sufficient hydrostatic head pressure to overcome trap losses and ensures complete condensate removal.
   a. Use float and thermostatic traps with atmospheric pressure gravity condensate return, with automatic controls, or where the possibility of low-pressure supply steam exists. (Float and thermostatic traps are recommended because of gravity drain and continuous discharge operation.)
   b. Use bucket traps only when the supply steam is not modulated and is 25 psig or higher.

Note: Trane steam coils require a minimum of 2 psi of pressure to assure even heat distribution.

2. Trap each coil separately to prevent holding up condensate in one or more of the coils.
3. Install strainers as close as possible to the inlet side of the trap.
4. If installing coils in series airflow, control each coil bank independently with an automatic steam-control valve. Size the traps for each coil using the capacity of the first coil in direction of airflow.
5. Use a modulating valve that has linear flow characteristics to obtain gradual modulation of the coil steam supply.

Note: Do not modulate systems with overhead or pressurized returns unless the condensate is drained by gravity into a receiver, vented to atmosphere, and returned to the condensate pump.

6. Pitch all supply and return steam piping down 1 inch for every 10 feet in the direction of the steam or condensate flow.

Note: Do not drain the steam mains or take-offs through the coils. Drain the mains ahead of the coils through a steam trap to the return line.

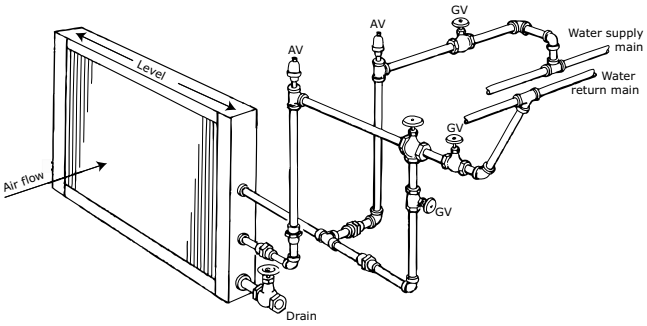
7. Ensure overhead returns have 1 psig of pressure at the steam trap discharge for every 2 feet of elevation for continuous condensate removal.

Water Coil Piping

Figure 25 illustrates a typical water coil piping configuration.

Water coils are self-venting only if the water velocity exceeds 1.5 feet per second (fps) in the coil tubes. See the unit submittals for coil water velocity.

Figure 25. Typical piping for water coil



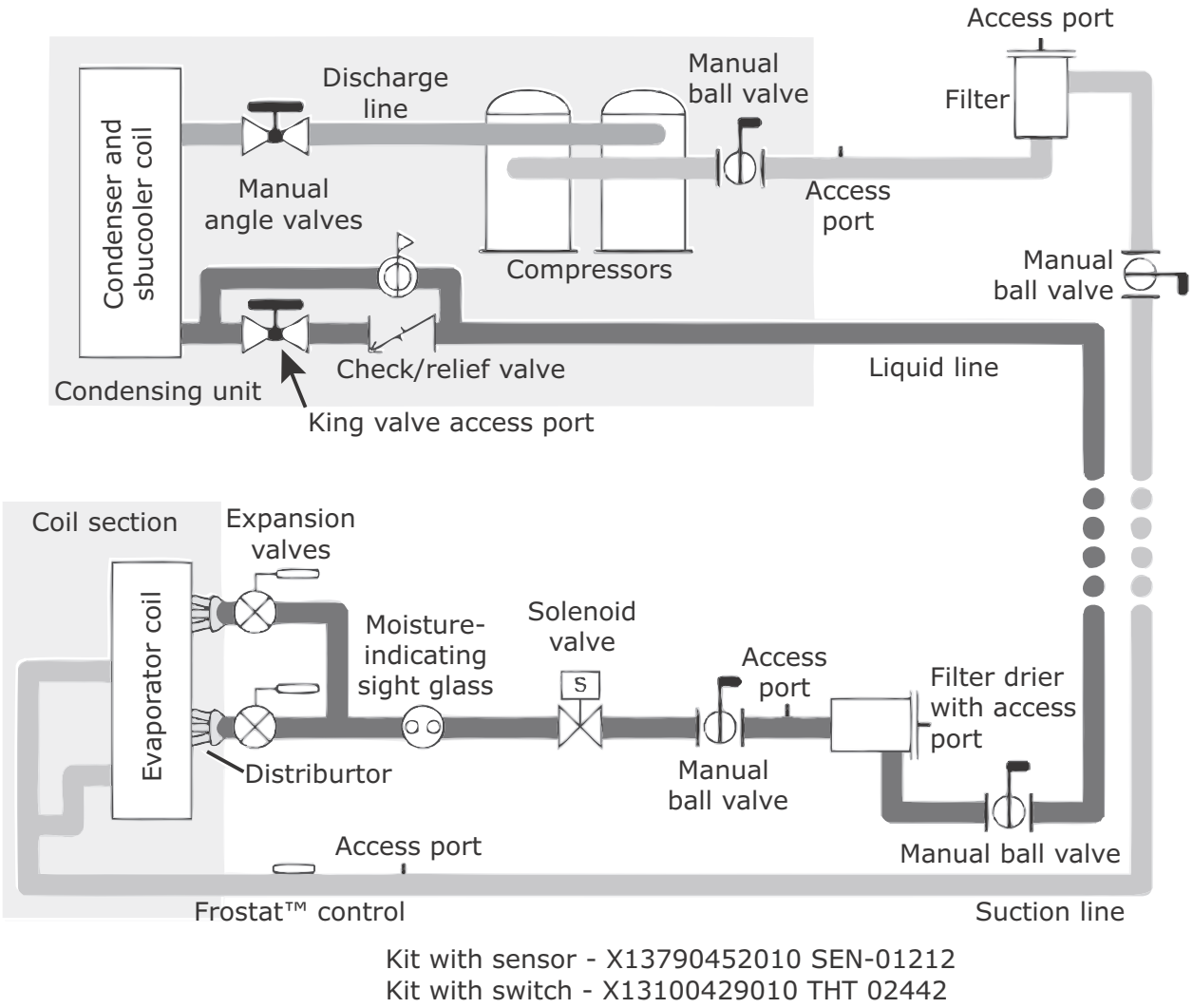
Refrigerant Coil Piping

Note: Refer to for information on handling refrigerants.

Coil Piping and Connections

Figure 26 illustrates an example of a split-system component arrangement. Use it to determine the proper, relative sequence of the components in the refrigerant lines that connect the condensing unit to an evaporator coil. Refer to "Field-Installed Evaporator Piping Examples," p. 36 for more detailed schematics of evaporator piping.

Figure 26. Example of placement for split-system components



Liquid Lines

Line Sizing

Properly sizing the liquid line is critical to a successful split-system application. The selected tube diameter must provide at least 5°F [2.7°C] of subcooling at the expansion valve throughout the operating envelope. Increasing the size of the liquid line will not increase the available subcooling.

Routing

Install the liquid line with a slight slope in the direction of flow so that it can be routed with the suction line. Minimize tube bends and reducers because these items tend to increase pressure drop and to reduce subcooling at the expansion valve. Liquid line receivers, other than those that are factory-installed, are not recommended.

Insulation

The liquid line is generally warmer than the surrounding air, so it does not require insulation. In fact, heat loss from the liquid line improves system capacity because it provides additional subcooling. However, if the liquid line is routed through a high-temperature area, such as an attic or a mechanical room, insulation would be required.

Components

Liquid-line refrigerant components necessary for a successful job include a filter drier, access port, solenoid valve, moisture-indicating sight glass, expansion valve(s), and ball shutoff valves. Figure 26 illustrates the proper sequence for positioning them in the liquid line. Position the components as close to the evaporator as possible.

- *Filter drier.* There is no substitute for cleanliness during system installation. The filter drier prevents residual contaminants, introduced during installation, from entering the expansion valve and solenoid valve.
- *Access port.* The access port allows the unit to be charged with liquid refrigerant and is used to determine subcooling. This port is usually a Schraeder® valve with a core.
- *Solenoid valve.* In split systems, solenoid valves isolate the refrigerant from the evaporator during off cycles; under certain conditions, they may also trim the amount of active evaporator as compressors unload. Generally, the "trim" solenoid valve is unnecessary for VAV comfort-cooling applications, and is only required for constant-volume applications when dehumidification is a concern.
  In split systems with mircochannel heat exchanger condensers (MCHE), solenoid valves isolate the refrigerant from the evaporator during the off cycles. Trim solenoids cannot be used with MCHE.

Note: Trane condensing units with MCHE no longer employ pump-down, but isolation solenoids are required. The suggested solenoid uses a 120-volt service and requires code-compliant wiring to the condensing unit.

- *Moisture-indicating sight glass.* Be sure to install one moisture-indicating sight glass in the main liquid line. The only value of the sight glass is its moisture indication ability. Use actual measurements of temperature and pressure—not the sight glass—to determine subcooling and whether the system is properly charged. The moisture indicator/sight glass must be sized to match the size of the liquid line at the thermal expansion valve.

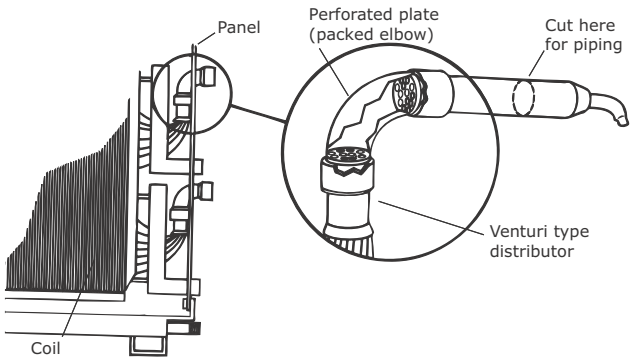
NOTICE:

Valve Damage!

Disassemble the thermal expansion valve before completing the brazing connections. If necessary, wrap the valve in a cool, wet cloth while brazing. Failure to protect the valve from high temperatures could result in damage to internal components.

- *Thermal expansion valve.* The expansion valve is the throttling device that meters the refrigerant into the evaporator coil. Metering too much refrigerant floods the compressor; metering too little elevates the compressor temperature. Choosing the correct size and type of expansion valve is critical to assure it will correctly meter refrigerant into the evaporator coil throughout the entire operating envelope of the system. *Correct refrigerant distribution into the coil requires an expansion valve for each distributor.* The thermal expansion valve must be selected for proper size and capacity. The size of the expansion valve should cover the full range of loadings. Check that the valve will successfully operate at the lightest load condition. For improved modulation, choose expansion valves with balanced port construction and external equalization. Cut the process tube and cap assembly from the liquid connection as shown in Figure 27 and install the expansion valve directly to the liquid connections.

Figure 27. Type F refrigerant coil with packed elbow



- *Ball shutoff valves.* Adding manual, ball-type shutoff valves upstream and downstream of the filter simplifies replacement of the filter core.

Suction Lines

Line sizing

Proper line sizing is required to guarantee the oil returns to the compressor throughout the system's operating envelope. At the same time, the line must be sized so that the pressure drop does not excessively affect capacity or efficiency. To accomplish both objectives, it may be necessary to use two different line diameters: one for the horizontal run and for the vertical drops, and another for the vertical lifts (risers).

Routing

To prevent residual or condensed refrigerant from "free-flowing" toward the compressor during the off cycle, install the suction line so it slopes by ¼ inch to 1 inch per 10 feet of run toward the evaporator.

When the application includes a suction riser, oil must be forced to travel the height of the riser. Riser traps are unnecessary in the suction line. They will add pressure drop. Double risers must not be used. They not only add pressure drop, but can hold great amounts of oil - oil better used in the compressor.

Note: If a suction riser is properly sized, oil will return to the compressor regardless of whether a trap is present. If a suction riser is oversized, adding a trap will not restore proper oil entrainment.

Avoid Underground Refrigerant Lines

Refrigerant condensation during the off cycle, installation debris inside the line (including condensed ambient moisture), service access, and abrasion/corrosion can quickly impair reliability.

Insulation

Any heat that transfers from the surrounding air to the cooler suction lines increases the load on the condenser (reducing the system's air-conditioning capacity) and promotes condensate formation. After operating the system and testing all fittings and joints to verify that the system is leak-free, insulate suction lines to prevent heat gain and unwanted condensation.

Components

Installing the suction line requires field installation of these components: a filter, access port, and a Frostat™ control when the refrigerant coil is used with Trane condensing units. Position them as close to the compressor as possible.

Note: Placement of the Frostat control is illustrated in Figure 26 on page 32.

- *Filter.* The suction filter prevents contaminants, introduced during installation, from entering the compressor. For this reason, the suction filter should be the replaceable-core type, *and* a clean core should be installed after the system is cleaned up.
- *Access port.* The access port is used to determine suction pressure. This port is usually a Schraeder valve with a core.
- *Frostat™ coil frost protection.* The Frostat control is the preferred method for protecting evaporator coils from freezing when the refrigerant coil is used with Trane condensing units. It senses the suction-line temperature and temporarily disables mechanical cooling if it detects frost conditions. The control is mechanically attached to the outside of the refrigerant line, near the evaporator, and wired to the unit control panel.
- *Ball shutoff valve.* Adding manual, ball-type shutoff valves upstream and downstream of the filter simplifies replacement of the filter core.

Expansion Valves

Expansion valves meter refrigerant into the evaporator under controlled conditions. If there is too much refrigerant, the refrigerant will not completely vaporize and the remaining liquid will slug the compressor. If there is too little refrigerant, there may not be enough cooling for the compressor.

Expansion valve requirements vary based on condensing unit design. Consult the product literature for the condensing unit to be used for proper valve selection.

Remodel, Retrofit, or Replacement

Inevitably, older condensing units and evaporator systems will need to be replaced or retrofitted. Due to the phase-out of many of these older refrigerants, the major components for those older units or systems may no longer be available. The only option will be to convert the system to R-410A, POE oil, and R-410A components.

When upgrading an existing refrigerant split system due to remodel, retrofit, or replacement, the entire system must be reviewed for compatibility with R-410A and POE oil. Each and every part of the split HVAC system MUST be compatible with the properties of R-410A refrigerant and POE oil. In addition, ensure the existing electrical service is adequate for the product being installed.

⚠WARNING

R-410A Refrigerant under Higher Pressure than R-22!

Failure to use proper equipment or components as described below, could result in equipment failing and possibly exploding, which could result in death, serious injury, or equipment damage. The units described in this manual use R-410A refrigerant which operates at higher pressures than R-22. Use ONLY R-410A rated service equipment or components with these units. For specific handling concerns with R-410A, please contact your local Trane representative.

Every part of an existing split system needs to be analyzed to determine if it can be reused in an R-410A and POE oil system:

- R-22 condensing units will not work with R-410A; they must be replaced.
- Most older evaporator coils were not pressure- and cycle-rated for R-410A pressures. If they weren't, they will need to be replaced. If they were properly pressure-rated for R-410A, existing coils must be modeled to determine if they will meet capacity requirements, are properly circuited, have correctly sized distributor tubes, and employ acceptable distributors and orifices.
- The required R-410A line sizes may be different than the existing line sizes. The lines need to be re-sized and compared to existing lines for reusability.
- Suction lines 2-5/8 OD and smaller of type L copper are suitable for use with R-410A. Suction lines 3-1/8 OD must use type K or thicker wall.
- Discharge lines, liquid lines, heat pump vapor lines, and hot gas bypass lines 1-3/8 OD and smaller of type L copper are suitable for use with R-410A. These same lines sized at 1-5/8 OD or 2-1/8 OD must use type K or thicker wall.
- Expansion valves need to be reselected. Expansion valves are refrigerant specific.
- Any gasket or o-ring should be replaced. Shrinkage of the original seal may occur after an HFC conversion, potentially causing a refrigerant leak. Components commonly affected are Schraeder cores, solenoid valves, ball valves, and flange seals. But *all* external seals in contact with refrigerant should be viewed as potential leak sources after a retrofit.
- All other valves, filters, valve packing, pressure controls, and refrigeration accessories must be researched through their manufacturer for compatibility with the pressures of an R-410A system, and for their compatibility with the newer POE oil.
- For the best performance and operation, the original mineral oil should be removed from the components of the system that are not being replaced. Any component of the system that is suspected of trapping oil (piping, traps, and coil), should be dismantled, drained, and reassembled. After all components have been drained, the amount of residual mineral oil will have a negligible effect on performance and reliability.

NOTICE:

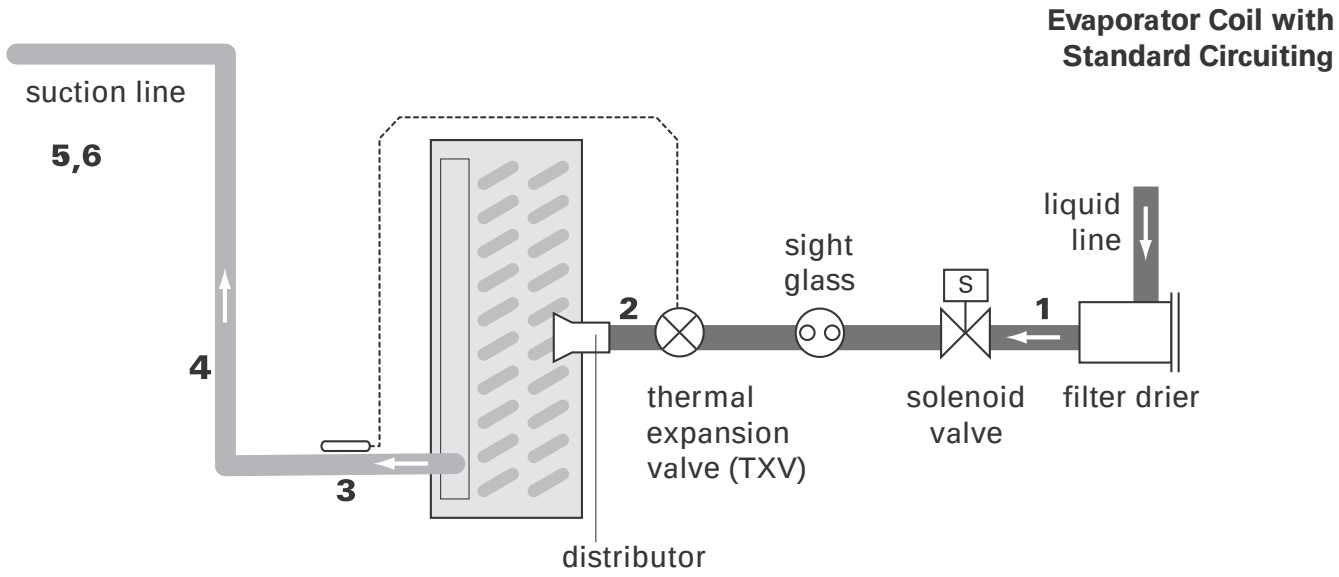
Compressor Damage!

POE oil is hygroscopic – it absorbs water directly from the air. This water is nearly impossible to remove from the compressor oil and can cause compressor failures. For this reason, the system should not be open for longer than necessary, dry nitrogen should flow in the system while brazing, and only new containers of oil should be used for service and maintenance.

All Codes take precedence over anything written here.

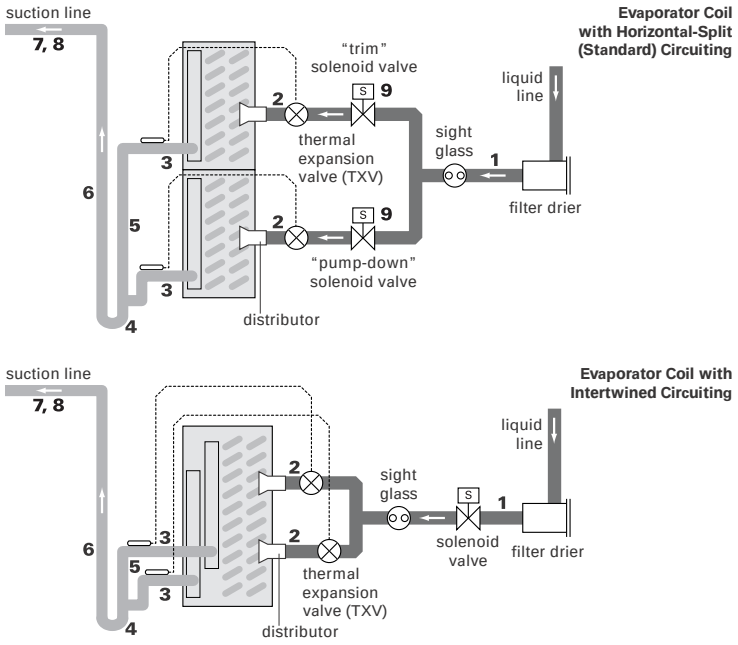
Field-Installed Evaporator Piping Examples

Figure 28. Single-circuit condensing unit: evaporator coil with one distributor



1. Pitch the liquid line slightly—1 inch/10 feet —so that the refrigerant drains toward the evaporator.
2. Provide one expansion valve per distributor.
3. Slightly pitch the outlet line from the suction header toward the suction riser—that is, 1 inch/10 feet in the direction of flow. Use the tube diameter that matches the suction-header connection.
4. Use the tube diameter recommended in the condensing unit application manual for a vertical rise. Ensure that the top of the riser is higher than the evaporator coil.
5. Pitch the suction line slightly—1 inch/10 feet —so the refrigerant drains toward the evaporator.
6. Insulate the suction line.

Figure 29. Single-circuit condensing unit: evaporator coil with two distributors



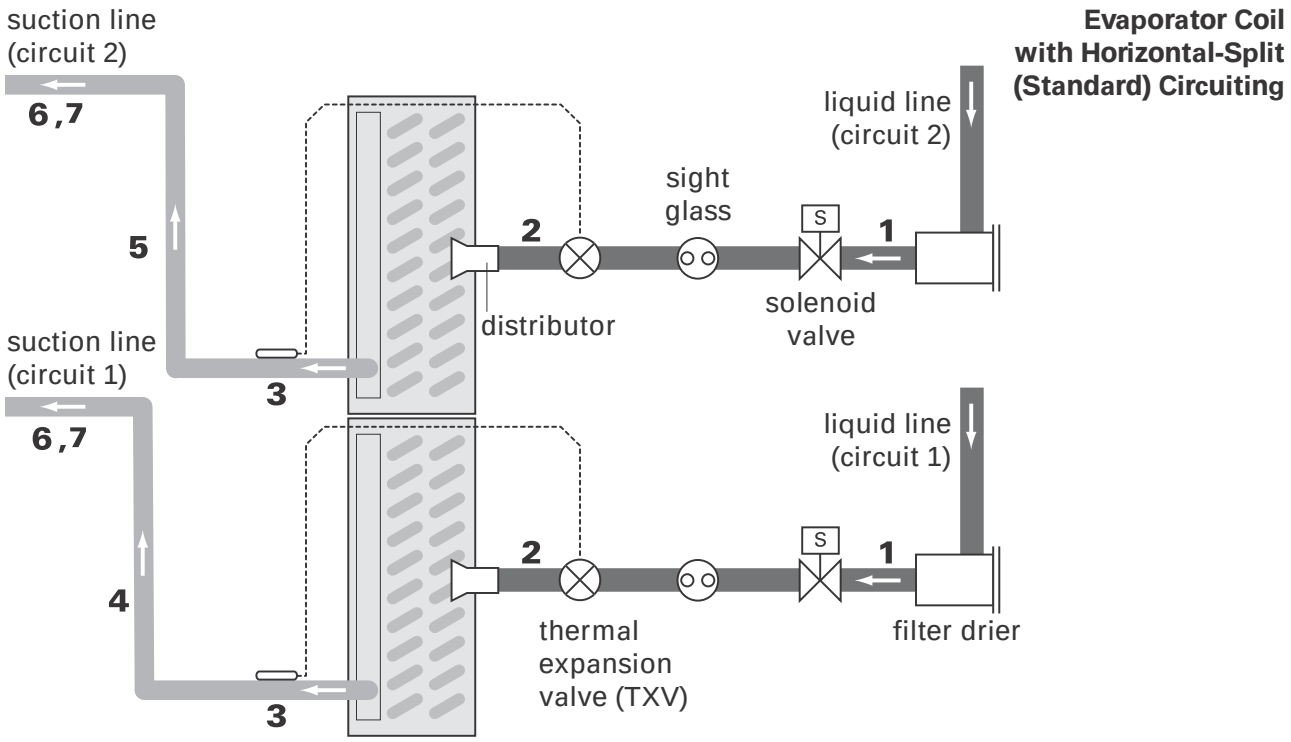
1. Pitch the liquid line slightly—1 inch/10 feet —so the refrigerant drains toward the evaporator.
2. Provide one expansion valve per distributor.
3. Slightly pitch the outlet line from the suction header toward the suction riser— 1 inch/10 feet in the direction of flow. Use the tube diameter that matches the suction-header connection. Use a double-elbow configuration to isolate the TXV bulb from other suction headers.
4. This looks like a trap, but is actually due to the requirement that the refrigerant gas leaving the coil flows downward, past the lowest suction-header outlet, before turning upward.
5. Use the "horizontal" tube diameter as specified in the condensing unit application manual.
6. Use the tube diameter recommended for a vertical rise as specified in the condensing unit application manual. Assure the top of the riser is higher than the evaporator coil.
7. Pitch the suction line slightly—1 inch/10 feet — so that the refrigerant drains toward the evaporator.
8. Insulate the suction line.
9. Only use a "trim" solenoid valve for constant-volume, humidity-sensitive applications. For all other applications, install a single solenoid valve (the "pumpdown" solenoid valve) between the liquid-line filter drier and the sight glass.

Note: Due to reduced coil volume in condensing units with microchannel heat exchanger condenser, do not use trim solenoid valves for these units.

TRANE

Coil Piping and Connections

Figure 30. Dual-circuit condensing unit: evaporator coil with two distributors



1. Pitch the liquid lines slightly—1 inch/10 feet —so that the refrigerant drains toward the evaporator.
2. Provide one expansion valve per distributor.
3. Slightly pitch the outlet line from the suction header toward the suction riser—1 inch/10 feet in the direction of flow. Use the tube diameter that matches the suction-header connection.
4. The top of the Circuit 1 suction riser must be higher than the bottom evaporator coil. Use the tube diameter recommended for a vertical rise as specified in the condensing unit application manual.
5. The top of the Circuit 2 suction riser must be higher than the top evaporator coil. Use the tube diameter recommended for a vertical rise as specified in the condensing unit application manual.
6. Pitch the suction lines slightly—1 inch/10 feet —so that the refrigerant drains toward the evaporator.
7. Insulate the suction lines.

Installation - Electrical

Unit Wiring Diagrams

Specific unit wiring diagrams are provided on the inside of the control panel door. Typical unit wiring diagrams are in "Wiring Diagrams," p. 69. Use these diagrams for connections or trouble analysis.

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

Supply Power Wiring

Refer to the unit nameplate to obtain the minimum circuit ampacity (MCA) and maximum overcurrent protection (MOP) to properly size field supply wiring and fuses or circuit breakers.

Refer to the unit operating voltage listed on the unit wiring schematic, submittal, or nameplate. Reference the wiring schematic for specific wiring connections.

NOTICE:

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors may result in equipment damage.

Note: All field wiring should conform to NEC and all applicable state and local code requirements. The control panel box is always on the end opposite the piping connections. Access the control box by removing the two screws that secure the front cover. This will allow the panel to be removed, to provide access to the electrical components.

⚠WARNING

Hazardous Electrical Shorts!

Insulate all power wire from sheet metal ground. Failure to do so may cause electrical shorts that could result in death or serious injury.

If the unit does not have a disconnect switch, the power leads and capped ground wire are inside the control panel.

If the unit has a disconnect switch, the power leads are wired to the junction box switch on the control panel. Pull the capped ground wire into the junction box.

Electrical Grounding Restrictions

All sensor and input circuits are normally at or near ground (common) potential. When wiring sensors and other input devices to the Tracer controller, avoid creating ground loops with grounded conductors external to the unit control circuit. Ground loops can affect the measurement accuracy of the controller.

NOTICE:

Equipment Damage!

Unit transformer IT1 provides power to blower coil unit only. Field connections directly to the transformer IT1 may create immediate or premature unit component failure.

All input/output circuits (except isolated relay contacts and optically isolated inputs) assume a grounded source, either a ground wire at the supply transformer to control panel chassis, or an installer supplied ground.

MCA and MFS Calculations

Minimum Circuit Ampacity (MCA) and Maximum Overcurrent Protection (MOP) Calculations for non-Electric Heat Units

MCA = 1.25 x motor FLAs

MOP = 2.25 x motor FLA

Minimum Circuit Ampacity (MCA) and Maximum Overcurrent Protection (MOP) Calculations for Units with Electric Heat

Heater amps = (heater kW x 1000) / heater voltage

Notes: Use 120 V heater voltage for 115 V units.
Use 240 V heater voltage for 230 V units.
Use 208 V heater voltage for 208 V units.
Use 277 V heater voltage for 277 V units.

MCA = 1.25 x (heater amps + all motor FLAs)
MOP = (2.25 x motor FLA) + heater amps

See Table 16 for motor FLAs.

Select a standard fuse size equal to the calculated MOP. Use the next smaller size if the selected MOP does not equal a standard size. Selected fuse must be larger than the MCA.

Standard fuse sizes: 15, 20, 25, 30, 35, 40, 45, 50, 60 amps

Useful Formulas

kW = (cfm x ΔT) / 3145
ΔT = (kW x 3145) / air flow
Single phase amps = (kW x 1000) / voltage
Electric heat MBh = (Heater kW) (3.413)

Table 14. Available electric heat (kW)

Electrical heat (kW)	Voltage					
	115/60/1	208/60/1	220/50/1	230/60/1	240/50/1	277/60/1
1.0	Sizes 12–90					
1.5						
2.0, 2.5, 3.0						
3.5, 4.0		Sizes 12–90				
4.5						
5.0						
5.5, 6.0		Sizes 18–90				
6.5, 7.0, 7.5, 8.0		Size 24-90				
9.0, 10.0, 11.0						Size 36-90

Notes:
- Magnetic contactors are standard. Mercury contactors are available on horizontal units only.
- Units with electric heat are available with or without door interlocking disconnect switch.
- Units with electric heat are available with or without line fuses.
- Units with electric heat must not be run below the minimum cfm listed in "General Data," p. 20.
- Electric heat is balanced staging: 1 stage = 100 percent, 2 stages = 50 percent/50 percent.

Motor Horsepower and Electrical Data

Table 15. Available motor horsepower

Motor	Unit Voltage	Motor Horsepower 0.50	1.00
60 Hz	115/1	•	•
	208/1	•	•
	230/1	•	•
	277/1	•	•
50 Hz	220/1	•	•
	240/1	•	•

Table 16. Motor electrical data

Voltage	Voltage range	RPM	Rated HP	LB	FLA
115/60/1	104–126	1725	1/2	14	7.5
			1.0	19	13.3
208–230/60/1	187–253	1725	1/2	14	4.3
			1.0	19	7.7
277/60/1	249–305	1725	1/2	14	3.8
			1.0	19	6.7
220/50/1	198–242	1725	1/2	14	4.3
			1.0	19	7.7
240/50/1	216–264	1725	1/2	14	4.3
			1.0	19	7.7

ECM Overview and Setup

Overview

This section addresses changes to the blower coil air handler, integrating the new Trane electronically commutated motor (ECM) and VelociTach™ motor control board. This exciting new series delivers outstanding comfort, safety, and performance with greatly reduced energy consumption compared to traditional units with induction AC motors.

The new series of units will provide a long service life with proper installation and operation. The new system provides a high degree of flexibility and configurability, but the simplicity of customized factory configuration appropriate to most installations.

Very little intervention is needed by service and installation personnel in most applications; however, installers must read through the entire document before beginning installation of the new equipment.

This literature focuses on unit motors and controls, including three new circuit modules developed specifically for this series.

Figure 31. Blower coil with Trane ECM

General Information

There are four primary components that enable the technology on your product:

1. Trane ECM
2. VelociTach motor control board
3. Manual fan speed switch (FSS)
4. CSTI adapter board

The motors and modules are combined as systems, and cannot work without each other.

Trane ECM

Figure 32. Trane ECM motor

- The ECM has integrated electronics, overload protection and short circuit protection. The motor contains no user-serviceable components inside.

NOTICE:

Equipment Damage!

The motor harness attached to the single plug to which the motor mates contains the very important motor voltage jumper and should not be modified or substituted. Failure to follow this instruction could result in equipment damage.

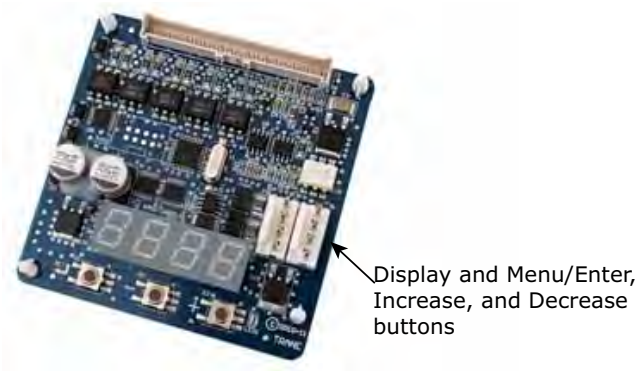
- The motor mates to the unit electrically via a single plug that contains both the operating voltage and the control signals that are needed for correct operation.

TRANE

ECM Overview and Setup

VelociTach Motor Control Board

Figure 33. VelociTach motor control board



The motor control board:

- Coordinates the operation of the fan in response to electric heat behavior and electric behavior in response to hydronic heat behavior.
- Incorporates a user interface that allows adjustment of certain unit parameters and provides constant feedback on motor operation.
- Integrates service and troubleshooting tools, including high-precision tachometers, fan status, and electric heat-enabled indicators.
- Integrates a versatile configurable auxiliary temperature sensor.
- Incorporates various safety and lockout features, such as maintaining proper fan speeds if electric heat is called for.

Status Display

Figure 34. Status display

The motor control board contains a four-digit, seven-segment display that is used to present information in a format close to real-world language, while having a small-form factor. Most characters are immediately recognizable; however, please consult Table 17 and Table 18 for the graphical representation of each alphanumeric character.

Table 17. Screen representation of alphabetical characters

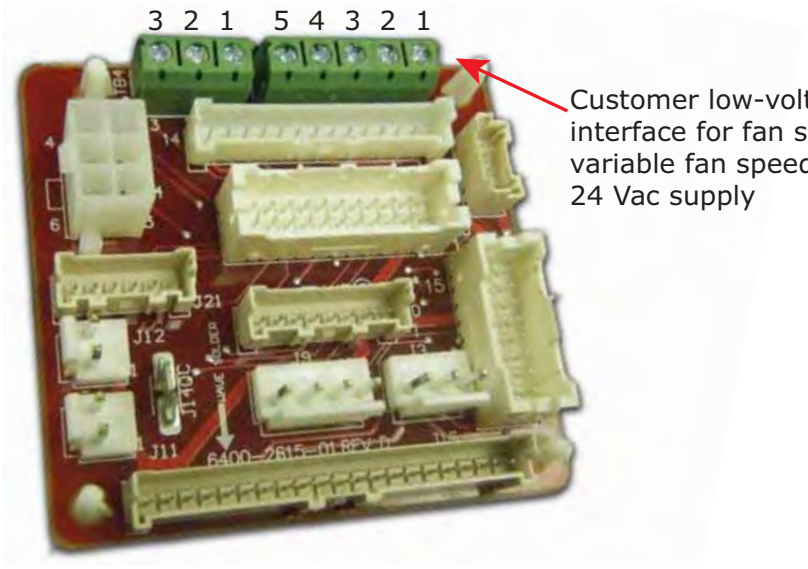
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	b	C	d	E	F	G	H	I	J	K	L	M	n	O	P	q	r	S	t	U	v	W	X	y	Z

Table 18. Screen representation of numeric characters

1	2	3	4	5	6	7	8	9	0
1	2	3	4	5	6	7	8	9	0

Manual Fan Speed Switch (FSS)

Figure 35. Standard adapter board field connections



1. VSP 10V
2. VSP 0–10V
3. VSP DC COM

1. 24 Vac Y (gnd)
2. 24 Vac Y (com)
3. High
4. Medium
5. Low

The adapter allows direct customer interfacing through the use of terminal strips. Standard interfacing includes:

- Fan speeds (H, M, L)
- Variable speed (2–10V) inputs

The standard adapter board eliminates many separate wiring harnesses in the panel and allows simple, mistake-proofed single-plug interfacing of:

- Motor control board
- Transformers
- Motors
- Valves
- Dampers
- Electric heat control
- Fan speed switches

The manual fan mode switch is available for fan-coil units that do not have Trane factory-mounted control packages. This four-position switch (off, high, medium, low) allows manual fan mode selection and is available wall mounted. The wall-mounted option is low-voltage using a factory-wired transformer. A courtesy 10 Vdc supply is provided for use with an external potentiometer or rheostat. The 10 Vdc supply supports up to 10 mA draw.

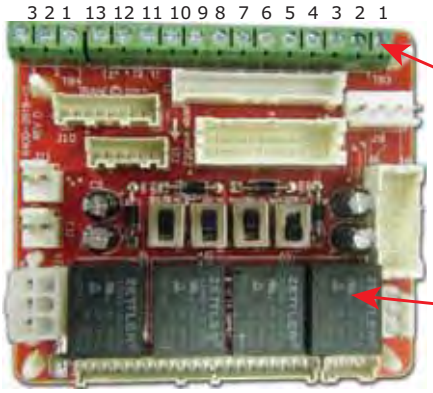
TB3 (right five positions) is normally used to provide 24V hookup to a wall mounted fan speed switch, and to accept the returns from the switch for High, Medium, and Low requests.

TB4 (left three positions) is normally used to control the system with a 0–10 Vdc output from a thermostat/controller, or a fan control rheostat/potentiometer.

The terminal block functional assignments and polarity are shown for reference only, and the schematics that ship with each unit should be consulted before wiring. Wiring assignments are configured for each unit.

Customer Supplied Thermostat Interface (CSTI)

Figure 36. CSTI adapter board and field connections



1. VSP 10V (TB4)
2. VSP 0–10V (TB4)
3. VSP DC COM (TB4)

1. 24 VAC B (hot) (TB3)
2. 24 VAC Y (gnd) (TB3)
3. Fan High (TB3)
4. Fan Medium (TB3)
5. Fan Low (TB3)
6. V1 Open (Cooling) (TB3)
7. V1 Close (Modulating Cooling) (TB3)
8. Freezestat (TB3)
9. Freezestat (TB3)
10. V2 Open/EH Stage 1 (Heating) (TB3)
11. V2 Close/EH Stage 2 (Heating) (TB3)
12. Damper Open/Condensate Overflow (TB3)
13. Damper Close/Condensate Overflow (TB3)

The control interface is intended to be used with a field-supplied, low-voltage thermostat or controller. The control box contains a relay board which includes a line voltage to 24-volt transformer and disconnect switch (for non-electric heat units). All end devices are wired to a low-voltage terminal block and are run-tested, so the only a power connection and thermostat connection is needed to commission the unit. Changeover sensors and controls are provided whenever a change-over coil is selected. When N.O. valves are selected, inverting relays are provided for use with standard thermostats.

The CSTI adapter board provides all the hookups of the standard adapter board, but in addition, provides hookups for valve control (main and auxiliary coils), electric heat control, and damper control. Screw terminal blocks provide convenient access to fan controls and to end device control. In addition, a courtesy 10-Vdc supply is provided for use with an external potentiometer or rheostat. The 10-Vdc supply supports up to 10 mA draw.

TB3 (right 13 positions) is normally used to provide:

1. 24 Vac supply to a wall fan speed switch or
2. 24 Vac supply to a field-installed unit-mounted controller, or a wall-mounted controller or thermostat
3. Inputs (returns) for thermostatic fan control: High, Medium, and Low
4. Inputs (returns) for cooling/heating requests
5. Inputs (returns) for electric heat requests
6. Inputs (returns) for damper operation requests

TB4 (left three positions) is normally used to control the system with a 0–10 Vdc input from a thermostat/controller with a variable speed output, or a fan control rheostat.

The terminal block functional assignments and polarity are shown for reference only, and the schematics that ship with each unit should be consulted before wiring. Wiring assignments are configured for each unit.

Installation and Initial Setup

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **The ECM motors contain capacitors which store residual energy. Please keep clear of the fan wheels for 5 minutes after the power has been removed from the system, as a power request with the motor powered off, could result in a very short period of actuation.**
- **All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the VelociTach motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.**
- **The adapter boards contain high voltage. Configuration adjustments to the motor control board should be made through the SMALLER of the two low-voltage lids on the front of the control panel, through the low-voltage insulation/shielding.**
- **Changes to switch settings on the CSTI adapter board take effect immediately. Changes should be made to the CSTI configuration switches with the power off.**
- **Initial hookups to the CSTI and Standard Adapter board, including low voltage interconnections, must be made with the power off.**
- **Do not make connections to the motors or the adapter boards while power is ON. Do not remove connections to the motor or the adapter boards while the power is ON.**
- **Do not free spin the fan wheels with your hands while the unit is powered on. The system is constantly scanning and responding to the operational status of the motors.**

Note: Normally, Trane ECMs are configured for soft ramps and transitions between speeds. However, to aid in commissioning of the unit, for approximately 10–15 minutes, the ramps will be shortened to quickly observe proper unit behavior and response to speeds.

For new installations, all boards and motors are pre-installed and pre-configured according to the unit configuration, indicated by its model number.

Under normal and intended operation, the only required intervention specific to the new ECM units is the wiring of:

- Wall-mounted low-voltage fan speed switch inputs to the adapter boards' terminal strips and 24 Vac tap to field-installed fan speed switch.
- Field-supplied controllers/thermostats to the adapter boards' terminal strips and 24 Vac power tap to field-supplied controller/thermostat.
- Adjustment and calibration of the variable speed inputs (VSP/0–10V) on the system.
- Adjustment, calibration or disabling of the optional auto-changeover function on CSTI units.

Otherwise, proceed with the mechanical, electrical and controls installations as defined in other sections of this manual, following all warnings and cautions.

After installation, turn power on.

Note: Specifications subject to change without notice. Consult the unit submittals and unit schematics before determining hookup requirements to the blower coil unit. Terminal block positions, polarities and assignments are determined for specific unit configurations only. Signal assignments are indicated, for reference only.

Both adapter boards come equipped with integrated terminal blocks to hook up to the field supplied/mounted fan speed switches and external controls. Connections should be made to the screw terminals with wires between 16 AWG and 24 AWG, with a ~4–5-mm wire strip length. The terminal blocks have 5-mm spacing, and are equipped with 3-mm screws. The field-supplied wires should have an insulation rating of 600V.

Adjustment and Configuration of the Motor Control Board

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.**
- **Configuration adjustments to the motor control board should be made through the SMALLER of the two low-voltage lids on the front of the control panel, through the low-voltage insulation/shielding.**

TRANE

ECM Overview and Setup

⚠CAUTION

Burn Hazard!

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a ECM configuration label. Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

Note: The motor control board functions and unit specific settings are summarized on the motor control board configuration label affixed to the back side of the control panel low voltage lid on every unit.

To check status, configuration, or to change settings on the motor control board with the power on the unit, detach the low voltage access lid and look or reach through the low voltage access panel. See Figure 37.

Figure 37. VelociTach motor control board

The motor control board features a nested menu integrated user interface (UI) that supports:

1. Status display for instant touch-free confirmation of unit operation.
2. Configuration parameter and value display and modification changes (using integrated menu/set buttons).
3. Error code prioritized reporting.

Note: Characters on the VelociTach motor control board display appear in red, on a black background.

The display contains decimal positions as well that change position with each parameter, as appropriate. Under normal conditions (i.e., with no error code displayed), the status will loop the following message:

Figure 38. Operational Status Codes

RPM Mode ***RUNNING/ FAN STATUS*** ***CONTINUOUS LOOP*** Displayed when: 1) No error codes are present 2) Motor has completed ramping	mtr 1 0000 → 2000	Indicates the current rpm of Motor 1 in the system. "0" rpm here indicate that no fan speed has been requested.
	mtr2 0000 → 2000	Indicates the current rpm of Motor 2 in the system. "0" rpm here indicate a fan off condition OR a fan "missing" condition(a).
	FSt 1 YES / no	Indicates the status being calculated or Fan Motor 1. If "off," this indicates that either: 1) No fan speed is being requested or 2) The fan performance is failing to meet the request; refer to "Troubleshooting (ECM)," p. 126 for additional information. If "on," this indicates that the fan is performing correctly and will be used to report fan status correctly, depending on FPrU mode.
	FSt2 YES / no	Indicates the status being calculated or Fan Motor 2. If "off," this indicates that either: 1) No fan speed is being requested or 2) The fan performance is failing to meet the request; refer to "Troubleshooting (ECM)," p. 126 for additional information. 3) If the target speed for Motor 2 is "0," this is used to indicate a missing motor(a). If "on," this indicates that the fan is performing correctly and will be used to report fan status correctly, depending on FPrU mode.
	EhEn YES / no	Indicates that the temperature sensing circuit has calculated a logical "on" based on the settings of the following parameters: A i2Ti / A i2b / A iPU

(a) Motor 1 is the only motor in blow coil units.

Configuration Parameter and Value Display and Modification Changes

The VelociTach motor control board's on-board user interface is easy to use and supports:

1. Verification/auditing of on-board parameter settings (read-only)
2. Adjustment of the on-board settings (write)

Figure 39. User interface input buttons

The user interface has three input buttons (see Figure 39), from left to right:

1. "Menu/Set"
2. "Decrement"
3. "Increment"

Each button has several different actuation levels depending on length of press, and what the UI is currently displaying.

Table 19. Button actuation levels

Menu/Set		
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration Display		Toggles between parameter name and value without saving (abandons value if changed).
Long Press/Hold in Status Display	>3 sec	Enters the configuration menu
Long Press/Hold in Configuration Display	>3 sec	If on a parameter name, toggles to the value. If on a parameter value, saves the value settings and returns to the parameter name as confirmation.

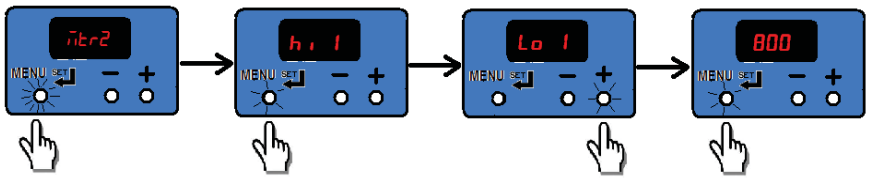
Decrement		
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration Display	<1 sec	Scrolls through parameter names, or decreases value of parameter.
Long Press/Hold in Status Display	>3 sec	n/a
Long Press/Hold in Configuration Display	>3 sec	Faster scroll through parameter name, or faster decrease of values of parameters.

Increment		
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration Display	<1 sec	Scrolls through parameter names, or increases value of parameter.
Long Press/Hold in Status Display	>3 sec	n/a
Long Press/Hold in Configuration Display		Faster scroll through parameter name, or faster increase of values of parameters.

Configuration Use Examples

Example 1. To view the value of parameters without saving. In this case we wish to verify that the “Low Speed Value” for Motor 1 is set correctly to 800 rpm.

Figure 40. Verify low speed value

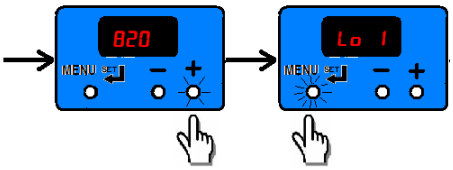


Example 2. We wish to change the change the value of Low Speed to 820 rpm:

We will continue from the previous example as shown below, using a long press to “save” the new desired value.

Note: If the display has timed out and returned to the status loop, repeat Example 1 to arrive back at this example’s starting point.

Figure 41. Change value of low speed

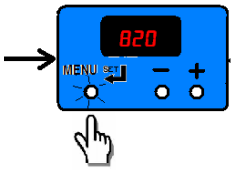


We start with the motor control board scrolling status display and proceed as follows:

Example 3. We wish to double check to see if the value of “820 rpm” has been saved.

Note: If the display has timed out and returned to the status loop, repeat Example 1 and Example 2 to arrive back at this example’s starting point.

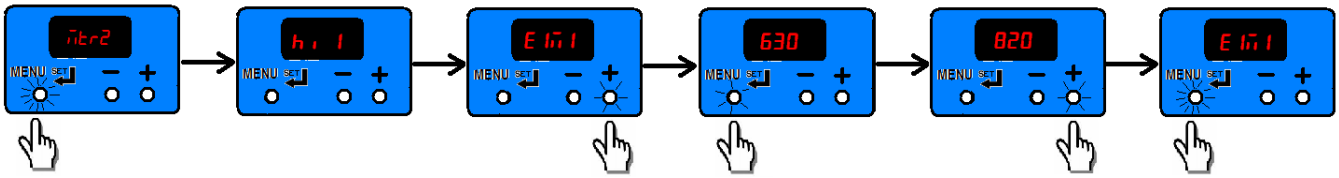
Figure 42. Verify value of 820 rpm



Example 4. We wish to change the value of a protected value on an electric heat unit. See Figure 43.

It would appear that the value has been changed, but if we check the value, we notice that the original value has been retained.

Figure 43. Change value on electric heat unit



Priority / Error Display

Under special conditions, the status display will interrupt briefly to prioritize display of events:

Notes:

- *During error displays, the user interface will be disabled, until the error is removed or resolved.*
- *If changes are made to parameters and saved, most settings take effect immediately. Any change to fan speeds will take effect and cause the configuration menu to exit immediately to begin tracking speeds via the on-board tachometer.*
- *If a error occurs while the configuration menu is in effect, all unsaved values will be discarded and the error codes will be displayed.*

Table 20. Error Codes

Displayed during abnormal operation.	MTR 1 LOCH	Indicates a locked rotor condition of Motor 1. The motor will be locked out until the cause has been resolved, and the power cycled; refer to "Troubleshooting (ECM)," p. 126 for resolution details. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shut down.
	MTR2 LOCH	Indicates a locked rotor condition of Motor 2. The motor will be locked out until the cause has been resolved, and the power cycled; refer to "Troubleshooting (ECM)," p. 126 for resolution details. Motor 1 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shut down.
	MTR 1 OSPd	Indicates that Motor 1 has experienced a run-away or over speed condition, and has been shutdown. The unit will offer limited "limp-in" performance, and Motor 2 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Refer to "Troubleshooting (ECM)," p. 126: to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shut down.
	MTR2 OSPd	Indicates that Motor 2 has experienced a run-away or over speed condition, and has been shutdown. The unit will offer limited "limp-in" performance, and Motor 1 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Refer to "Troubleshooting (ECM)," p. 126: to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shut down.
	RAMP 0000 → 2000 2000 → 0000	Indicates the motor is transitioning between speeds, ramping up or down. The message "RAMP" is briefly displayed, followed by the target speed for "Motor 1" only. Once the target speed has been reached, the status display will resume operation.
	U 123	On power on, the version of software is briefly displayed, followed by the results of a POST (power on self test).

Note: Blower coil units have only Motor 1 installed.

Initial Setup and Configuration

After connections of power and hookup of customer installed controls/fan speed switches and under normal/operative conditions the only adjustments needed to be made to the motor control board during commissioning of the unit are:

- Adjustment and calibration of the variable speed inputs (VSP/0–10V) on the system, where applicable.
- Adjustment, calibration or disabling of the optional auto-changeover function on CSTI units, where applicable.

In addition, the CSTI adapter board offers configurability that can be used in special cases to adjust the following operation of the unit:

- Courtesy cooling/main valve logic inversion relays for use with normally open valves
- Courtesy heating/auxiliary valve logic inversion relays for use with normally open valves
- Changeover function for use with changeover coils (in conjunction with the motor control board)

The switches are factory-set based on the model number configuration as ordered; however, the information is provided below to aid in the understanding of the operation of the system.

Configuration

Configuring the VelociTach Motor Control Board

Adjustment and Calibration of the Variable Speed Inputs (VSP/0–10V)

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **Connections to the adapter boards/changes to the CSTI configuration switches should be made only with the power to the unit disconnected.**
- **All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.**

⚠CAUTION

Burn Hazard!

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a motor control board configuration label. Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

NOTICE:

Equipment Damage!

You MUST follow all recommendations below. Failure to do so could result in equipment damage.

- **Care should be taken in the system to use a single 24 Vac supply system to avoid damage to equipment.**
- **Care should be taken to observe proper polarity and grounding in the hookup of the 0–10V system to avoid damage to equipment.**

Notes:

- *The 0–10V (variable speed) inputs are available for use, but are not mandatory. The ECM system comes standard with three to five field-accessible thermostatic inputs (with adjustable speed), so the use of the 0–10V inputs is optional.*
- *All inputs are independently configurable and simultaneously accessible, and the motor control board will choose the highest user (configured and*

requested) speed. However, care should be taken with customer controls to avoid contention of signals.

The motor control board and adapter boards offer standard, normalizing 0–10V Variable speed fan inputs for use with field supplied controllers or thermostats. These inputs can be used as the only input to the system, used in addition to the thermostatic (H, M, L) inputs, or not used at all. The inputs are accessible via 1TB4 on the adapter boards.

The motor control board is factory configured to drive the unit to a minimum speed (catalogue "low speed" value), defined as ALn1 and ALn2 once the analog (0–10V) input is honored. As a default, the noise floor/threshold is set to 3 percent (0.3V). At 0.3V, the system will drive the motors to the speeds defined in defined as ALn1 and ALn2. If the analogue input goes to 10V, the motor control board will drive the motor to maximum speed (normally catalogue "high speed" value), defined as AHn1 and AHn2, and will change speed in response.

Although the VelociTach motor control board ships with settings that will work with most 0–10 Vdc outputs, calibration should be performed to maximize response range and controller authority. Typically, the only settings needed for the VSP inputs are calibration of the signal to ensure that the system obeys the following rules:

1. The minimum output from the field supplied controller is met with a positive fan response. That is, we do not want the uFLr setting on the motor control board to be higher than the minimum output of the field supplied controller, as the motor control board will "ignore" a portion of the usable range of the customer fan variable speed output.
2. The minimum output from the field supplied controller is not significantly greater than the floor setting uFLr floor. If the minimum output of the controller is significantly greater than the floor setting, the first point that the motor will turn on will be above the ALn1 and ALn2 value. The full range of motor control will not be fully utilized in this case, as the motor will never reach the low speed motor analogue input scaling value for Motor 1 and Motor 2 (ALn1 and ALn2)
3. The maximum output of the controller needs to be 10V, or if lower, needs to be compensated using the analog input scaling value, A1Sc to normalize the operational range. As a default, the scaling value is set to 1.00 (so a voltage of 5V will be graded as 5V); however, to compensate for long runs or lower max voltages (i.e., lower than 10.00), the scaling value can be increased accordingly to maximize operational range.

   For example, if the voltage is only reaching a value of 9.0V at the adapter boards, then the A1Sc parameter should be set to (10/9=) 1.111. If left un-calibrated, the unit will never attain maximum speeds, defined as AHn1 and AHn2.
4. The motor control board can accept slightly over-biased inputs up to 12 Vdc, and the A1Sc parameter can be set to a value less than 1.0 to compensate.

VSP Setup Examples

Figure 44. Example 1: uFLr set too high and A1Sc set too high

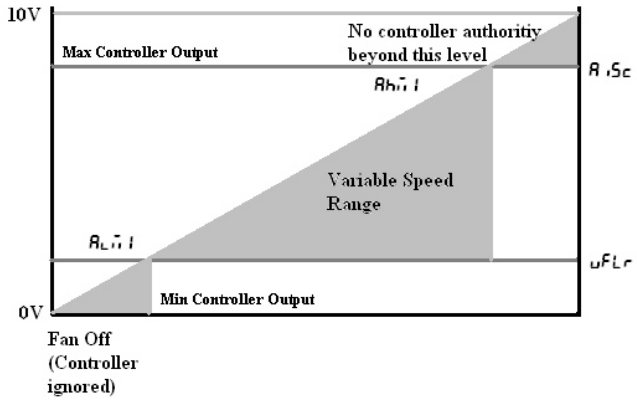


Figure 45. Example 2: uFLr set too high but A1Sc set correctly

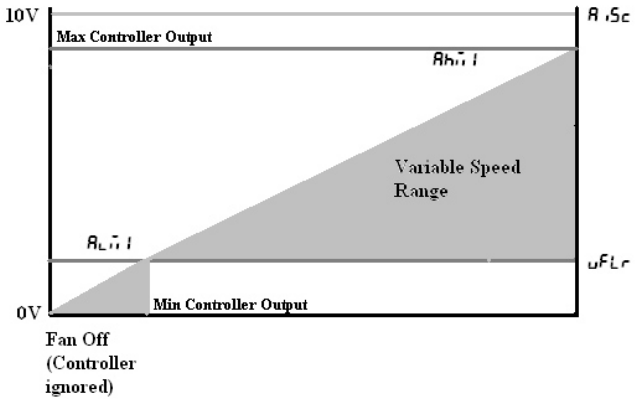
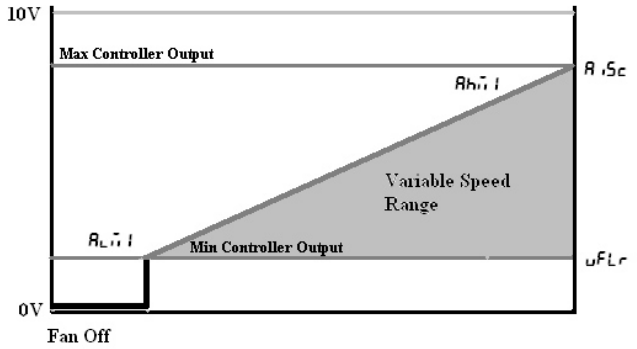


Figure 46. Example 3: uFLr set correctly and A1Sc set correctly



Use of Potentiometer/Rheostat For VSP

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

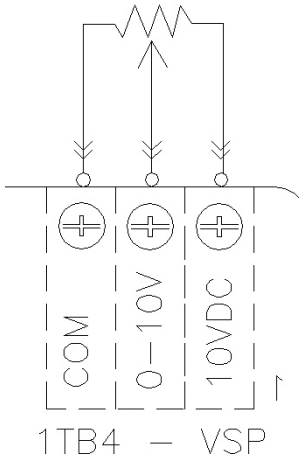
You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **Connections to the adapter boards/changes to the CSTI configuration switches should be made only with the power to the unit disconnected.**
- **All settings take effect immediately, including fan startup, enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.**

A courtesy 10-Vdc supply is provided that can support a 10-mA draw. The use of a 1K or a 10K potentiometer is recommended, and only a stand-alone potentiometer (not shared with any other electrical system) should be employed. When a simple potentiometer is used as depicted in Figure 47, the uFLr setting will define a null-zone (off).

The typical connection is depicted in Figure 47; however, please consult the unit schematic for the most updated instruction, as Figure 47 is provided as reference only.

Figure 47. Typical connection



Adjustment or Disabling of Optional Auto-Changeover Function on CSTI Units

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

The motor control board provides additional temperature controlled logic to help coordinate certain electric-heat and valve logic functions:

- On units with electric heat and a changeover coil, the motor control board and adapter boards are pre-configured to cause hydronic heat and electric heat to be mutually exclusive:
  - On units with ComfortLink™ controls (Tracer ZN controllers) or BacNet™ controls (UC400), the Tracer ZN controller board will serve as the primary logic to select the electric heat only if hot water is not available, but the motor control board will service as a backup lockout.
  - On units with Customer Supplied Controllers (CSTI units), the motor control board and CSTI board will serve as the primary lockout.
- On CSTI units selected with a changeover coil configuration, the motor control board is factory configured to work in conjunction with the CSTI adapter board to provide a useful auto-changeover

function. Traditionally, a fixed setpoint bi-metallic disc temperature switch is used to provide changeover with customer controls; however, the motor control board has defeatable and configurable bi-metallic disc temperature switch emulation when combined with the CSTI adapter board. The motor control board is preconfigured for typical values, so changeover settings do not necessarily need to be changed.

  – An NTC thermistor is supplied and affixed to the supply pipes where applicable. The motor control board has several settings that affect the operation of the changeover function:
    - FPrU parameter should normally be set to EHL or EhFS to use the changeover functions.
    - EhL parameter should be chosen if the unit has a changeover coil without electric heat.
    - EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EhL parameter but in addition, will disable heating function on electric heat and on the changeover coil if there are fan failures. The auxillary heating coil function will continue to operate and respond to the customer heating request.

- A iPU parameter should be set to In for CSTI units and to OUt for ComfortLink or BacNet controller units.
- A i2T parameter defines the temperature at which the motor control board will close the triac onboard the motor control board (if FPrU parameter is set correctly).
- A i2b parameter defines the temperature at which the motor control board will open the triac onboard the motor control board (if FPrU parameter is set correctly). By leaving a “gap” between the make and break value, we will simulate hysteresis of a real bi-metallic disc temperature switch.
- When combined with the CSTI adapter board, the bi-metallic disc temperature switch emulation and the electric heat lockout function will work when the switches are set correctly.

Adjustment and Configuration of the CSTI Adapter Board

⚠CAUTION

Burn Hazard!

If SW4 is turned off, the factory/customer controller/ thermostat will be able to actuate the electric heat while hot water is available or if the fans have failed. This switch should NOT be turned off if the unit schematic indicates that it should be on, to prevent overheating of the unit (due to simultaneous electric heat and hydronic heat actuation, or failure of the fan) and to use the preferred hydronic heating over electric heat. Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

For CSTI units, the board mounted switches have to be set appropriately to enable the desired functionality.

Figure 48. CSTI adapter board: board-mounted switches

Table 21. CSTI adapter board: switch functions

Switch (L-R)	SW1	SW2	SW3	SW4
Function	Valve one operation logic	Valve two operation logic	Changeover Function	Electric Heat / Fan Proving Function
UP position (towards terminal strip)	Normally Open Valve	Normally Open Valve	Changeover Function ON	Electric Heat / Fan Proving Function
DOWN position (towards black relays)	Normally Closed Valve	Normally Closed Valve	Changeover Function OFF	Electric Heat / Fan Proving Function

Notes:

- *All switches are factory-set based on customer configuration of the unit model number. The unit will function correctly as shipped; however, the switch functions and positions are depicted for customer convenience and for service and troubleshooting aids.*
- *SW3 and SW4 work in conjunction with settings on the motor control board controller. Simple activation of changeover and electric heat lockout function may not work correctly unless the motor control board is configured to perform these functions.*
- *Customers are advised to locate the changeover coil temperature sensor on the bypass line if possible, to avoid measuring standing water temperature.*

- *If a 4-pipe unit with changeover function is selected, the heating input will drive the main coil if hot water is detected, but will always drive the auxiliary coil or electric heat (where available).*
- *Where electric heat is available with a changeover coil, the electric heat is factory-configured to be deactivated if there is hot water available and if there is a fan failure.*

The CSTI board comes with courtesy valve inversion relays that allow both normally open and normally closed two-position valves to be used with simple thermostats that do not have the configurability to adapt to the customer choice of valves. Independent switches, SW1 and SW2, are provided for 2-pipe or 4-pipe units, or 2-pipe units with an optional reheat coil. The functions of SW1 and SW2 is downstream of the changeover function (SW3 and motor control board). Decisions made by the changeover circuits will be flowed to the inversion circuits, if they are selected.

SW3 enables or disables the changeover function for 2-pipe changeover coil units, or 4-pipe units where the coil has both a heating/cooling circuit and a heating circuit piped internally. If SW3 is turned off, the changeover function will be disabled, and the unit will then be configured as a cooling only coil, a heating only coil, or a combination of cooling only/heating only coil. Thus, customer cooling requests will drive the main valve, and heating requests will drive the auxiliary valve.

The changeover function is designed to work with customer controllers that request heating or cooling (based on customer request), but have coil water temperatures that are “changed over” from heating to cooling (or cooling to heating) depending on the season and the building equipment available. Customer thermostats MUST be hooked to the correct terminal strip locations (V1 and V2) for the changeover function to work.

Cooling

In general, the (CSTI) changeover function will provide cooling if:

1. A unit is factory configured with a changeover coil (cooling/heating) as the only coil or as the main coil portion.
2. SW3 on the CSTI adapter board is turned on, and the FPrU parameter set to EHL or EhFS to use the changeover functions.
   a. EhL parameter should be chosen if the unit has a changeover coil without electric heat.
   b. EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EhL parameter but will in addition, disable the heating function on electric heat and on the changeover coil heat if there are fan failures. The auxiliary heating coil valve will continue to respond to customer heating requests.
3. The motor control board has sensed that there is cold water available on the supply/bypass line for the changeover coil. In this case, “cold” water is inferred by the motor control board if:
   a. A 10K NTC thermistor (similar to Trane part number X13790374010) is wired properly to the motor control board, through the crossover cables and CSTI adapter boards.
   b. The input impedance of the thermistor circuit must be set correctly (the A iPU parameter should be set to in for CSTI units).
   c. The temperature sensed is lower than the A i2Ti parameter.
   d. The A i2b parameter is higher than the A i2Ti parameter.
   e. The temperature is not in the dead-band between the A i2b parameter and the A i2Ti parameter (in this case, previous state will be retained).
4. The customer thermostat is properly hooked up the input strip 1TB3, and is requesting cooling input (V1) based on the customer cooling setpoint being lower than the space temperature.

Heating

In general, the (CSTI) changeover function will provide heating if:

1. A unit is factory-configured with a changeover coil (cooling/heating) as the only coil or as the main coil portion.
2. SW3 on the CSTI adapter board is turned on, and the FPrU parameter set to EHL or EhFS to use the changeover functions.
   a. EhL parameter should be chosen if the unit has a changeover coil without electric heat.
   b. EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EhL parameter but will in addition, disable the heating function on electric heat and on the changeover coil heat if there are fan failures. The auxiliary heating coil valve will continue to respond to customer heating requests.
3. The motor control board has sensed that there is hot water available on the supply/bypass line for the changeover coil. In this case, “hot” water is determined if:
   a. A 10K NTC thermistor (similar to Trane part number X13790374010) is wired properly to the motor control board, through the crossover cables and CSTI adapter boards.
   b. The input impedance of the thermistor circuit must be set correctly (the A iPU parameter should be set to in for CSTI units).
   c. The temperature sensed is higher than the A i2b parameter.
   d. The A i2b parameter is higher than the A i2Ti parameter.

e. The temperature is not in the dead-band between the A 126 parameter and the A 127 parameter (in this case, previous state will be retained).

4. The customer thermostat is properly hooked up the input strip 1TB3, and is requesting heating input (V2) based on the customer heating set point being higher than the space temperature.
5. The heating input on 1TB3 will drive the main changeover coil IF conditions 1–4 are satisfied, but will always drive the auxiliary coil valve (if present). Electric heat will be locked out (where present) if hot water is available since SW4 will be factory set to “ON” in these units.

SW4 selects the electric heat lockout function, where we will lock out the electric heat circuit based on either:

1. The presence of hot water in the changeover coil section (if the FPrU parameter is set to EHL).
2. Abnormal behavior of the fan/s (if the FPrU parameter is set to FnSt).
3. Or a combination of both the presence of hot water or abnormal behavior of the fan/s (if the FPrU parameter is set to EHFS).
4. The preceding three examples depend on the inference of the motor control board that hot water is present. In this case, “hot” water is determined if:
   a. The temperature sensed is higher than the A 126 parameter.
   b. The A 126 parameter is higher than the A 127 parameter.
   c. The temperature is not in the dead-band between the A 126 parameter and the A 127 parameter (in this case, previous state will be retained).
   d. The input impedance of the thermistor circuit must be set correctly (the A 1PU parameter should be set to 10 for CSTI units).

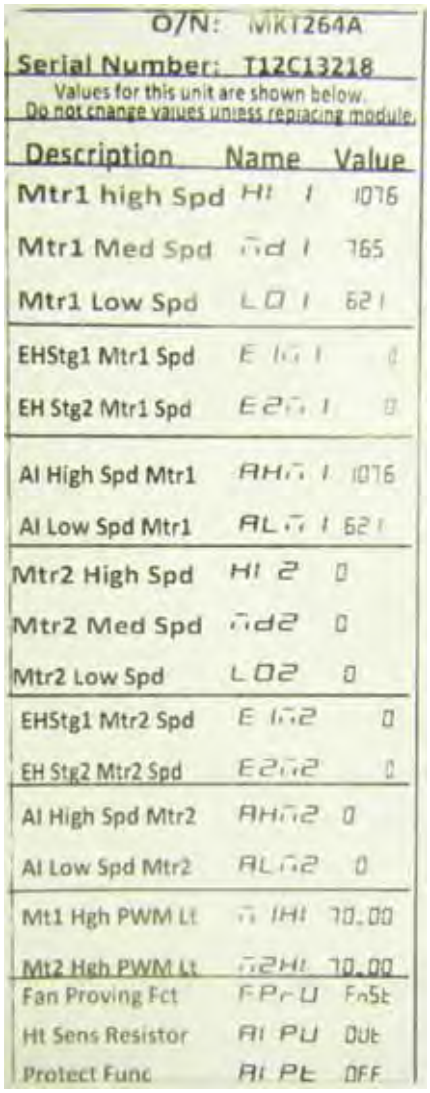
Configuring the VelociTach Motor Control Board

Every Trane unit with ECM motors will have modules specifically configured at the factory for the operation of that unit. The motor control board configuration label is affixed to the low-voltage access lid on the outside of the control panel (see Figure 37, p. 46 and Figure 49, p. 56). The motor control board label may be on the back-side of the low voltage access lid, depending on the unit configuration.

The serial number of each unit and the custom configuration settings specific to that unit will be printed on the label for convenient matching of labels/settings to specific units. Programming a unit with the settings from another unit will result in abnormal operation. The label contains four important sections:

1. How to enter the configuration menu
2. The description and meaning of the Error Codes
3. The description and meaning of the status display
4. The parameter names and values specific to that unit

Figure 49. Motor control board label



Note: This label is provided for reference only, as an example, and should not be used to configure the unit.

Configuration Settings of the Motor Control Board

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.

The adapter boards contain high voltage. Configuration adjustments to the motor control board should be made through the SMALLER of the two low-voltage lids on the front of the control panel, through the low-voltage insulation/shielding.

⚠CAUTION

Burn Hazard!

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a ECM configuration label. Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

NOTICE:

Equipment Damage!

Do not change the PWM output voltage settings as motor damage could occur.

Note: The motor control board functions and unit specific settings are summarized on the motor control board configuration label affixed to the back side of the control panel low voltage lid, on every unit.

The following table lists the parameter names and typical settings of the motor control board, for reference only.

Additional Notes:

1. *This list is applicable only to blower coil products.*
2. *Do not change the electric heat protection settings if your unit has electric heat.*
3. *If the format setting for rpm values are not correct (i.e., not four-digit: XXXX), please check the operation mode of the motor control board* Mod 1 *and* Mod 2 *and motor signal output format* SI 91 *and* SI 92*.*

TRANE

ECM Overview and Setup

Table 22. Configuration settings of the motor control board

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	Note: These notes are provided for reference only, and the motor control board label must be used as the ultimate guide for setting up an motor control board on specific units.
Mtr 1 High Spd	H i 1	1080	Sets the high-speed rpm for Motor 1.	Do not exceed 2300 rpm.
Mtr 1 Med Spd	ñd 1	777	Sets the medium-speed rpm for Motor 1.	
Mtr 1 Low Spd	Lo 1	632	Sets the low-speed rpm for Motor 1.	Do not set under 600 rpm.
EHStg1 Mtr1 Spd	E ñ1	0	Assigns an rpm to be associated with a call for 1st stage electric heat, for Motor 1 (only on units equipped with electric heat).	E ñ1, E ñ2, E2ñ1, E2ñ2 settings are locked out on units with electric heat.
EH Stg 2 Mtr 1 Spd	E2ñ1	0	Assigns an rpm to be associated with a call for 2nd stage electric heat, for Motor 1 (only on electric heat equipped units).	
AI High Spd Mtr 1	Ahñ1	0	Sets the maximum rpm for Motor 1 for the maximum input value of the analog input.	Analog inputs below the uFLr setting will be rejected.
AI Low Spd Mtr 1	ALñ1	0	Sets the minimum turn-on rpm for Motor 1, when the analog input becomes active.	
Mtr 2 Hgh Spd	H i 2	0	Sets the high-speed rpm for Motor 2.	Blower coils have only one motor.
Mtr 2 Med Spd	ñd 2	0	Sets the medium-speed rpm for Motor 2.	
Mtr 2 Low Spd	Lo 2	0	Sets the low-speed rpm for Motor 2.	
EHStg1 Mtr2 Spd	E ñ2	0	Assigns an rpm to be associated with a call for 1st stage electric heat, for Motor 2 (only on electric heat equipped units).	If the unit has only one motor, all seven speed settings for the second motor (H i 2, ñd 2, Lo 2, E ñ2, E2ñ2, ALñ2, AHñ2) should be set to zero.
EH Stg 2 Mtr 2 Spd	E2ñ2	0	Assigns an rpm to be associated with a call for 2nd stage electric heat, for Motor 2 (only on electric heat equipped units).	
AI High Spd Mtr 2	Ahñ2	0	Sets the maximum rpm for Motor 2 for the maximum input value of the analog input.	
AI Low Spd Mtr 2	ALñ2	0	Sets the minimum turn-on rpm for Motor 2, when the analog input becomes active.	
Op Mode Mtr 1	ñod 1	rPñ	Sets the operational mode for Motor 1.	Must be set to rPñ for blower coil units.
Op Mode Mtr 2	ñod2	rPñ	Sets the operational mode for Motor 2.	Must be set to rPñ for blower coil units.
Mtr 1 Out Format	S ,91	P_5ñ	Sets the interface type for Motor 1.	Must be set to P_5ñ for blower coil units.
Mtr 2 Out Format	S ,92	P_5ñ	Sets the interface type for Motor 2	Must be set to P_5ñ for blower coil units.
Mtr 1/2 PWM Freq.	FrE9	100	Sets the PWM frequency, for cases when the PWM outputs are used.	On blower coil units, the P_5ñ must not be changed.
Mtr 1 PWM Volt	ñ1uL	5	Sets the PWM voltage, for cases when the PWM outputs are used.	This setting must NOT be changed, as damage to the motor may occur!
Mtr 2 PWM Volt	ñ2uL	5	Sets the PWM voltage, for cases when the PWM outputs are used.	This setting must NOT be changed, as damage to the motor may occur!
Mt1 Hgh PWM Lt	ñ1h i	90	Sets the maximum output % that the controller will request from Motor 1.	This envelope protection value should not be altered.
Mt1 Low PWM Lt	ñ1Lo	14.5	Sets the minimum maximum output % that the controller will request from Motor 1.	This envelope protection value should not be altered.
Mt2 Hgh PWM Lt	ñ2h i	90	Sets the maximum output % that the controller will request from Motor 2.	This envelope protection value should not be altered.
Mt2 Low PWM Lt	ñ2Lo	14.5	Sets the minimum maximum output % that the controller will request from Motor 2.	This envelope protection value should not be altered.
Mt1 Ovspd RPM	rPñ1	2500	Selects the rpm above which the Motor 1 will be assumed to be in an overspeed condition and will need to be shut down.	This envelope protection value should not be altered.
Mt2 Ovspd RPM	rPñ2	2500	Selects the rpm above which the Motor 2 will be assumed to be in an overspeed condition and will need to be shut down.	This envelope protection value should not be altered.
Fan Proving Fct	FPru	FnSt	Selects which mode should be assigned to the Binary output circuit, depending on unit type.	This setting has to be correct for proper unit operation of electric heat and changeover units.
AI Boost Amp	A ,Sc	1	Boosts or attenuates the analog input signal to compensate for long wire runs.	A value of 1 should be used if no voltage level compensation is needed (i.e., voltage peak is at 10 Vdc).

Table 22. Configuration settings of the motor control board (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	Note: These notes are provided for reference only, and the motor control board label must be used as the ultimate guide for setting up an motor control board on specific units.
AI Floor	uFLr	0.5	Rejects noise on the analog input lines and sets up the motor control board to turn on if the thermostat or controller is commanding its analog outputs on.	
PulsePerRev	FdbH	18	Sets up the tachometer function to be compatible with the on-board motor and for correct speed calculation and calibration.	Do not change this setting as this is critical to proper unit operation.
P Value Mtr 1	PuL 1	0.03	Sets up the on board closed loop control to control Motor 1 with proper stability.	Do not change this setting.
I Value Mtr 1	I uL 1	0.03	Sets up the on board closed loop control to control Motor 1 with proper stability.	Do not change this setting.
P Value Mtr 2	PuL2	0.03	Sets up the on board closed loop control to control Motor 2 with proper stability.	Do not change this setting.
I Value Mtr 2	I uL2	0.03	Sets up the on board closed loop control to control Motor 2 with proper stability.	Do not change this setting.
Ht Sens Mk Val F	A i2n	85	Sets the make value for the motor control board triac output based on the thermistor input.	Operation also depends on FPru, A i2b, and A iPU settings.
Ht Sens Bk Val F	A i2b	90	Sets the break value for the motor control board triac output based on the thermistor input.	Operation also depends on FPru, A i2n, and A iPU settings.
Ht Sens Resistor	A iPU	oUt	Sets the input impedance of the thermistor input.	Should be pre-set to “OUT” for Tracer ZN controllers.
Mt 1 Ramp %/sec	n1rP	3	Sets the ramp rate for Motor 1, in % per second.	
Mt 2 Ramp %/sec	n2rP	3	Sets the ramp rate for Motor 2, in % per second	
EH Ramp Accel	EhrP	2	Sets the acceleration factor for the electric heat inputs.	Is used to force faster ramps when electric heat is requested.
Ramp MAX Time	nhrP	15	Sets the maximum ramp time for both Motor 1 and Motor 2 (in seconds).	Overrides the ramp rates n1rP and n2rP if the calculated ramp time exceeds nhrP.
EH Fan off delay	EHdL	15	Selects how long the fan needs to stay on after an electric heat request has been turned off.	Not used on fan-coil unit.
Lck Rtr Protect	LrPt	on	Selects whether to use the on-board locked rotor protection function.	This will shut down the affected motor, if rotational response is not detected.
Protect Funct	EhPt	on	This function protects settings on the board that affect the safety of the electric heat system.	Do NOT change this setting. This setting locks out the following parameters from being changed, for safe operation of the unit. A iPU FPru A inH A ibH E1n1 E1n2 E2n1 E2n2 S.9 nod1 nod2 n1H1 n1Lo
Rmp dft (auto rst)	rPdF	oFF	This function shortens the ramps for faster unit commissioning and auto-resets to off after approximately 15 minutes of power-on operation.	To aid in commissioning of the unit, for approximately 10–15 minutes, the ramps will be shortened to quickly observe proper unit behavior and response to speeds.
Soft Rev	SoFt	u2.00	Displays the software version.	

TRANE

ECM Overview and Setup

Fan Speed Response Verification

1. After performing controller specific commissioning, observe the display on the motor control board with the power on, to the unit. The motor control board display should display a looping status indicator as follows:

   ntr 1 → 0 → ntr2 → 0 → FSt 1 → 0
   FF → FSt2 →
   OFF → EhEn → On

Notes:

- *The* EhEn *indicator is unit-specific and may indicate "Off" at this point; refer to thermistor function for more information.*
- *A representative fan speed of "1080" rpm are shown in the example below. Each unit is factory-configured differently and will have different settings for different fan speeds.*

2. While the unit remains on, exercise the fan controls on the unit, either directly or indirectly through request for unit heat/cool. Observe the fan spinning, and then observe the fan display on the motor control board. It should display a looping status indicator as follows:

   For a size 200, 300, 400, 600, or 800 unit (using typical unit operating fan speeds):

   ntr 1 → 1080 → ntr2 → 0 → FSt 1
   → On → FSt2 →
   OFF → EhEn → On

   For a size 1000 or 1200 unit (using typical unit operating fan speeds):

   ntr 1 → 1080 → ntr2 → 1080 → FSt
   1 → On → FSt2 →
   on → EhEn → On

Note: The EhEn *indicator is unit-specific and may indicate "Off" at this point; refer to thermistor function for more information.*

3. *OPTIONAL:*

   While the fan is running, if practical, change the fan speeds and observe the display temporarily indicate: rAmP

   Exercise all fan speeds to ensure positive unit response and to validate any field wiring.

Installation - Controls

Control sensor options include both unit-mounted (factory-installed) and wall-mounted sensors. Installation instructions for the wall-mounted sensors are provided in this chapter.

Zone Sensor Options

Zone sensors are available as wall-mounted options. Wall-mounted zone sensor options have an internal thermistor. Zone sensors operate on 24 Vac.

A variety of wall-mounted zone sensors are available for design flexibility. Zone sensors have an internal thermistor and operate on 24 Vac. Options with setpoint knobs are available in Fahrenheit or Celsius. See Figure 50 through Figure 56 for available options and model number references.

TRANE

Installation - Controls

Figure 50. Digit 38 = 1
Wall-mounted zone sensor with setpoint knob, off/auto fan speeds, occupied/unoccupied, and COMM jack.

Figure 51. Digit 38 = 3
Wall-mounted temp sensor with setpoint knob, occupied/unoccupied, and COMM jack.

Figure 52. Digit 38 = 4
Wall-mounted temp sensor with occupied/ unoccupied and COMM jack.

Figure 53. Digit 38 = C
Wireless temperature sensor and unit-mounted receiver.

Figure 54. Digit 38 = E
Wall-mounted temperature sensor with setpoint knob, off/auto/low/medium/high fan speeds

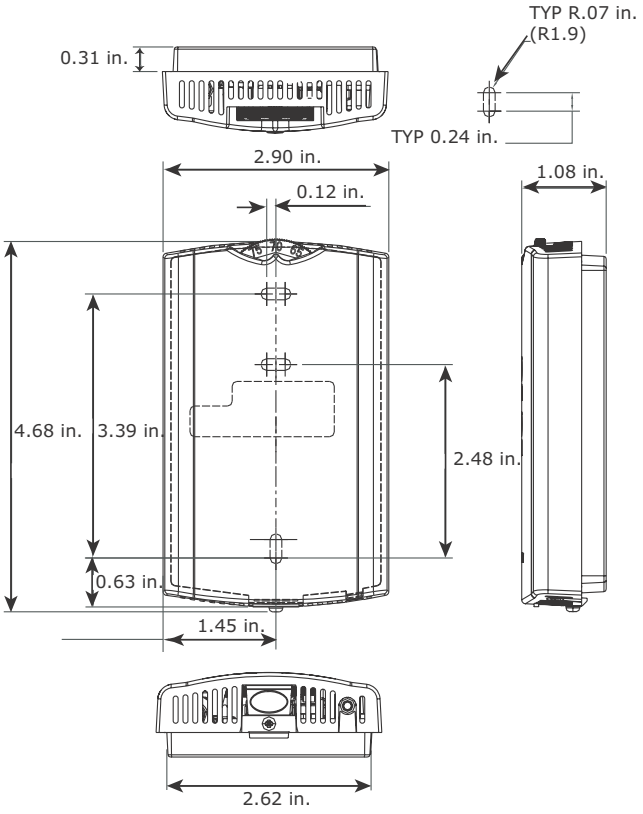
Figure 55. Digit 38 = F
Wall-mounted display temperature sensor with setpoint knob, occupied/unoccupied and COMM jack.

Figure 56. Digit 38 = G
Wireless display sensor, unit-mounted receiver.

Installing Wall-Mounted Wired Sensors

Reference the wall-mounted zone sensor dimensions in Figure 57, p. 63. Position the sensor on an inside wall three to five feet above the floor and at least 18 inches from the nearest outside wall. Installing the sensor at a lower height may give the advantage of monitoring the temperature closer to the zone, but it also exposes the sensor to airflow obstructions. Ensure that air flows freely over the sensor.

Figure 57. Wall-mounted wired and wireless zone sensor dimensions



Sensor

When selecting a sensor location, avoid the following:

- Areas of direct sunlight
- Areas in the direct airstream of air diffusers
- Exterior walls and other walls that have a temperature differential between the two sides
- Areas that are close to heat sources such as sunlight, appliances, concealed pipes, chimneys, or other heat-generating equipment
- Drafty areas
- Dead spots behind doors, projection screens, or corners
- Walls that are subject to high vibration
- Areas with high humidity
- High traffic areas (to reduce accidental damage or tampering)
- Metal barriers between the receiver and the sensor (for example, plastered walls with metal lathe or metal roof decks)
- Thick, solid concrete walls between the receiver and the sensor
- Placing the sensor inside metal enclosures

Height Requirements

It is recommended that you mount the back plate a maximum distance of 54 inches above the floor. If a parallel approach by a person in a wheelchair is required, reduce the maximum height to 48 inches.

Note: Consult section 4.27.3 of the 2002 ADA (Americans with Disability Act) guideline, and local building codes, for further details regarding wheelchair requirements.

Mounting Surfaces

Using the hardware provided, mount the back plate of the sensor to a flat surface such as sheetrock or plaster, or an electrical junction box. The sensor must be mounted plumb for accurate temperature control and to ensure proper air movement through the sensor.

- If mounting onto sheetrock or plaster, use the plastic threaded anchors (pre-drilling holes is not usually necessary) and the two M3.5 x 20 mm mounting screws.
- For mounting onto an electrical junction box, use the two 6-32 x 3/4 in. screws.

Before beginning installation, consider the location considerations below. Also, refer to the unit wiring schematic for specific wiring details and point connections.

Location Considerations

Avoid mounting the sensor in an area subject to the following conditions:

- Dead spots, such as behind doors or in corners that do not allow free air circulation.
- Air drafts from stairwells, outside doors, or unsectioned hollow walls.
- Radiant heat from the sun, fireplaces, appliances, etc.
- Airflow from adjacent zones or other units.
- Unheated or uncooled spaces behind the controller, such as outside walls or unoccupied spaces.
- Concealed pipes, air ducts, or chimneys in partition spaces behind the controller.

Location Considerations for Wireless zone sensors

Placement of the sensor is critical to proper operation (the receiver is factory mounted). For most installations, barriers limit proper radio signal strength more than distance. For best radio transmission range and reliability, mount the receiver and sensor in line of sight. Where this is not possible, try to minimize the number of barriers between the pair of devices. In general, sheetrock walls and ceiling tiles offer little restriction to the transmission range for the sensor is as follows:

- Open range: 2,500 ft (packet error rate = 2%)
- Usable range: 200 ft
- Typical range: 75 ft

Fan Mode Switch Installation

The fan mode switch ships loose inside the unit accessory bag. Follow the steps below to install the fan mode switch.

Items needed:

2 x 4 electrical junction box

1. Remove the brown wire if not using a field-supplied damper.
2. Remove the terminals, cut and strip wires as required for installation.
3. Level and position a 2 x 4 electrical junction box.
4. Follow the instructions given in "Installing Wall-Mounted Wired Sensors," page 63 and route the wires as shown in the wiring diagram. Refer to the typical wiring diagram or to the unit specific diagram on the unit.
5. Position the fan mode switch over the junction box with the two screws supplied.

Zone Sensor Installation

Follow the procedure below to install the wired zone sensor module.

1. Note the position of the setpoint adjustment knob and gently pry the adjustment knob from the cover using the blade of a small screwdriver.
2. Insert the screwdriver blade behind the cover at the top of the module and carefully pry the cover away from the base.
3. To mount the sensor back plate:
   a. Hold the back plate against the mounting surface and mark the screw locations.
   b. Secure the back plate against the mounting surface using included hardware.
4. To install the zone sensor module to a standard junction box:
   a. Level and install a 2 x 4-in. junction box (installer supplied) vertically on the wall.
   b. Pull the control wires through the cutout. Attach the module to the wall using the screws provided.
5. Strip the insulation on the interconnection wires back 0.25-inch and connect to TB1 (for wired sensors).
6. Screw down the terminal blocks (for wired sensors).
7. To replace the cover:
   a. Hook the cover over the top of the back plate. Apply light pressure to the bottom of the cover until it snaps in place.
   b. Install the security screw into the bottom of the cover (if desired).

If installing a Tracer ZN510 or Tracer ZN520 zone sensor, see "Zone Sensor Installation," page 64 for more information.

Figure 58. Mounting zone sensor base plate

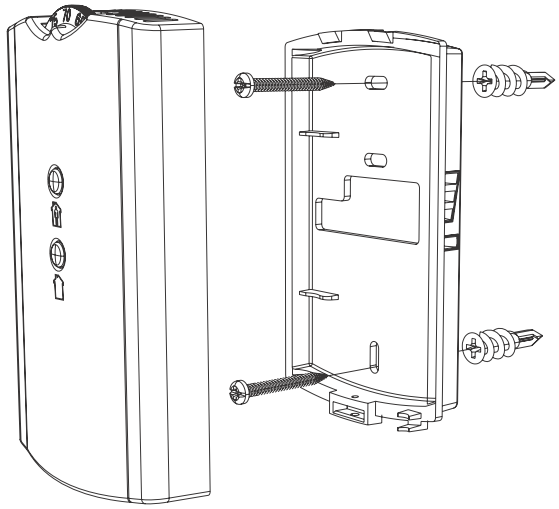
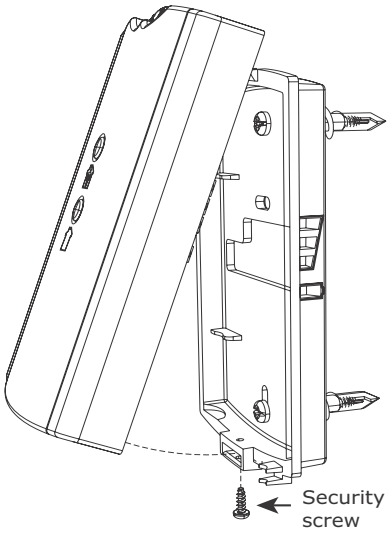


Figure 59. Mounting zone sensor security screw



Start-Up

Pre-Startup Checklist

Complete this checklist after installing the unit to verify all recommended installation procedures are complete before unit startup. This does not replace the detailed instructions in the appropriate sections of this manual. Disconnect electrical power before performing this checklist. Always read the entire section carefully to become familiar with the procedures.

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

General Checks

- Ensure the unit has been installed level.
- Ensure supply-air and return-air ducts have been connected.
- Ensure damper operator motors and connecting linkage have been installed.
- Verify damper operation and linkage alignment.
- Check that air filters are in place and positioned properly.
- Remove any debris from the unit interior.
- Remove all foreign material from the drain pan and check drain pan opening and condensate line for obstructions.
- Inspect electrical connections to the unit and unit controllers.
  - Connections should be clean and secure.
  - Compare the actual wiring with the unit diagrams.
  - Reference the appropriate controller manual for more details about starting units with factory-mounted controls.
- Check piping and valves for leaks. Open or close the valves to check for proper operation. Drain lines should be open.
- Leave this manual with the unit.

Fan-Related Checks

- If using isolators, properly mount unit according to the isolator placement sheet.
- Rotate fan wheel manually to confirm it turns freely in the proper direction.
- Verify the fan and motor are aligned.

Coil-Related Checks

NOTICE:

Proper Water Treatment!

The use of untreated or improperly treated water in coils could result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

- Ensure coil and condensate drain piping connections are complete.
- Check the piping and valves for leaks.
  - Open or close the valves to check operation.
  - The drain lines should be open.
- If unit has a refrigerant coil, ensure that it has been charged and leak-tested according to the instructions provided with the condenser equipment. Adjust the superheat setting.
- Remove all foreign material from the drain pan and check the pan opening and condensate line for obstructions.
- For steam coils, slowly turn the steam on full for at least 10 minutes before opening the fresh air intake on units with fresh air dampers.

Electrical Checks

- Check all electrical connections for tightness.
- Verify motor voltage and amps on all phases with the unit nameplate ratings to ensure unit operates correctly.

Ductwork Checks

- If using return ductwork to the unit, secure it with three inches of flexible duct connector.
- Extend discharge duct upward without change in size or direction for at least one and one half fan diameters.
- Use a 3-inch flexible duct connection on discharge.
- Ensure trunk ductwork is complete and secure to prevent leaks.
- Verify that all ductwork conforms to NFPA 90A or 90B and all applicable local codes

Tracer Controller Sequence of Operation

Controller Start-Up

Refer to *Installation, Operation and Programming Guide: Tracer™ ZN.520 Unit Controller* (CNT-SVX04A-EN, or the most recent version) to operate the Tracer controller with Trane Integrated Comfort System (ICS). The factory pre-programs the Tracer controller with default values to control the temperature and unit airflow. Use Tracer Summit building automation system or Rover (used with Tracer ZN010, ZN510, or ZN520 controllers) or Tracer SC system controller and Tracer T (used with Tracer UC400 controllers) software to change the default values.

Follow the procedure below to operate the Tracer controller in a stand-alone operation:

1. Turn power on at the disconnect switch option.
2. Position the fan mode switch to either high, low, or the auto position.
3. Rotate the setpoint dial on the zone sensor module to 55°F for cooling or 85°F for heating.

The appropriate control valve will actuate assuming the following conditions:

1. Room temperature should be greater than 55°F and less than 85°F.
2. For a two-pipe unit with an automatic changeover sensor, the water temperature input is appropriate for the demand placed on the unit. For example, cooling operation is requested and cold water (5° lower than room temperature) flows into the unit.
3. Select the correct temperature setpoint.

Note: Select and enable zone sensor temperature settings to prevent freeze damage to unit.

Power-Up Sequence

When 24 Vac power is initially applied to the Tracer controller, the following sequence occurs:

- All outputs are controlled off
- Tracer reads all input values to determine initial values
- Random start time (0–25 seconds) expires
- Normal operation begins

Modes of Operation

Tracer controllers operate the fan in one of the modes listed below as noted:

- Occupied
- Unoccupied
- Occupied standby (Tracer ZN510, ZN520, or UC400 only)
- Occupied bypass
- Tracer Summit with supply fan control (Tracer ZN510, ZN520, or UC400 only)

Note: The Tracer ZN520 or UC400 controller operates the supply fan continuously when the controller is in the occupied and occupied standby modes, for either heating or cooling. The controller only cycles the fan off with heating and cooling capacity in the unoccupied mode.

When the communicated occupancy request is unoccupied, the occupancy binary input (if present) does not affect the controller's occupancy. When the communicated occupancy request is occupied, the controller uses the local occupancy binary input to switch between the occupied and occupied standby modes.

Occupancy Sources

There are four ways to control the Tracer controller's occupancy, as noted below:

1. By pressing the zone sensor's timed override "on" button
2. Occupancy binary input, either normally open or normally closed, see Table 23 for occupancy sensor states

Table 23. Occupancy sensor state

Sensor Type	Sensor Position	Unit Occupancy Mode
Normally open	Open	Occupied
Normally open	Closed	Unoccupied
Normally closed	Open	Unoccupied
Normally closed	Closed	Occupied

3. Default operation of the controller (occupied mode)
4. Communicated request, usually provided by the building automation system (BAS) or peer device (available on Tracer ZN510, ZN520, and UC400 only).

A communicated request will control the controller's occupancy. Typically, this request comes from the BAS time-of-day or Tracer SC area scheduling to the controller. However, if a communication request from a BAS, Tracer SC, or peer controller is lost, the controller reverts to the default operating mode (occupied) after 15 minutes (configurable, specified by the "receive heartbeat time"), if no local hard-wired occupancy signal exists.

If the unit is communicating with Tracer Summit or Tracer SC and the supply fan control programming point is configured for BAS (the factory configures as local), then

Tracer Summit or Tracer SC will control the fan regardless of the fan mode switch position.

For complete information about Tracer Summit application setup using the Tracer controller, see the Tracer Summit product literature. For information regarding Tracer SC application and setup, refer to *Applications Guide: Air Systems for Tracer™ SC* (BAS-APG007-EN). For more information on the setup of another BAS, refer to the product-specific literature from that manufacturer.

Occupied Mode

When the controller is in the occupied mode, the unit attempts to maintain the space temperature at the active occupied heating or cooling setpoint, based on:

- Measured space temperature
- Discharge air temperature (Tracer ZN520 and UC400 only)
- Active setpoint
- Proportional/integral control algorithm

The modulating control algorithm used when occupied or in occupied standby is described in the following sections. Additional information related to the handling of the controller setpoints can be found in the previous setpoint operation section.

Note: Heating and cooling setpoint high and low limits are always applied to the occupied and occupied standby setpoints.

Unoccupied Mode

When the controller is in the unoccupied mode, the controller attempts to maintain space temperature at the stored unoccupied heating or cooling setpoint based on:

- Measured space temperature
- Active setpoint
- Control algorithm, regardless of the presence of a hard-wired or communicated setpoint

Similar to other controller configuration properties, the locally stored unoccupied setpoints can be modified using Rover service tool (used with Tracer ZN010, ZN510, or ZN520 controllers) or Tracer TU service tool (used with Tracer UC400 controllers).

During cooling mode, when the space temperature is above the cool setpoint, the primary cooling capacity operates at 100 percent. If more capacity is needed, the supplementary cooling capacity turns on (or opens to 100 percent).

During heating mode, when the space temperature is below the heat setpoint, the primary heating capacity turns on. All capacity turns off when the space temperature is between the unoccupied cooling and heating setpoints. Note that primary heating or cooling capacity is defined by the unit type and whether heating or cooling is enabled or disabled. For example, if the economizer is enabled (Tracer ZN520 and UC400 only) and possible, it is the primary cooling capacity. If hydronic heating is possible, it will be the primary heating capacity.

Occupied Standby Mode

Tracer ZN510, ZN520 and UC400 only

The controller can be placed into the occupied standby mode when a communicated occupancy request is combined with the local (hard-wired) occupancy binary input signal.

During occupied standby mode, the Tracer ZN520 or UC400 controller's economizer damper position goes to the economizer standby minimum position.

Note: The economizer standby minimum position can be changed using Rover service tool (used with Tracer ZN010, ZN510, or ZN520 controllers) or Tracer TU service tool (used with Tracer UC400 controllers).

In the occupied standby mode, the controller uses the occupied standby cooling and heating setpoints. Because the occupied standby setpoints typically cover a wider range than the occupied setpoints, the controller reduces heating/cooling demand for the space. Also, units with Tracer ZN520 or UC400 and the fresh air economizer damper use the economizer standby minimum position to reduce heating and cooling demand.

When no occupancy request is communicated, the occupancy binary input switches the controller's operating mode between occupied and unoccupied. When no communicated occupancy request exists, the unit cannot switch to occupied standby mode.

Occupied Bypass Mode

Tracer ZN510, ZN520, or UC400 only

The controller can be placed in occupied bypass mode by either communicating an occupancy bypass request to the controller or by using the timed override "on" button on the zone sensor. When the controller is in unoccupied mode, pressing the "on" button will place the controller into occupied bypass mode for the duration of the bypass time (typically 120 minutes).

Tracer Summit With Supply Fan Control

Tracer ZN510, ZN520, or UC400 only

All Tracer lockouts (latching diagnostics) are manually reset whenever the fan mode switch is set to the off position or when power is restored to the unit. The last diagnostic to occur is retained until the unit power is disconnected. Refer to *Installation, Operation and Programming Guide: Tracer™ ZN.520 Unit Controller* (CNT-SVX04A-EN, or the most recent version) for specific Tracer ZN520 operating procedures; refer to *Installation and Operation: Tracer™ UC400 Programmable Controller for Factory- or Field-installed Blower Coil* (BAS-SVX48A-EN, or the most recent version) for specific Tracer UC400 operating procedures.

Cooling Operation

During cooling mode, the Tracer controller attempts to maintain the space temperature at the active cooling setpoint. Based on the controller's occupancy mode, the active cooling setpoint is either the:

- Occupied cooling setpoint
- Occupied standby cooling setpoint (Tracer ZN510, ZN520, or UC400 only)
- Unoccupied cooling setpoint

The controller uses the measured space temperature, the active cooling setpoint, and discharge air temperature (Tracer ZN520 or UC400 only) along with the control algorithm to determine the requested cooling capacity of the unit (0 percent to 100 percent). The outputs are controlled based on the unit configuration and the required cooling capacity. To maintain space temperature control, the cooling outputs (modulating or 2-position hydronic valve, or economizer damper) are controlled based on the cooling capacity output.

Note: Economizer dampers and modulating valves are only available on units with the Tracer ZN520 or UC400 controller. Two-position dampers are only available on units with Tracer ZN010 and ZN510.

Cooling output is controlled based on the cooling capacity. At 0 percent capacity, all cooling capacities are off and the damper is at minimum position. Between 0 percent and 100 percent capacity, the cooling outputs are controlled according to modulating valve logic (Tracer ZN520 or UC400 only) or cycled with 2-position valves. As the load increases, modulating outputs open further and binary outputs are energized longer. At 100 percent capacity, the cooling valve or damper is fully open (modulating valves) or on continuously (2-position valves).

Note: Unit diagnostics can affect fan operation, causing occupied and occupied standby fan operation to be defined as abnormal. Refer to "Troubleshooting," page 58 for more information about abnormal fan operation.

Economizer Cooling

Tracer ZN520 or UC400 only

The economizer provides cooling whenever the outdoor temperature is below the economizer enable setpoint and there is a need for cooling. The economizer operates to meet the space demand, with other forms of cooling enabling when the economizer cannot meet the demand alone. See economizer air damper operation for additional information.

DX Cooling

Tracer ZN520 or UC400 only

The controller does not use both the DX compressor and the economizer at the same time. This prevents problems where the entering air temperature is too low for the evaporator coil to operate as designed, which leads to compressor short cycling due to low discharge air temperatures.

Discharge Air Tempering

Tracer ZN520 or UC400 only

Cascade cooling control initiates a discharge air tempering function if:

- Discharge air temperature falls below the discharge air temperature control low limit
- All cooling capacity is at minimum, and
- Discharge control loop determines a need to raise the discharge air temperature

The controller then provides heating capacity to raise the discharge air temperature to its low limit.

The discharge air tempering function enables when cold, fresh air is brought in through the fresh air damper and causes the discharge air to fall below the discharge air temperature control low limit. The controller exits the discharge air tempering function when heat capacity has been at 0 percent for five minutes.

Heating Operation

During heating mode, the Tracer controller attempts to maintain the space temperature at the active heating setpoint. Based on the controller's occupancy mode, the active heating setpoint can be:

- Occupied heating
- Occupied standby heating (Tracer ZN510, ZN520, or UC400 only)
- Unoccupied heating

Note: Unit diagnostics can affect the controller operation, causing unit operation to be defined as abnormal. Refer to "Troubleshooting," page 58 for more information about abnormal unit operation.

Heating output is controlled based on the heating capacity. At 0 percent capacity, the heating output is off continuously. Between 0 percent and 100 percent capacity, the heating output is controlled according to modulating valve logic (Tracer ZN520 or UC400 only) or cycled with 2-position valves. As the load increases, modulating outputs open further and binary outputs are energized longer. At 100 percent capacity, the modulating valve is fully open (Tracer ZN520 or UC400 only) or on continuously with 2-position valves.

Economizer Damper

Tracer ZN520 or UC400 only

The economizer damper option is never used for as a source for heating, but only for ventilation. Therefore, the damper is at the occupied minimum position in the occupied mode. The damper control is primarily associated with occupied fan operation.

Dehumidification

Tracer ZN520 only

During dehumidification, the Tracer ZN520 controller adjusts the heating setpoint up to the cooling setpoint. This reduces the relative humidity in the space with a minimum of energy usage.

The controller uses the measured space temperature, the active heating setpoint, and discharge air temperature (Tracer ZN520 only) along with the control algorithm, to determine the requested heating capacity of the unit (0 percent to 100 percent). The outputs are controlled based on the unit configuration and the required heating capacity.

Fan Mode Operation

⚠WARNING

Rotating Components!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

For multiple fan speed applications, the Tracer controller offers additional fan configuration flexibility. See Table 24 for fan operation sequences. Separate default fan speeds for heating and cooling modes can be configured using Rover service software (used with Tracer ZN010, Tracer ZN510, or ZN520 controllers) or Tracer TU service software (used with Tracer UC400 controllers).

Table 24. Tracer ZN520 and UC400 fan configuration

	Fan Operation	Fan Speed Default
Heating (primary and secondary)	Continuous	Off Auto Low High
Cooling	Continuous	Off Auto Low High

The fan runs continuously at selected speeds, high or low. When the fan mode switch is in the auto position or a hard-wired fan mode input does not exist, the fan operates at the default configured speed. See Table 25, p. 69 for Tracer ZN520 and UC400 default fan configuration for heating and cooling modes. During unoccupied mode, the fan cycles between high speed and off with heating and cooling fan modes. If the requested speed is off, the fan always remains off.

Table 25. Fan sequence of operation

Fan Speed	Tracer Controller	Sequence of Operation
Off	ZN010, ZN510, ZN520, UC400	• Fan is off • Control valves and damper option are closed • Low air temperature detection open is still active
Low, medium, or high (continuous fan)	ZN010, ZN510	• Fan operates continuously at selected speed • 2-position control valve option cycle as needed • 2-position control valve option opens to an adjustable mechanical stop-position
Low, medium, or high (continuous fan)	ZN520, UC400	• Fan operates continuously at selected speed • Modulating control valve option cycles as needed
Auto (cycling)	ZN010, ZN510	• Fan, 2-position damper cycle, and control valve cycle as needed • In cooling mode, fan cycles from off to high • in heating mode, fan cycles from off to low • When heating/cooling is not required, the fan is off and the 2-position damper option closes
Auto	ZN520	• Fan cycles between high and low, and never turns off unless the controller is in unoccupied mode • modulating or 2-position control open to maintain setpoint
Auto	UC400	• Fan speed will modulate and not cycle between low and high

When the fan is in auto during dehumidification (Tracer ZN520 only), the fan speed can switch depending on the error. The fan speed increases as the space temperature rises above the active cooling setpoint.

Additional flexibility built into the controller allows you to enable or disable the local fan switch input. The fan mode request can be hard-wired to any of the Tracer controllers or communicated to the Tracer ZN510 or ZN520 controller. When both inputs are present, the communicated request has priority over the hard-wired input. See Table 24, p. 69.

Fan Speed Switch

Off. Fan is turned off.

High, Medium, or Low. Fan runs continuously at the selected speed.

Tracer ZN010 and ZN510

Off. Fan is off; control valves and fresh air damper option close. Low air temperature detection option is still active.

Auto (Fan Cycling). Fan and fresh air damper cycle with control valve option to maintain setpoint temperature. In cooling mode the fan cycles from off to high and in heating mode it cycles from off to low (factory default that can be field-adjusted using Rover service software). When no heating or cooling is required, the fan is off and the fresh air damper option closes. Units can also be field-

configured using Rover to run at a defined speed when the fan speed switch is in the auto position.

Low or High (Continuous Fan). Fan operates continuously while control valve option cycles to maintain setpoint temperature. Fresh air damper option is open.

Tracer ZN520 and UC400

Off. Fan is off; control valve options and fresh air damper options close. The low air temperature detection option is still active.

Auto. Fan speed control in the auto setting allows the modulating (three-wire floating point) control valve option and single or two-speed fan to work cooperatively to meet precise capacity requirements, while minimizing fan speed (motor/energy/acoustics) and valve position (pump energy/chilled water reset). As the capacity requirement increases at low fan speed, the water valve opens. When the low fan speed capacity switch point is reached, the fan switches to high speed and the water valve repositions to maintain an equivalent capacity. The reverse sequence takes place with a decrease in required capacity.

Continuous Fan Operation

During occupied and occupied standby modes, the fan normally is on. For multiple speed fan applications, the fan normally operates at the selected or default speed (off, auto, low, or high). When fan mode is auto, the fan operates at the default fan speed.

During unoccupied mode, the fan is off. While unoccupied, the controller will heat or cool to maintain the unoccupied heating and cooling setpoints. In unoccupied mode, the fan runs on high speed only, with heating or cooling. See Table 30, p. 71.

The unit fan is always off during occupied, occupied standby, and unoccupied modes when the unit is off due to a diagnostic or when the unit is in the off mode due to the local zone sensor module, a communicated request, or the default fan speed (off).

If both a zone sensor module and communicated request exist, the communicated request has priority. See Table 29, p. 71.

Fan Cycling Operation

Tracer ZN520 and UC400 does not support fan cycling in occupied mode. The fan cycles between high speed and off in the unoccupied mode only. The controller's cascade control algorithm requires continuous fan operation in the occupied mode.

Fan Off Delay

When a heating output is controlled off, the Tracer controller automatically holds the fan on for an additional 30 seconds. This 30-second delay allows the fan to blow off any residual heat from the heating source, such as a steam coil. When the unit is heating, the fan off delay is normally applied to control the fan; otherwise, the fan off delay does not apply.

Fan Start on High Speed

On a transition from off to any other fan speed, the Tracer controller automatically starts the fan on high speed and runs the fan at high speed for 3.0 seconds. This provides ample torque required to start all fan motors from the off position.

Fan Operation During Occupied Heating Modes

The Tracer ZN520 and UC400 fan output(s) normally run continuously during the occupied and occupied standby modes, but cycle between high and off speeds with heating/cooling during the unoccupied mode. When in the occupied mode or occupied standby mode and the fan speed is set at the high or low position, the fan runs continuously at the selected speed. Refer to "Troubleshooting," page 58 for more information on abnormal fan operation.

Table 26. Fan mode operation, Tracer ZN010 and ZN510

	Heating Mode		Cooling Mode	
Fan Mode	Occupied	Unoccupied	Occupied	Unoccupied
Off	Off	Off	Off	Off
Low	Low	Off/high[a]	Low	Off/high[a]
High	High	Off/high[a]	High	Off/high[a]
Auto continuous	Heat default	Off/high[a]	Cool default	Off/high[a]
Cycling off	Off/heat default[a]	Off/high[a]	Off/cool default[a]	Off/high[a]

Notes:

1. During the transition from off to any fan speed but high, Tracer ZN010 and ZN510 automatically start the fan on high speed and run for one-half of a second before transitioning to the selected speed (if it is other than high). This provides enough torque to start all fan motors from the off position.
2. When the heating output is controlled off, ZN010 and ZN510 automatically control the fan on for an additional 30 seconds. This delay allows the fan to dissipate any residual heat from the heating source, such as electric heat.

(a) Whenever two states are listed for the fan, the first state (off) applies when there is not a call for heating or cooling. The second state (varies) applies where there is a call for heating or cooling. The heat default is factory-configured for low fan speed, and the cool default is high.

Table 27. Valid operating range and factory default setpoints, Tracer ZN010 and ZN510

Setpoint/Parameter	Default Setting	Valid Operating Range
Unoccupied cooling setpoint	85°F	40°F–115°F
Occupied cooling setpoint	74°F	40°F–115°F
Occupied heating setpoint	71°F	40°F–115°F
Unoccupied heating setpoint	60°F	40°F–115°F
Cooling setpoint high limit	110°F	40°F–115°F
Cooling setpoint low limit	40°F	40°F–115°F
Heating setpoint high limit	105°F	40°F–115°F
Heating setpoint low limit	40°F	40°F–115°F
Power up control wait	0 sec	0 sec–240 sec

Table 28. Valid operating range and factory default setpoints, Tracer UC400

Setpoint/Parameter	Default Setting	Valid Operating Range
Unoccupied cooling	85°F	40°F–115°F
Unoccupied heating	60°F	40°F–115°F
Occupied offset	2.5°F	0.90°F–45°F
Standby offset	7.5°F	0.90°F–45°F
Space temperature setpoint default	72.5°F	40°F–115
Power up control wait	N/A (random, not settable)	5–30 seconds

Table 29. Local fan switch enabled[a]

Communicated	Fan Switch (Local)	Fan Operation Fan Speed Input
Off	Ignored	Off
Low	Ignored	Low
High	Ignored	High
Auto	Off	Off
	Low	Low
	High	High
	Auto	Auto (configured default, determined by heat/cool mode)

(a) If the fan switch is not present with Tracer UC400 controls, the fan will operate in Auto mode.

Table 30. Fan operation in heating and cooling modes

	Heating		Cooling	
Fan Mode	Occupied	Unoccupied	Occupied	Unoccupied
Off	Off	Off	Off	Off
Low	Low	Off/high	Low	Off/high
High	High	Off/high	High	Off/high
Auto (continuous)	Default fan speed	Off/high	Default fan speed	Off/high

Two- and Four-Pipe Changeover Operation

Tracer controllers offer accurate and reliable unit changeover using 2-way valves and the controller's entering water temperature sampling function. Only units using the main hydronic coil for both heating and cooling (2-pipe and 4-pipe changeover units) use the entering water temperature sampling function.

Two-pipe and 4-pipe changeover applications require an entering water temperature sensor to allow the main coil to be used for heating and cooling. This sensor is factory-provided and should be field-installed on the entering water pipe.

The entering water temperature sampling function periodically opens the two-way valve to allow temporary water flow, producing reliable entering water temperature measurement. To ensure accurate unit changeover without sacrificing the benefits of 2-way, 2-position valves, Tracer controllers periodically test the entering water temperature on all hydronic main coil changeover units. Hydronic heating/cooling changeover operation requires central plant operation, and the unit controller must use an entering water temperature sensor to verify delivery of the correct water temperature from the central plant.

Entering Water Temperature Sampling Function

The entering water temperature (EWT) must be five degrees above the space temperature for hydronic heating and five degrees below the space temperature for hydronic cooling. When water flows normally and frequently through the coil, the controller does not invoke the sampling function because the EWT is satisfactory.

Table 31. Unit mode as related to water temperature

Unit Type	EWT Sensor Required?	Coil Water Temperature
2-pipe changeover	Yes	• Can cool if: space temp—EWT ≥ 5°F • Can heat if: EWT—space temp ≥ 5°F
4-pipe changeover	Yes	• Can cool if: space temp—EWT ≥ 5°F • Can heat if: EWT—space temp ≥ 5°F
2-pipe heating only	No	Hot water assumed
2-pipe cooling only	No	Cold water assumed
4-pipe heat/cool	No	• Cold water assumed in main coil • Hot water assumed in auxiliary coil

However, when the controller detects an incorrect water temperature based on heating or cooling mode, it invokes the entering water temperature sampling function. For example, when the measured EWT is too cool to heat or too warm to cool. For cooling the EWT needs to be five degrees below the measured space temperature. For heating, the EWT should be five degrees above the measured space temperature.

After the controller invokes the function, the unit opens the main hydronic valve for no more than three minutes before considering the measured EWT. The controller allows an initial stabilization period, equal to 30 seconds plus 1/2 the valve stroke time, to flush the coil. Once the temperature stabilization period expires, the controller compares the EWT against the effective space temperature (either hard-wired or communicated) to determine whether the EWT is correct for the desired heating or cooling mode. If the EWT is not usable for the desired mode, the controller continues to compare the EWT against the effective space temperature for a maximum of three minutes.

The controller automatically disables the entering water temperature sampling and closes the main hydronic valve when the measured EWT exceeds the high EWT limit (110°F). When the EWT is warmer than 110°F, the controller assumes the EWT is hot because it is unlikely the coil would drift to a high temperature unless the actual loop temperature was very high.

If the EWT is unusable—too cool to heat or too warm to cool—the controller closes the hydronic valve and waits 60 minutes before initializing another sampling. If the controller determines the EWT is valid for heating or cooling, it resumes normal heating/cooling control and effectively disables entering water temperature sampling until it is required.

Electric Heat Operation

Tracer controllers support 1-stage electric heat. Also, Tracer ZN520 and UC400 support 2-stage electric heat. Tracer ZN520 and UC400 cycle the electric heat to control the discharge air temperature. The rate of cycling is dependent upon the load in the space and the temperature of the incoming fresh air from the economizer (if any). Two-pipe changeover units with electric heat use the electric heat only when hot water is not available.

Economizer Damper

Tracer ZN520 and UC400 only

With a valid outdoor air temperature (either hard-wired or communicated), Tracer ZN520 and UC400 use the modulating economizer damper as the highest priority cooling source. Economizer operation is only possible using a modulating damper during the occupied, occupied standby, unoccupied, and occupied bypass modes.

The controller initiates the economizer function if the fresh air temperature is cold enough for use as free cooling capacity. If the fresh air temperature is less than the economizer enable setpoint (absolute dry bulb), the controller modulates the fresh air damper (between the active minimum damper position and 100 percent) to control the amount of fresh air cooling capacity. When the fresh air temperature rises 5°F above the economizer enable point, the controller disables economizing and moves the fresh air damper back to its predetermined minimum position based on the current occupancy mode or communicated minimum damper position.

Table 32. Relationship between outdoor temperature sensors and economizer damper position (Tracer ZN520 and UC400 controllers only)

Outdoor Air Temperature	Modulating Fresh Air Damper Occupied or Occupied Bypass	Occupied Standby	Unoccupied
None or invalid	Open to occupied minimum position	Open to occupied standby minimum position	Closed
Failed	Open to occupied minimum position	Open to occupied standby	Closed
Present and economizer feasible	Economizing: minimum position to 100%	Economizing: between occupied standby minimum position to 100%	Open and economizing only when unit operating, closed otherwise
Present and economizer not feasible	Open to occupied minimum position	Open to occupied standby minimum position	Closed

Tracer Dehumidification

Tracer ZN520 only

Dehumidification is possible when mechanical cooling is available, the heating capacity is located in the reheat position, and the space relative humidity setpoint is valid.The controller starts dehumidifying the space when the space humidity exceeds the humidity setpoint. The controller continues to dehumidify until the sensed humidity falls below the setpoint minus the relative humidity offset. The controller uses the cooling and reheat capacities simultaneously to dehumidify the space. While dehumidifying, the discharge air temperature is controlled to maintain the space temperature at the current setpoint.

A typical scenario involves high humidity and high temperature load of the space. The controller sets the cooling capacity to 100 percent and uses the reheat capacity to warm the discharge air to maintain space temperature control. Dehumidification may be disabled via Tracer or configuration.

Note: If the unit is in the unoccupied mode, the dehumidification routine will not operate.

Data Sharing

Notes:

- *Does not apply to the Tracer ZN010 or UC400 controllers.*
- *The Tracer UC400 controller is a BACnet controller and does not support data sharing. However, data sharing with Tracer UC400 controls can be accomplished through custom programming in the Tracer SC system controller.*

Tracer ZN510 or ZN520

Because Tracer ZN510 and ZN520 controllers utilize LonWorks technology, the controller can send or receive data (setpoint, heat/cool mode, fan request, space temperature, etc.) to and from other controllers on the communication link, with or without the existence of a building automation system. This applies to applications where multiple unit controllers share a single space temperature sensor (for rooms with multiple units but only one zone sensor) for both standalone (with communication wiring between units) and building automation system applications. For this application you will need to use the Rover service tool. For more information on setup, refer to EMTX-SVX01G-EN (or the most recent version), *Installation, Operation, and Programming: Rover™ Service Tool*.

Binary Inputs

Tracer ZN010, ZN510, and ZN520 Controller

Tracer ZN010, ZN510, and ZN520 controllers have the following binary inputs, factory-configured for the following functions:

- Binary input 1: low temperature detection (freezestat)
- Binary input 2: condensate overflow
- Binary input 3: occupancy/generic
- Binary input 4: fan status (Tracer ZN520 only)

Note: The generic binary input can be used with a Tracer Summit building automation system only.

BIP1: Low Temperature Detection Option

The factory hard wires the low temperature detection sensor to binary input #1 (BIP1) on the Tracer ZN010, ZN510, or ZN520 controller. The sensor defaults normally closed (N.C.), and will trip off the unit on a low temperature diagnostic when detecting low temperature. In addition, Tracer controls the following unit devices:

Fan: Off
Valves: Open
Electric heat: Off
Damper: Closed

Note: For more information, refer to "Troubleshooting," page 58.

BIP2: Condensate Overflow Detection Option

The factory hard wires the condensate overflow sensor to binary input #2 (BIP2) on the Tracer ZN010, ZN510, or ZN520 controller. The sensor defaults normally closed (N.C.), and will trip off the unit on a condensate overflow diagnostic if condensate reaches the trip point. In addition, Tracer controls unit devices as listed below:

Fan: Off
Valves: Closed
Electric heat: Off

BIP3: Occupancy Sensor

Binary input #3 (BIP3) on the Tracer ZN010, ZN510, or ZN520 controller is available for field wiring an occupancy sensor, such as a binary switch or a timeclock, to detect occupancy. The sensor can be either normally open or normally closed. Reference Table 33, p. 74.

BIP4: Fan Status (ZN520 only)

Binary input #4 (BIP4) on the Tracer ZN520 controller is available for sensor, such as a binary switch or a timeclock, to detect occupancy. The sensor defaults normally open but can be configured as either normally open or closed.

Table 33. Binary input configurations (Tracer ZN010, ZN510, or ZN520 controller)

Binary Input	Description	Config	Controller Operation	
			Contact Closed	Contact Open
BI 1	Low temperature detection[a]	NC	Normal	Diagnostic[b]
BI 2	Condensate overflow[a]	NC	Normal	Diagnostic[b]
BI 3	Occupancy	NO	Unoccupied	Occupied
BI 3	Generic binary input	NO	Normal[c]	Normal[c]
BI 4	Fan status[a]	NO	Normal	Diagnostic

Notes:

1. The occupancy binary input is for standalone unit controllers as an occupied/unoccupied input. However, when the controller receives a communicated occupied/unoccupied request, the communicated request has priority over the hard-wired input.
2. If the fan mode input is in the off position or the controller is in the unoccupied mode with the fan off, the fan status input will be open. A diagnostic will not be generated when the controller commands the fan off. A diagnostic will only be generated if the fan status input does not close after one minute from energizing a fan output or any time the input is open for one minute. The controller waits up to one minute after energizing a fan output to allow the differential pressure to build up across the fan.

(a) During low temperature, condensate overflow, and fan status diagnostics, the Tracer ZN520 control disables all normal unit operation of the fan, valves, and damper.
(b) The table below shows the controller's response to low temperature detection, condensate overflow, and fan status diagnostics.
(c) The generic binary input does not affect unit operation. A building automation system reads this input as a generic binary input.

Table 34. Manual Reset Diagnostics (Tracer ZN010, ZN510, or ZN520 controller)

BIP	Description	Fan	Valve	Electric Heat	Damper
BI 1	Low temperature detection	Off	Open	Off	Closed
BI 2	Condensate overflow	Off	Closed	Off	Closed
BI 4	Fan status	Off	Closed	Off	Closed

Tracer UC400 Controller

Tracer UC400 controllers have the following binary inputs, factory-configured for the following functions:

- Binary input 1: occupancy
- Binary input 2: condensate overflow
- Binary input 3: low coil temp detect (hydronic/steam coils only)
- Binary input 4: frost detection (DX only)
- Binary input 5: fan status

Note: Any Tracer UC400 input can be reconfigured to be a generic input.

BI1: Occupancy

The function of occupancy is to save energy by spreading zone setpoints when the zone is unoccupied. As the occupancy input, BI3 can be used for two related functions. For stand-alone controllers, BI3 can be hard-wired to a binary switch or timeclock to determine the occupancy mode—either occupied or unoccupied. For controllers receiving a BAS-communicated occupancy request, the function of BI3 is to change the mode from occupied to occupied standby.

BI3 is the only binary input that can be configured as generic. If configured as a generic binary input, it can be monitored by a BAS and has no direct effect on UC400 operation.

BI2: Condensate Overflow

The function of condensate overflow is to prevent the condensate drain pan from overflowing and causing water damage to the building. If BI2 is wired to a condensate overflow switch and the level of condensate reaches the trip point, the UC400 will detect the condition and generate a Condensate Overflow diagnostic.

BI3: Low Coil Temp Detection (Hydronic/Steam Coils only)

The function of low-coil-temperature detection is to protect the coil from freezing. If BI1 is wired to a binary low-coil-temperature detection device (freeze-protection switch) and a low-coil-temperature condition exists, the UC400 will detect the condition and generate a Low Coil Temp Detection diagnostic.

BI4: Frost Detection (DX only)

The function of the frost detection sensor is to detect conditions that will produce frost on the coil surface. When these conditions are present, the UC400 detects the condition and generates a Frost Detect Input alarm.

BI5: Fan Status

The fan status input provides feedback to the controller regarding the fan's operating status. If BI4 is wired to a fan status device and the input indicates that the fan is not operating when the controller has the fan controlled to on, the controller will generate a Low AirFlow—Fan Failure diagnostic.

Table 35. Binary input configurations (Tracer UC400 controller)

Binary Input	Description	Out-of-Service Value
BI1	Occupancy (hydronic/steam coils only)	n/a
BI2	Condensate overflow	Inactive
BI3	Low coil temperature detection	Inactive
BI4[a]	Frost detection (DX only)	Inactive
BI5[b]	Fan status	Active

(a) May be used as analog output 1 (AO1) for frost detection.
(b) May be used as analog output 2 (AO2) for supply fan status.

Analog Inputs

Tracer ZN010, ZN510, or ZN520 Controller

See Table 36 for a complete description of analog inputs for the Tracer ZN010, ZN510, or ZN520 controller.

Table 36. Analog inputs (Tracer ZN010, ZN510, or ZN520 controller)

Analog Input	Terminal	Function	Range	ZN010	ZN510	ZN520
Zone	TB3-1	Space temperature input	5°F to 122°F (-15°C to 50°C)	•	•	•
Ground	TB3-2	Analog ground	n/a	•	•	•
Set	TB3-3	Setpoint input	40°F to 115°F (4.4°C to 46.1°C)	•	•	•
Fan	TB3-4	Fan switch input	4821 Ω to 4919 Ω (Off) 2297 Ω to 2342 Ω (Auto) 10593 Ω to 10807 Ω (Low) 15137 Ω to 16463 Ω (High)	•	•	•
Ground	TB3-6	Analog ground	n/a	•	•	•
Analog Input 1	J3-1 J3-2	Entering water temperature Analog ground	-40°F to 212°F (-40°C to 100°C) n/a	•	•	•
Analog Input 2	J3-3 J3-4	Discharge air temperature Analog ground	-40°F to 212°F (-40°C to 100°C) n/a	•	•	•
Analog Input 3	J3-6	Fresh air temp/generic temp Analog ground	-40°F to 212°F (-40°C to 100°C) N/A			•
Analog Input 4	J3-7	Universal Input Generic 4–20 ma Humidity CO_2	0%–100% 0%–100% 0 ppm–2000 ppm			•
Ground	J3-8	Analog ground	n/a			•
Ground	J3-9	Analog ground	n/a			•

Notes:
1. The zone sensor, entering water temperature sensor, discharge air sensor, and the outside air temperature sensor are 10KΩ thermistors.
2. Zone sensor: Wall-mounted sensors include a thermistor soldered to the sensor's circuit board.
3. Changeover units include an entering water temperature sensor.

Tracer UC400 Controller

The Tracer UC400 controller includes seven analog inputs. Table 37 describes their functions. Each function is explained in the following paragraphs. For an explanation of the diagnostics generated by each analog input, see "Diagnostics (Tracer UC400 Controller)," page 67. For more information about how the controller operates, see "Tracer Controller Sequence of Operation," page 66.

Table 37. Analog and universal inputs (Tracer UC400 controller)[a]

Analog/Universal Input Terminal Label	Function
AI1	Space temperature
AI2	Setpoint local
AI3	Supply fan mode input
AI4	Discharge air temperature
AI5	Entering water temperature
UI1	Universal input
UI2	Outside air temperature or generic temperature

(a) For more information on analog and universal inputs for the Tracer UC400 controller, refer to *Installation and Operation: Tracer™ UC400 Programmable Controller for Factory- or Field-installed Blower Coil* (BAS-SVX48A-EN, or the most recent version).

Ground Terminals

Use a ⏚ terminal as the common ground for all space temperature sensor analog inputs.

Binary Outputs

Tracer ZN010, ZN510, or ZN520 Controller

Binary outputs are configured to support the following:

- Three fan stages
- One hydronic cooling stage
- One hydronic heating stage (dehumidification requires this to be in the reheat position)
- One DX cooling stage
- One or two-stage electric heat (dehumidification requires this to be in the reheat position)
- Modulating fresh air damper (Tracer ZN520 only)
- One-stage baseboard heat (Tracer ZN010, ZN510, and ZN520 only)

Table 38. Binary output configuration (Tracer ZN010, ZN510, or ZN520 controller)

Binary Output Pin Connection	Configuration	ZN010	ZN510	ZN520
J1-1	Fan high	•	•	•
J1-2	n/a	•	•	•
J1-3	Fan low			•
J1-4	(Key) Fan low	•	•	•
J1-5	Main valve - open, or 2 pos. valve[a]	•	•	•
J1-6	Aux. valve/elec. ht. Aux. valve - close[a]	•	•	•
J1-7	2-pos. damper	•	•	
J1-9	Heat valve - open, or 2 pos. valve, or first stage elec. ht.[a]			•
J1-10	Heat valve - close or sec. stage elec. ht.[a]			•
J1-11	Fresh air damper - open			•
J1-12	Fresh air damper - close			•
TB4-1	Generic/baseboard heat output			•
TB4-2	24 Vac			•

Notes:

1. If no valves are ordered with the unit, the factory default for Tracer ZN010 and ZN510 controllers are: main valve configured as normally closed and aux. valve configured as normally open.
2. If the fresh air damper option is not ordered on the unit, 2-position damper is configured as none.
3. Pin J1-2 can be configured for an exhaust fan with the use of Rover software. Factory default is none.

(a) Two-pipe hydronic heat/cool changeover units use terminals J1-5 and J1-6 to control the primary valve for both heating and cooling. Units configured and applied as 2-pipe hydronic heat/cool changeover with electric heat, use terminals J1-5 and J1-6 to control the primary valve (for both cooling and heating), and terminals J1-9 and J1-10 for the electric heat stage. For those 2-pipe changeover units, electric heat will not energize while the hydronic supply is hot (five or more degrees above the space temperature). In a 4-pipe application, pin J1-5 is for cooling and pin J1-6 for heating.

Tracer UC400 Controller

The UC400 supports the following blower coil applications:

- Supply fan with up to two speeds
- Hydronic cooling and/or heating coils with two-position or tri-state modulating control valve
- DX cooling (single stage)
- Electric heat (single stage or two stage)
- Baseboard heat (single stage)
- Tri-state modulating outdoor/return air damper

The Tracer UC400 controller includes nine binary outputs. BO1, BO2, and BO3 are relay outputs with a rating of 2.88 amps at 24 Vac pilot duty. BO4 through BO9 are TRIAC outputs with a rating of 12 VA at 24 Vac.

Table 39 describes the function of each output.

Table 39. Binary output functions (Tracer UC 400)

Binary Output Terminal Label	Functions
BO1	Generic
BO2	Generic
BO3	Generic
TRIAC Binary Output	**Functions**
BO4	Cooling; 2-position, Modulating TRIAC Open, DX Cool Output 1
BO5	Cooling; Modulating TRIAC Close
BO6	Heating; 2-position, Modulating TRIAC Open, Electric Heat Stage 1
BO7	Heating; Modulating TRIAC Close, Electric Heat Stage 2
BO8	Outside Air Damper; 2-position, Economizer Modulating TRIAC Open
BO9	Outside Air Damper; Economizer Modulating TRIAC Close

Wiring Requirements and Options

Tracer UC400

Table 40 shows required controller inputs for minimal proper operation of all applications.

Table 40. Required controller inputs for proper operation

Function	Input Source	For More Information, See:
24 Vac power	Terminals: Ground 24 Vac	*Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version)
Space temperature local	Terminals: AI1 Ground	*Installation and Operation: Tracer™ UC400 Programmable Controller for Factory- or Field-installed Blower Coil* (BAS-SVX48A-EN, or the most recent version)
Discharge air temperature	Terminals: AI4	
Entering water temperature - required only for units with auto changeover	Terminal: AI5 or communicated	
Outdoor air temperature local - required only for economizing	Terminals: UI2 or communicated	

For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).

Zone Sensor

The Tracer controller accepts the following zone sensor module inputs:

- Space temperature measurement (10 kΩ thermistor)
- Local setpoint (either internal or external on the zone sensor module)
- Fan mode switch
- Timed override, using “on” and “cancel” buttons (Tracer ZN510, ZN520, and UC400 only)
- Communication jack (Tracer ZN510, ZN520, and UC400 only)

Table 41. Zone sensor wiring connections

TB1	Description
1	Space temperature
2	Common
3	Setpoint
4	Fan mode
5	Communications
6	Communications

Space Temperature Measurement

Zone sensors use a 10 kΩ thermistor to measure the space temperature. Wall-mounted zone sensors include a space temperature thermistor. Unit-mounted zone sensors have a return air sensor mounted in the unit’s return airstream. If both a hard-wired and communicated space temperature value exists, the controller ignores the hard-wired space temperature input and uses the communicated value.

Local Setpoint

The zone sensor may be equipped with a thumbwheel for setpoint adjustment.

Fan Mode Switch

The zone sensor may be equipped with a fan mode switch. The fan mode switch offers selections of off, low, high, or auto.

External Setpoint Adjustment

Tracer ZN010, ZN510, and ZN520

Zone sensors with an external setpoint adjustment (1 kΩ) provide the Tracer controller with a local setpoint (50°F to 85°F or 10°C to 29.4°C). The external setpoint is exposed on the zone sensor’s front cover.

When the hard-wired setpoint adjustment is used to determine the setpoints, all unit setpoints are calculated based on the hard-wired setpoint value, the configured setpoints, and the active mode of the controller. The hard-wired setpoint is used with the controller’s occupancy mode (occupied, occupied standby, or unoccupied), the heating or cooling mode, the temperature deadband values, and the heating and cooling setpoints (high and low limits) to determine the controller’s active setpoint.

All Controllers

When a building automation system or other controller communicates a setpoint to the controller, the controller ignores the hard-wired setpoint input and uses the communicated value. The exception is the unoccupied mode, when the controller always uses the stored default unoccupied setpoints. After the controller completes all setpoint calculations, based on the requested setpoint, the occupancy mode, the heating and cooling mode, and other factors, the calculated setpoint is validated against the following setpoint limits:

- Heating setpoint high limit
- Heating setpoint low limit
- Cooling setpoint high limit
- Cooling setpoint low limit

Note: Only units with Tracer ZN510, ZN520, or UC400 can receive a communicated setpoint from Tracer Summit, Tracer SC, or other building automation system. However, Rover service software can communicate with Tracer ZN010 or ZN510.

These setpoint limits only apply to the occupied and occupied standby heating and cooling setpoints. These setpoint limits do not apply to the unoccupied heating and cooling setpoints stored in the controller’s configuration.

When the controller is in unoccupied mode, it always uses the stored unoccupied heating and cooling setpoints. The unit can also be configured to enable or disable the local (hard-wired) setpoint. This parameter provides additional flexibility to allow you to apply communicated, hard-wired, or default setpoints without making physical changes to the unit.

Similar to hard-wired setpoints, the effective setpoint value for a communicated setpoint is determined based on the stored default setpoints (which determines the occupied and occupied standby temperature deadbands) and the controller’s occupancy mode.

Fan Switch

The zone sensor fan switch provides the controller with an occupied (and occupied standby) fan request signal (Off, Low, Medium, High, Auto). If the fan control request is communicated to the controller, the controller ignores the hard-wired fan switch input and uses the communicated value. The zone sensor fan switch input can be enabled or disabled through configuration using the Rover service tool (used with Tracer ZN010, ZN510, or ZN520 controllers) or the Tracer TU service tool (used with Tracer UC400 controllers). If the zone sensor switch is disabled, the controller resorts to its stored configuration default fan speeds for heating and cooling, unless the controller receives a communicated fan input.

When the fan switch is in the off position, the controller does not control any unit capacity. The unit remains powered and all outputs drive to the closed position. Upon a loss of signal on the fan speed input, the controller

reports a diagnostic and reverts to using the default fan speed.

On/Cancel Buttons

Momentarily pressing the on button during unoccupied mode places the controller in occupied bypass mode for 120 minutes. You can adjust the number of minutes in the unit controller configuration using Rover service tool (used with Tracer ZN010, ZN510, or ZN520 controllers) or the Tracer TU service tool (used with Tracer UC400 controllers). The controller remains in occupied bypass mode until the override time expires or until you press the Cancel button.

Communication Jack

Use the RJ-11 communication as the connection point from Rover service tool to the communication link—when the communication jack is wired to the communication link at the Tracer ZN010, ZN510, or ZN520 controller (the Tracer UC400 controller connects to the Tracer TU service tool using the Tracer TU adaptor). By accessing the communication jack via Rover (used with Tracer ZN010, ZN510, or ZN520 controllers) or Tracer TU (used with Tracer UC400 controllers), you gain access to any controller on the link.

Note: The preferred connection for Tracer UC400 controllers is via USB; connection speeds are faster via direct USB connection.

Figure 60. Resistance temperature curve for the zone sensor, entering water temperature sensor, and discharge air sensor

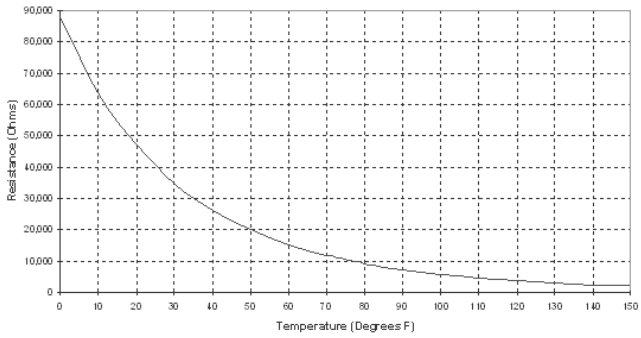


Table 42. Zone Sensor Thermistor Curve (Resistance in Ohms)

°C	°F	R	°C	°F	R	°C	°F	R	°C	°F	R
0	32	32885	25	77	10004	50	122	3759	75	167	1484
1	33.8	31238	26	78.8	9557	1	123.8	3597	76	168.8	1436
2	35.6	29684	27	80.6	9135	52	125.6	3445	77	170.6	1389
3	37.4	28216	28	82.4	8737	53	127.4	3301	78	172.4	1345
4	39.2	26830	29	84.2	8362	54	129.2	3165	79	174.2	1302
5	41	25520	30	86	8007	55	131	3037	80	176	1260
6	42.8	24282	31	87.8	7672	56	132.8	2915	81	177.8	1220
7	44.6	23112	32	89.6	7355	57	134.6	2800	82	179.6	1182
8	46.4	22005	33	91.4	7056	58	136.4	2691	83	181.4	1145
9	48.2	20957	34	93.2	6772	59	138.2	2588	84	183.2	1109
10	50	19966	35	95	6503	60	140	2490	85	185	1074
11	51.8	19028	36	96.8	6248	61	141.8	2397	86	186.8	1041
12	53.6	18139	37	98.6	6006	62	143.6	2309	87	188.6	1009
13	55.4	17297	38	100.4	5777	63	145.4	2225	88	190.4	978
14	57.2	16499	39	102.2	5559	64	147.2	2145	89	192.2	948
15	59	15743	40	104	5352	65	149	2070	90	194	920
16	60.8	15025	41	105.8	5156	66	150.8	1998	91	195.8	892
17	62.6	14345	42	107.6	4969	67	152.6	1929	92	197.6	865
18	64.4	13700	43	109.4	4791	68	154.4	1864	93	199.4	839
19	66.2	13087	44	111.2	4621	69	156.2	1802	94	201.2	814
20	68	12505	45	113	4460	70	158	1742	95	203	790
21	69.8	11953	46	114.8	4306	71	159.8	1686	96	204.8	767
22	71.6	11428	47	116.6	4160	72	161.6	1632	97	206.6	744
23	73.4	10929	48	118.4	4020	73	163.4	1580	98	208.4	722
24	75.2	10455	49	120.2	3886	74	165.2	1531	99	210.2	701

Routine Maintenance

⚠WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

⚠WARNING

Rotating Components!

The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel. Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

Maintenance Checklist

Table 43. Maintenance Checklist

Frequency	Maintenance
Every week	Observe unit weekly for any change in running condition and unusual noise.
Every month	• Clean or replace air filters if clogged or dirty.
Every three to six months	• Manually rotate the fan wheel to check for obstructions in the housing or interference with fan blades. Remove any obstructions and debris. • Check motor bracket torque. • Inspect and clean drain pans. • Inspect coils for dirt build-up. Clean fins if airflow is clogged.
Every year	• Inspect the unit casing for chips corrosion. If damage is found, clean and repaint. • Clean the fan wheels. Remove any rust from the shaft with an emery cloth and recoat with L.P.S. 3 or equivalent. • Inspect and clean drain pans. • Check damper linkages, fan set screws, and blade adjustment. Clean, but do not lubricate, the nylon damper rod bushings. • Clean damper operators. • Inspect, clean, and tighten all electrical connections and wiring. • Rotate the fan wheel and check for obstructions. The wheel should not rub. Adjust the center if necessary. • Examine flex connections for cracks or leaks. Repair or replace damaged material.

Air Filters

⚠WARNING

Rotating Components!

The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel. Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

Always install filters with directional arrows pointing toward the fan. For units with high efficiency filters (MERV 8 or MERV 13), the filters need to replaced with equivalent MERV-rated filters to maintain unit performance.

Fans

⚠WARNING

Rotating Components!

The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel. Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

TRANE

Routine Maintenance

Inspecting and Cleaning Fans

Fan sections of air handlers should be inspected every six months at a minimum or more frequently if operating experience dictates. If evidence of microbial growth (mold) is found, identify and remedy the cause immediately. Refer to "Troubleshooting" on page 143 for possible causes and solutions. To clean the fan section:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, remove any contamination.
3. Vacuum the section with a vacuum device that uses high-efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97 percent at 0.3 micron particle size.
4. Thoroughly clean any contaminated area(s) with a mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use.
5. Immediately rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of metal surfaces.
6. Allow the unit to dry completely before putting it back into service.
7. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Fan Motors

Inspect fan motors periodically for excessive vibration or temperature. Operating conditions will vary the frequency of inspection.

Torque Rating

Check and adjust fan wheel set screws whenever a component is removed or an adjustment is made. Refer to Table 44 for recommendations.

Table 44. Recommended torques

	Torque (in·lb)	Ft·lb	N·m
Fan wheel screw	120-130	10.0-10.8	13.6-14.7

Table 45. BCHD/BCVD valve package waterflow limits

Tube Size (in.)	GPM
1/2	8.6
3/4	19.3
1	34.3
1-1/4	53.5

Table 46. BCHD/BCVD fan, filter, and mixing box general data

Unit Size Nominal cfm	12 400	18 600	24 800	36 1200	54 1800	72 2400	90 3000
Air flow							
Minimum cfm	250	375	500	750	1125	1500	1875
Maximum cfm	500	675	1000	1600	2400	3000	4000
Fan data							
Fan wheel, in. (dia. x width)	9.5 x 4.5	9.5 x 4.5	9.5 x 6.0	9.5 x 6.0	12.6 x 9.5	12.6 x 9.5	12.6 x 9.5
Maximum rpm	2300	2300	2000	2000	1500	1500	1500
Motor hp	0.50–1.0	0.50–1.0	0.50–1.0	0.50–1.0	0.50–1.0	0.50–1.0	0.50–1.0
Unit flat filter							
(Qty.) Size	(1) 12 x 24	(1) 12 x 24	(1) 16 x 25	(2) 16 x 20	(2) 20 x 20	(1) 20 x 20 (1) 20 x 25	(3) 16 x 25
Area, sq. ft	2.000	2.000	2.778	4.444	5.556	6.250	8.333
Velocity, ft/min.	200	300	288	270	324	384	360
Angle filter							
(Qty.) Size	(2) 12 x 24	(2) 12 x 24	(2) 12 x 24	(2) 20 x 20	(4) 16 x 20	(6) 16 x 16	(6) 16 x 20
Area, sq. ft	4.000	4.000	4.000	5.556	8.889	8.889	11.111
Velocity, ft/min.	100	150	200	216	203	270	270
Bottom / top access filter box							
(Qty.) Size	(1) 12 x 20	(1) 12 x 24	(1) 16 x 25	(1) 16 x 20 (1) 16 x 16	(1) 16 x 20 (1) 20 x 20	(1) 20 x 25 (1) 20 x 20	(1) 16 x 25 (2) 14 x 25
Area, sq. ft	1.700	2.000	2.800	4.000	5.000	6.300	8.000
Velocity, ft/min.	240	300	288	300	360	384	375
Mixing box							
Damper opening width, in.	15.5	19.5	19.5	31.5	31.5	31.5	31.5
Damper opening height, in.	7	7	7	7	12.75	12.75	12.75
Area, sq. ft	0.753	0.948	0.948	1.531	2.789	2.789	2.789
Velocity, ft/min.	531	633	844	784	645	861	1076

Note: Minimum air flow limits apply to units with hot water or electric heat only. There is no minimum airflow limit on cooling on units. Maximum airflow limits are to help prevent moisture carryover.

Table 47. BCHD/BCVD coil general data

Unit Size	12	18	24	36	54	72	90
Nominal cfm	**400**	**600**	**800**	**1200**	**1800**	**2400**	**3000**
Hydronic and DX coil data							
Area - ft^2	0.89	1.11	1.67	2.67	4.00	5.00	6.67
Width - in. (a), (b)	8	8	12	12	18	18	24
Length - in. (d)	16	20	20	32	32	40	40
Velocity - ft/min.	450	540	480	450	450	480	450
Hydronic coil data - high capacity							
Area - ft^2	0.89	1.11	1.67	2.67	3.89	4.86	6.25
Width - in. (a), (c)	8	8	12	12	17.5	17.5	22.5
Length - in. (d)	16	20	20	32	32	40	40
Velocity - ft/min.	450	540	480	450	463	494	480
1-row coil							
Minimum gpm (e)	1.0	1.0	1.0	1.0	6.1	6.1	7.9
Maximum gpm (f)	5.2	5.2	5.2	5.2	32.6	32.6	42.0
Dry coil weight - lb	4.4	5.2	6.6	9.3	17.6	20.4	25.8
Wet coil weight - lb	5.1	6.0	7.8	11.0	22.4	26.0	32.9
Internal volume - in^3	19.4	22.2	33.2	47.1	132.9	155.1	196.6
2-row coil - high capacity							
Minimum gpm (e)	1.0	1.0	2.0	2.0	6.1	6.1	7.9
Maximum gpm (f)	5.2	5.2	10.4	10.4	32.6	32.6	42.0
Dry coil weight - lb	5.9	7.0	9.9	14.1	27.2	32.1	39.4
Wet coil weight - lb (kg)	7.2	8.4	12.3	17.6	36.1	42.5	52.6
Internal volume - in^3	36.0	38.8	66.5	96.9	246.5	288.0	365.5
4-row coil - standard capacity							
Minimum gpm (e)	n/a	n/a	n/a	n/a	8.8	8.8	11.7
Maximum gpm (f)	n/a	n/a	n/a	n/a	47.0	47.0	62.6
Dry coil weight - lb (g)	n/a	n/a	n/a	n/a	37.2	44.5	58.5
Wet coil weight - lb (g)	n/a	n/a	n/a	n/a	48.3	57.7	77.0
Internal volume - in^3 (g)	n/a	n/a	n/a	n/a	307.4	365.5	512.3
4-row coil - high capacity							
Minimum gpm (e)	2.0	2.0	2.9	2.9	6.1	6.1	7.9
Maximum gpm (f)	10.4	10.4	15.7	15.7	32.6	32.6	42.0
Dry coil weight - lb	10.5	12.4	17.7	25.5	47.0	56.3	73.1
Wet coil weight - lb	13.1	15.5	22.5	32.5	62.7	74.9	97.9
Internal volume - in^3	72.0	85.8	132.9	193.8	433.0	516.7	688.3
6-row coil - standard capacity							
Minimum gpm (e)	n/a	n/a	n/a	n/a	8.8	8.8	11.7
Maximum gpm (f)	n/a	n/a	n/a	n/a	47.0	47.0	62.6
Dry coil weight - lb (g)	n/a	n/a	n/a	n/a	52.4	63.1	82.7
Wet coil weight - lb (g)	n/a	n/a	n/a	n/a	68.1	82.0	108.7
Internal volume - in^3 (g)	n/a	n/a	n/a	n/a	434.8	523.4	720.0
6-row coil - high capacity							
Minimum gpm (e)	2.0	2.0	2.9	2.9	6.1	6.1	7.9
Maximum gpm (f)	10.4	10.4	15.7	15.7	32.6	32.6	42.0
Dry coil weight - lb	14.6	17.4	24.7	36.1	65.4	78.6	101.5
Wet coil weight - lb	18.2	21.8	31.5	46.1	87.8	105.6	137.0
Internal volume - in^3	99.7	121.8	188.3	276.9	620.4	745.9	983.1
Steam coil data							
Area - ft^2	0.71	0.88	1.75	2.75	4.13	5.13	6.83
Width - in. (a)	6	6	12	12	18	18	24
Length - in. (d)	17	21	21	33	33	41	41
Velocity - ft/min.	26	25	18	17	17	16	16
1-row coil	3	3	5	5	14	14	9
Minimum steam press - psig	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Maximum steam press - psig	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Dry coil weight - lb	16.7	18.7	32.5	41.1	57.4	64.8	84.9
Wet coil weight - lb	18.2	20.4	36.0	45.8	64.5	73.2	96.1
Internal volume - in^3	41.7	47.7	95.3	130.8	196.1	231.6	308.7

(a) Coil width = Length in the direction of a coil header, typically vertical.
(b) "**Hydronic and DX coil data**" width dimensions apply only to DX coils (all unit sizes), 1-row standard capacity hydronic coils (unit sizes 012 through 036), and 4- and 6-row standard capacity hydronic coils (054 through 090).
(c) "**High-capacity hydronic coil data**" width dimensions apply only to 1-row standard capacity hydronic coils (unit sizes 054 through 090) and 2-, 4-, and 6-row high capacity hydronic coils (all unit sizes).
(d) Coil length = Length of coil in direction of the coil tubes, typically horizontal and perpendicular to airflow.
(e) The minimum waterflow at 1.5 fps tubeside velocity is to ensure the coil self-vents properly. There is no minimum waterflow limit for coils that do not require self venting.
(f) Maximum gpm limits are to prevent erosion and noise problems.
(g) DX coil height and width dimensions are same as comparable hydronic coils. Four- and six-row DX coil dry weight dimensions are same as comparable 4- and 6-row hydronic coils. A 3-row DX coil dry weight is 25% less than a comparable 4-row hydronic coil. Internal volumes are approximately 6% less than comparable hydronic coils.

TRANE

Routine Maintenance

Coils

All coils should be kept clean to maintain maximum performance.

Steam and Water Coils

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

⚠WARNING

Hazardous Chemicals!

Coil cleaning agents can be either acidic or highly alkaline and can burn severely if contact with skin occurs. Handle chemical carefully and avoid contact with skin. ALWAYS wear Personal Protective Equipment (PPE) including goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices. Failure to follow all safety instructions could result in death or serious injury.

To clean steam and water coils:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a soft brush to remove loose debris from both sides of the coil.
3. Install a block-off to prevent spray from going through the coil and into a dry section of the unit and/or system ductwork.
4. Mix a high-quality coil cleaning detergent with water according to the manufacturer's instructions.

Note: If the detergent is strongly alkaline after mixing (PH 8.5 or higher), it must contain an inhibitor. Follow the cleaning solution manufacturer's instructions regarding the use of the product.

5. Place the mixed solution in a garden pump-up sprayer or high-pressure sprayer. If a high pressure sprayer is to be used:
   - Maintain minimum nozzle spray angle of 15 degrees.
   - Spray perpendicular to the coil face.
   - Keep the nozzle at least 6 inches from the coil.
   - Do *not* exceed 600 psi.
6. Spray the leaving air side of the coil first, then the entering air side.
7. Thoroughly rinse both sides of the coil and the drain pan with cool, clean water.
8. Repeat steps 6 and 7 as necessary.
9. Straighten any coil fins that may have been damaged during the cleaning process.
10. Confirm the drain line is open following the cleaning process.
11. Allow the unit to dry thoroughly before putting it back into service.
12. Replace all panels and parts and restore electrical power to the unit.
13. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials.

Refrigerant Coils

⚠WARNING

Hazardous Pressures!

Coils contain refrigerant under pressure. When cleaning coils, maintain coil cleaning solution temperature under 150°F to avoid excessive pressure in the coil. Failure to follow these safety precautions could result in coil bursting, which could result in death or serious injury.

To clean refrigerant coils:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a soft brush to remove loose debris from both sides of the coil.
3. Install a block-off to prevent spray from going through the coil and into a dry section of the unit and/or system ductwork.
4. Mix a high-quality coil cleaning detergent with water according to the manufacturer's instructions.

Note: If the detergent is strongly alkaline after mixing (PH 8.5 or higher), it must contain an inhibitor. Follow the cleaning solution manufacturer's instructions regarding the use of the product.

5. Place the mixed solution in a garden pump-up sprayer or high-pressure sprayer. If a high pressure sprayer is to be used:
   - Maintain minimum nozzle spray angle of 15 degrees.
   - Spray perpendicular to the coil face.
   - Keep the nozzle at least 6 inches from the coil.
   - Do *not* exceed 600 psi.

   entering air side.

7. Thoroughly rinse both sides of the coil and the drain pan with cool, clean water.
8. Repeat steps 6 and 7 as necessary.
9. Straighten any coil fins damaged during the cleaning process.
10. Confirm the drain line is open following the cleaning process.
11. Allow the unit to dry thoroughly before putting it back into service.
12. Replace all panels and parts and restore electrical power to the unit.
13. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Coil Winterization

Water coil winterization procedures consist primarily of draining water from the coil before the heating season. Trane recommends flushing the coil with glycol if coils will be exposed to temperatures below 35 degrees.

NOTICE:

Coil Freeze-up!

Drain and vent coils when not in use. Trane recommends glycol protection in all possible freezing applications. Use a glycol approved for use with commercial cooling and heating systems and copper tube coils. Failure to do so could result in equipment damage.

Install field-fitted drains and vents to permit winterization of coils not in use and to assist in evacuating air from the water system during startup. If draining is questionable because of dirt or scale deposits inside the coil, fill the coil with glycol before the heating season begins.

Individual coil types determine how to properly winterize the coil. To determine the coil type find the "Service Model No of Coil" on the coil section nameplate. The coil type is designated by the second and third digits on that model number. For example, if the model number begins with "DUWB," the coil type is UW; if the model number begins with "DW0B," the coil type is W.

Note: On many unit sizes, there are multiple coils in the coil section. Be sure to winterize all coils in a given coil section.

To winterize type D1, D2, WL, LL, UA, UW, UU, W, P2, P4, P8, WD, 5D, and 5W coils:

1. Remove the vent and drain plugs.
2. Blow the coil out as completely as possible with compressed air.
3. Fill and drain the coil several times with full strength glycol so that it mixes thoroughly with the water retained in the coil.
4. Drain the coil out as completely as possible.
5. To ensure no water remains in the coil, do not replace the vent and drain plugs until the coils are put back into service.

Note: Use care in removing header plugs from Type P2, P4, and P8 coils. Over-torquing may result in twisted tubes.

Moisture Purge Cycle

By it's very nature, any HVAC unit with a cooling coil serves as a dehumidifier, reducing the surrounding air's ability to hold water vapor as its temperature falls. This normally doesn't present a problem when the unit is running. However, when the fan stops, water vapor condenses on the cold metal surfaces inside the air handler and remains there until the air warms sufficiently to re-evaporate it. This damp, dark environment—though temporary—can encourage the growth of mold, mildew, and other microbial contaminants.

Providing a moisture purge cycle 15 to 30 minutes after shutdown disperses the cold, humid air inside the air-handling system more evenly throughout the building. This four-step cycle:

- Closes the outdoor air dampers.
- Turns off the cooling coil.
- Opens any variable-air-volume terminals connected to the air handler.
- Operates the supply fan for 10 to 15 minutes.

Air movement discourages water condensation and hastens re-evaporation of any condensate that does happen to form. This simple preventative measure effectively combats microbial growth and curbs moisture-related deterioration of air-handling components.

Cleaning Non-Porous Surfaces

⚠ WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

If microbial growth on a non-porous insulating surface (closed cell insulation or sheet metal surface) is observed:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a brush for sheet metal surfaces or a soft sponge on a foil face or closed cell foam surface to mechanically remove the microbial growth.

Note: Be careful not to damage the non-porous surface of the insulation.

3. Install a block-off to prevent spray from going into a dry section of the unit and/or system ductwork.
4. Thoroughly clean the contaminated area(s) with an EPA-approved sanitizer specifically designed for HVAC use.
5. Rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of the drain pan and drain line
6. Repeat steps 4 and 5 as necessary.
7. Confirm the drain line is open following the cleaning process.
8. Allow the unit to dry thoroughly before putting it back into service.
9. Replace all panels and parts and restore electrical power to the unit.
10. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Cleaning Porous Surfaces

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

To clean a porous insulating surface (fiberglass insulation):

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a vacuum device with a HEPA filter (99.97 percent efficient at 0.3 micron particles) to remove the accumulated dirt and organic matter.

Note: Be careful not to tear the insulation surface or edges.

3. Confirm the drain line is open following the cleaning process.
4. Allow the unit to dry thoroughly before putting it back into service.
5. Replace all panels and parts and restore electrical power to the unit.
6. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Drain Pans

⚠WARNING

Hazardous Chemicals!

Coil cleaning agents can be either acidic or highly alkaline and can burn severely if contact with skin occurs. Handle chemical carefully and avoid contact with skin. ALWAYS wear Personal Protective Equipment (PPE) including goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices. Failure to follow all safety instructions could result in death or serious injury.

The condensate drain pan and drain line must be checked to assure the condensate drains as designed. This inspection should occur a minimum of every six months or more often as dictated by operating experience.

If evidence of standing water or condensate overflow exists, identify and remedy the cause immediately. Refer to "Troubleshooting" on page 143 for possible causes and solutions.

To clean drain pans:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, remove any standing water.
3. Scrape solid matter off of the drain pan.
4. Vacuum the drain pan with a vacuum device that uses high-efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97 percent at 0.3 micron particle size.
5. Thoroughly clean any contaminated area(s) with a mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use.
6. Immediately rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of metal surfaces.
7. Allow the unit to dry completely before putting it back into service.
8. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Troubleshooting

This section is intended to be used as a diagnostic aid only. For detailed repair procedures, contact your local Trane service representative.

⚠ WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Table 48. Air handler troubleshooting recommendations

Symptom	Probable Cause	Recommended Action
Motor fails to start	Blown fuse or open circuit breaker	Replace fuse or reset circuit breaker.
	Overload trip	Check and reset overload.
	Improper wiring or connections	Check wiring with diagram supplied on unit.
	Improper current supply	Compare actual supply power with motor nameplate recommendations. Contact power company for adjustments.
	Mechanical failure	Check that fan rotates freely.
Motor stalls	Low line voltage	Check across AC line. Correct voltage if possible.
Excessive vibration	Poor fan alignment	Check motor bracket screws. Check fan position on shaft. Align bearing set screws (see Table 38, p. 118). Loosen and retighten bearing set screws.
	Shipping spacers not removed	Remove shipping spacers and/or bolts (see "Fan Isolation," page 64).
Motor runs and then dies down	Partial loss of line voltage	Check for loose connections. Determine adequacy of main power supply.
Motor does not come up to speed	Low voltage at motor terminals	Check across AC line and correct voltage loss if possible.
	Line wiring to motor too small	Replace with larger sized wiring.
Motor overheats	Overloaded motor	Reduce load or replace with a larger motor.
	Motor fan is clogged with dirt preventing proper ventilation	Remove fan cover, clean fan and replace cover.
Excessive motor noise	Motor mounting bolts loose	Tighten motor mounting bolts.
	Rigid coupling connections	Replace with flexible connections.
	Fan rubbing on fan cover	Remove interference in motor fan housing.
Low water coil capacity	Incorrect airflow	Check fan operating condition.
	Incorrect water flow	Inspect the water pumps and valves for proper operation and check the lines for obstructions.
	Incorrect water temperature	Adjust the chiller or boiler to provide the proper water temperature.
	Coil is piped incorrectly	Verify coil piping (see "Coil Piping and Connections," page 29).
	Dirty fin surface	Clean the fin surface.
	Incorrect glycol mixture	Verify glycol mixture and adjust if necessary.
Low refrigerant coil capacity	Incorrect airflow	Check fan operating condition.
	Expansion valve is not operating properly or is sized incorrectly	Check sensing bulb temperature. Verify valve operation. Verify proper valve size.
	Incorrect refrigerant charge	Verify refrigerant charge and adjust if necessary.
	Condensing unit failure	Verify condensing unit operation.
	Coil is piped incorrectly	Verify coil piping (see "Coil Piping and Connections," page 29.)
	Clogged refrigerant line filter	Change filter core.
	Failure of suction/liquid line components	Verify component operation
	Dirty fin surface	Clean the fin surface. Do not use steam to clean refrigerant coils.
	Fin frosting	Verify defrost cycle operation. Verify frostat operation. Verify refrigerant charge.

TRANE

Troubleshooting

Table 48. Air handler troubleshooting recommendations

Symptom	Probable Cause	Recommended Action
Low steam coil capacity	Incorrect airflow	Check fan operating condition.
	Coil is piped incorrectly	Verify coil piping (see "Coil Piping and Connections," page 29).
	Incorrect steam pressure	Verify steam pressure and adjust if necessary.
	Excessive steam superheat	Check steam superheat. Steam superheat should not exceed 50ºF.
	Failure of steam line/condensate return components	Verify component operation
	Boiler failure	Verify boiler operation
	Dirty fin surface	Clean the fin surface (see the "Coils" section on page 130).
Drain pan is overflowing	Plugged drain line	Clean drain line
	Unit not level	Level unit
	Improper trap design	Design trap per unit installation instructions
Standing water in drain pan	Improper trap design	Design trap per unit installation instructions
	Unit not level	Level unit
	Plugged drain line	Clean drain line
Wet interior	Coil face velocity too high	Reduce fan speed
	Improper trap design	Design trap per unit installation instructions
	Drain pan leaks/overflows	Repair leaks
	Condensation on surfaces	Insulate surfaces
Excess dirt in unit	Missing filters	Replace filters
	Filter bypass	Reduce filter bypass by ensuring all blockoffs are in place.
Microbial growth (mold) inside air handler	Standing water in drain pan	See "Standing water in drain pan" above

LED Activity for Tracer Controllers ZN010, ZN510, ZN520

Red Service LED

The red LED normally indicates if the unit controller is operating properly or not. Refer to Table 49.

Table 49. Red service LED activity for Tracer ZN010, ZN510, or ZN520 controllers

LED Activity	Description
Off continuously after power is applied to the controller.	Normal operation
On continuously, even when power is first applied to the controller.	Someone is pressing the Service button or the controller has failed.
LED flashes about once every second.	Uninstall (normal controller mode). To restore normal operation, use the Rover service tool.
Black Service push button.	Use the Service button to install the Tracer ZN520 controller in a communication network.

Green Status LED

The green LED normally indicates whether the controller is powered on (24 Vac supplied). Refer to Table 50.

Table 50. Green status LED activity (Tracer ZN010, ZN510, or ZN520 controller)

Green LED Activity	Description
On continuously	Power on (normal operation).
Blinks (one blink)	The controller is in manual output test mode. No diagnostics present.
Blinks (two blinks)	The controller is in manual output test mode. One or more diagnostics are present.
LED blinks (1/4 second on, 1/4 second, off for 10 seconds)	Wink mode.[(a)]
LED off	Power is off. Controller failure. Test button is pressed.

(a) The Wink feature allows you to identify a controller. By sending a request from the Rover service tool, you can request the controller to wink (blink on and off as a notification that the controller received the signal). The green LED blinks (1/4 second on, 1/4 second off for 10 seconds) during Wink mode.

Yellow Comm LED

The yellow comm LED blinks at the rate the controller receives communication. The yellow LED does not blink when the controller is transmitting communication data. Refer to Table 51.

Table 51. Yellow comm LED activity (Tracer ZN010, ZN510, or ZN520 controller)

LED Activity	Description
Off continuously	The controller is not detecting any communication. (Normal for standalone applications.)
LED blinks or flickers	The controller detects communication. (Normal for communicating applications, including data sharing.)
LED on continuously	Abnormal condition or extremely high traffic on the link. High traffic on the link.

Note: If the service push button is held down for more than 15 seconds, the Tracer controller will uninstall itself from the ICS communication network and shut down all unit operation. This mode is indicated by the red Service LED flashing once every second. See the Red Service LED section. Use the Rover service tool to restore the unit to normal operation. Refer to the service tool product literature for more information.

LED Activity for Tracer UC400

There are 15 LEDs on the front of the Tracer UC400 controller. The following table provides a description of LED activity, an indication or troubleshooting tip for each, and any related notes.

Table 52. LED activity and troubleshooting tips (Tracer UC400 controller)

LED Name	Activities	Indication and Troubleshooting Tips	Notes
Marquee LED	Shows solid green when the unit is **powered** and no alarm exists	Indicates normal operation	When powering the UC400 and expansion module, the Marquee LED will blink **RED**, blink **GREEN** (indicating activated and controller/expansion module are communicating), and then stay **GREEN CONTINUOSLY** (indicating normal power operation).
	Shows blinking green during a device reset or firmware download	Indicates normal operation	
	Shows solid red when the unit is **powered**, but represents low power or a malfunction	**If low power**; could be under voltage or the microprocessor has malfunction. Measure for the expected value range. For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version). **If malfunction**; un-power and then re-power unit to bring the unit back up to normal operation.	
	Shows blinking red when an **alarm** or fault exists	An alarm or fault condition will occur if the value for a given point is invalid or outside the configured limits for the point. Alarm and fault conditions vary, and they can be configured by the programmer.	
	LED not lit	Indicates power is OFF or there is a malfunction **OFF** or **malfunction**; cycle the power. For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).	
Link and IMC	TX blinks green	Blinks at the data transfer rate when the unit transfers data to other devices on the link	TX LED: Regardless of connectivity or not, this LED will constantly blink as it continually looks for devices to communicate to. LED not lit: Determine if, for example, a Tracer SC or BACnet device is trying to talk to the controller or if it is capable of talking to the controller. Also determine if the communication status shows down all of the time. In addition, check polarity and baud rate. For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).
	RX blinks yellow	Blinks at the data transfer rate when the unit receives data from other devices on the link **ON solid yellow**; indicates there is reverse polarity	
	LED is not lit	Indicates that the controller is not detecting communication **Not lit**; cycle the power to reestablish communication	
Service	Shows solid green when the LED has been pressed		***When the UC400 is placed into boot mode, the system will not run any applications such as trending, scheduling, and TGP2 runtime. The controller will be placed into boot mode if the service pin is held in when power is applied. In boot mode, the controller is non-operational and is waiting for a new main application to be downloaded.***
	LED not lit	Indicates controller is operating normally	
Binary B01 through B09	Shows solid yellow	Indicates a corresponding binary output has been *commanded* **ON** **Relay coil**; indicates that a command has been made to energize **TRIAC**; indicates that a command has been made to turn ON	If the user is currently powering the UC400 from a USB port, the Led lights will turn **ON**. However, the binary outputs *will not* be activated. **Commanded ON**; As an example of commanded ON, a command could be a manual command such as an override or a command could be from TGP2 based on a list of conditions that are met telling these outputs to turn ON.
	LED not lit	Indicates that a relay output is de-energized or no power to the board **Not lit**; cycle power to reestablish communication	LED not lit: Did the user command it to be ON? If yes, see the Marquee LED at the top of this table. For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).

Manual Output Test

Tracer ZN010, ZN510, or ZN520

The purpose of the manual output test sequence is to verify output and end device operation. Use the manual output test to:

- Verify output wiring and operation without using the service tool.
- Force the water valve to open and balance the hydronic system.

Note: The manual output test is not an automatic cycle. You must press the Test button to proceed through each step.

The controller observes all diagnostics that occur during the test sequence. Although an automatic diagnostic reset sequence exists as part of the controller's normal operation, the automatic diagnostic reset feature is not active during the test sequence.

If left in an individual test step, the controller remains in test mode for 60 minutes and then exits to normal operation.

Many service calls are due to unit diagnostics. The test sequence resets unit diagnostics and attempts to restore normal unit operation prior to testing the outputs. If the diagnostics remain after a reset, the STATUS LED indicates the diagnostic condition is still present (two blinks).

Manual Output Test Procedure

Tracer ZN010, ZN510, or ZN520

Follow the procedure below to test the Tracer ZN010, ZN510, or ZN520 controller.

1. Press and hold the Test button for at least two seconds (not exceeding five seconds), and then release, to start the test mode.
2. The test sequence will turn off all outputs and then attempt to clear all diagnostics.
3. Press the Test button several more times (no more than once per second) to advance through the test sequence.

The outputs are not subject to minimum times during the test sequence. However, the test sequence only permits one step per second which limits minimum output time.

The green LED is turned off when the Test button is pressed. To begin the manual output test mode, press and hold the Test button (turning off the green LED) for at least two seconds. The green LED will begin to blink, indicating the controller is in test mode.

Overriding Outputs

Tracer UC400

Analog and multistate value request points are included in order to safely override outputs without disrupting TGP2 program operation. To override valves and dampers for commissioning or testing purposes, access the following points on the Tracer TU analog or multistate status pages:

- Cool valve request
- DX cool request
- Heat valve request
- Electric heat request
- Economizer request
- Supply fan speed active

For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).

Table 53. Tracer ZN010 and ZN510 test sequence for 1-heat/1-cool configurations

Steps	Fan J1-1, J1-3	Cool Output[a] J1-	Heat Output J1-	Damper J1-
1. Off	Off	Off	Off	Closed
2. Fan high	High	Off	Off	Closed
3. Exhaust fan	[b]	Off	Off	Closed
4. Fan	Low	Off	Off	Closed
5. Cool	High	On	Off	Closed
6. Heat	High	Off	On	Closed
7. Two-position damper[c]	High	Off	Off	Open
8. Exit	[d]			

Note: The 2-position damper energizes during this step if the controller is configured for a 2-position damper.

(a) At the beginning of step 2, the controller attempts to clear all diagnostics.

(b) Tracer ZN010 and ZN510 have a binary output default as "none" on J1-X from the factory. If the unit has a 2-speed fan, step 3 will energize the low fan speed. If the unit has a single speed fan, step 3 will continue to energize the high fan speed. This binary output can be reconfigured as an exhaust fan, with the use of Rover software.

(c) After the fresh air damper step, the test sequence performs the exit step.This initiates a reset and attempts to return the controller to normal operation.

(d) For all 1-heat/1-cool applications including 2-pipe changeover, the cooling and heat test stage energize. This occurs even though during normal 2-pipe changeover operation binary output controls the unit valve for both cooling and heating.

Table 54. Tracer ZN520 test sequence

Step		Fan		Main Valve	Electric Heat or Aux. Valve		Fresh Air Damper	Generic/Baseboard Heat			
		J1-1	J1-2	J1-3	J1-5	J1-6	J1-9	J1-10	J1-11	J1-12	TB4-1
1.	Off[a]	Off	Off	Off	Off	On EH: off	Off	aux: on	Off	On	Off
2.	Fan high[b]	High	Off	Off	Off	Off	Off	Off	Off	Off	Off
3.	[c]	Off		Off	Off	Off	Off	Off	Off	Off	Off
4.	Fan low	Off	Off	Low	Off	Off	Off	Off	Off	Off	Off
5.	Main open	High	Off	Off	On	Off	Off	Off	Off	Off	Off
6.	Main close, EH1 on	High	Off	Off	Off	On	On	Off	Off	Off	Off
7.	Aux. open	High EH1 on	Exh[d]	Off	Off	Off	On	Off	Off	Off	Off
8.	Aux. close, damper open	High	Off	Off	Off	Off	Off EH1 off	On EH2 on	On	Off	Off
9.	Damper close	High	Off	Off	Off	Off	Off	Off	Off	On	Off
10.	Generic/baseboard heat energized	High	Off	Off	Off	Off	Off	Off	Off	Off	On
11.	Exit[e]	Exit									

(a) Upon entering manual output test mode, the controller turns off all fan and electric heat outputs and drives.
(b) At the beginning of Step 2, the controller attempts to clear all diagnostics.
(c) The low fan speed output energizes at Step 3. If the unit is configured for a 1-speed fan, the fan remains on high speed at Step 3.
(d) If the unit is configured for a 1- or 2-speed fan, and BOP2 is configured for an exhaust fan, the exhaust fan output energizes on Step 7. The exhaust fan output is shared with medium speed.
(e) After Step 10, the test sequence performs an exit. This initiates a reset and attempts to return the controller to normal operation.

Diagnostics

Translating Multiple Diagnostics

The controller senses and records each diagnostic independently of other diagnostics. It is possible to have multiple diagnostics present simultaneously. The diagnostics are reported in the order they occur.

Possible diagnostics include:

- Low coil temperature detection
- Condensate overflow
- Low air flow—fan status
- Discharge air temp limit
- Space temperature failure[1]
- Entering water temp failure[1]
- Discharge air temp failure
- Outdoor air temp failure[1]
- Local setpoint failure[1]
- Local fan mode failure[1]
- CO_2 sensor failure[1]
- Generic AIP failure[1]
- Humidity input failure[1]
- Defrosting compressor lockout[1]
- Maintenance required[2]
- Invalid Unit Configuration[2]
- Generic temperature failure[2]
- Discharge air low limit

Resetting Diagnostics

There are seven ways to reset unit diagnostics:

1. Automatically by the controller
2. By initiating a manual output test at the controller (Tracer ZN010, ZN510, or ZN520 only)
3. By cycling power to the controller
4. By using a building automation system
5. By using the Rover or Tracer TU service tool
6. By using any other communicating device able to access the controller's diagnostic reset input (Tracer ZN510 or ZN520 only)
7. By cycling the fan switch from off to any speed setting (Tracer ZN520 only)

Automatic Reset by the Controller

The controller includes an automatic diagnostic reset function which attempts to automatically restore the unit when a low temperature diagnostic occurs.

Note: The controller implements the automatic diagnostic reset function only once every 24 hours. For the controller to increment the 24-hour timer, you must maintain power to the controller. Cycling power resets all timers and counters.

After the controller detects the first low temperature diagnostic, the unit waits 30 minutes before invoking the automatic diagnostic reset function. The automatic diagnostic reset function clears the special diagnostic and attempts to restore the controller to normal operation. The

[1] Non-latching diagnostics automatically reset when the input is present and valid.
[2] Does not apply to the Tracer UC400 controller.

controller resumes normal operation until another diagnostic occurs.

Note: The automatic diagnostic reset function does not operate during the manual output test sequence.

If a special diagnostic occurs within 24 hours after an automatic diagnostic reset, the controller must be manually reset. Other possible methods of resetting diagnostics are described in the sections that follow.

Manual Output Test (Tracer ZN010, ZN510, or ZN520 Controller only)

You can use the Test button on the controller either during installation to verify proper end device operation or during troubleshooting. When you press the Test button, the controller exercises all outputs in a predefined sequence. The first and last outputs of the sequence reset the controller diagnostics. See p. 89 for more information about the manual output test.

Cycling Power

When someone turns off the controller's 24 Vac power, then re-applies power, the unit cycles through a power up sequence. By default, the controller attempts to reset all diagnostics at power up. Diagnostics present at power-up and those that occur after power-up are handled according to the defined unit diagnostics sequences (see Table 55, p. 91 and Table 56, p. 92).

Building Automation System

Some building automation systems can reset diagnostics in the Tracer ZN510, ZN520, or UC400 controller. For more complete information, refer to the product literature for the building automation system.

Diagnostic Reset (Tracer ZN510 or ZN520 only)

Any device that can communicate the network variable nviRequest (enumeration "clear_alarm") can reset diagnostics in the Tracer ZN510 or ZN520 controller. The controller also attempts to reset diagnostics whenever power is cycled.

Cycling the Fan Switch (Tracer ZN520 only)

If the user cycles the fan speed switch from off to any speed, the controller resets all diagnostics. Diagnostics may recur immediately if the problem still exists.

The green LED normally indicates whether or not the controller is powered on (24 Vac).

Trane Service Tools

Rover, Trane's service tool for Tracer ZN010, ZN510, and ZN520, can reset diagnostics present in the controller. For complete information about Rover, refer to EMTX-SVX01G-EN (or the most recent version), *Installation, Operation, and Programming: Rover™ Service Tool*.

Tracer TU can be used to reset diagnostics present in a Tracer UC400 controller.

Alarm Reset

Any device that can communicate alarm reset information can reset diagnostics present in the controller.

Table 55. Tracer ZN010 and ZN510 controller diagnostics

Diagnostic	Latching	Fan	Valves	Electric Heat	Damper
Auxiliary temperature failure	No	Enabled	No action	No action	No action
Condensate overflow detection	Yes	Off	Closed	Off	Closed
Entering water temperature	No	Enabled	Enabled	Enabled	Enabled
Fan mode failure	No	Enabled	Enabled	Enabled	Enabled
Invalid unit configuration failure	Yes	Disabled	Disabled	Disabled	Disabled
Low temperature detection	Yes	Off	Open	Off	Closed
Maintenance required	Yes	Enabled	No action	No action	No action
Setpoint	No	Enabled	No action	No action	No action
Zone temperature failure	No	Off	Closed	Off	Closed

Notes:
1. Priority Level: Diagnostics are listed in order from highest to lowest priority. The controller senses and records each diagnostic independently of other diagnostics. It is possible to have multiple diagnostics present simultaneously. The diagnostics affect unit operation according to priority level.
2. Latching: A latching diagnostic requires a manual reset of the controller; while a non-latching diagnostic automatically resets when the input is present and valid.
3. Enabled: End device is allowed to run if there is a call for it to run.
4. Disabled: End device is not allowed to run even if there is a call for it to run.
5. No Action: The diagnostic has no affect on the end device.

Table 56. Tracer ZN520 diagnostics

Diagnostic	Fan	Other Outputs[a]
Condensate overflow	Off	Valves closed, fresh air damper closed, electric heat off, baseboard heat off
Low temperature detection	Off	Valves open, fresh air damper closed, electric heat off, baseboard heat off
Low air flow—fan failure	Off	Valves closed, fresh air damper closed, electric heat off, baseboard heat off
Space temperature failure	Off	Valves closed, fresh air damper closed, electric heat off, baseboard heat off
Entering water temperature failure	On	Valves enabled[b], fresh air damper enabled(b), electric heat enabled(b), baseboard heat off
Discharge air temperature low limit	Off	Valves open, fresh air damper closed, electric heat off, baseboard heat off
Discharge air temperature failure	Off	Valves closed, fresh air damper closed, electric heat off, baseboard heat off
Fresh air temperature failure	On	Valves enabled, fresh air damper minimum position[c], electric heat enabled, baseboard heat enabled
Relative humidity failure[d]	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Generic 4–20 mA failure(d)	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
CO_2 input failure	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Maintenance required	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Local fan mode failure	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Local setpoint failure	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Invalid unit configuration(d)	Off	Valves disabled, fresh air damper disabled, electric heat disabled, baseboard heat disabled
Normal—power up	On	Valves enabled, fresh air damper enabled, electric heat enabled

(a) The generic binary output (TB4-1, TB4-2) state is unaffected by all unit diagnostics.
(b) When the entering water temperature is required but not present, the Tracer ZN520 controller generates a diagnostic to indicate the sensor loss condition. The controller automatically clears the diagnostic once a valid entering water temperature value is present (non-latching diagnostic). When the entering water temperature sensor fails, the controller prohibits all hydronic cooling operation, but allows the delivery of heat when heating is required. In the Cool mode, all cooling is locked-out, but normal fan and outdoor air damper operation is permitted.
(c) When the outdoor air temperature sensor has failed or is not present, the Tracer ZN520 controller generates a diagnostic to indicate the sensor loss condition. The controller automatically clears the diagnostic once a valid outdoor air temperature value is present (non-latching diagnostic). When the outdoor air temperature sensor fails or is not present, the controller prohibits economizer operation.
(d) Does not apply to the Tracer UC400 controller.

Common Diagnostics for Tracer ZN010, ZN510, or ZN520 Controllers

Table 57. Fan outputs do not energize (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Random start observed	After power-up, the controller always observes a random start that varies between 0 and 30 seconds. The controller remains off until the random start time expires.
Power-up control wait[a]	When power-up control wait is enabled (non-zero time), the controller remains off until one of two conditions occurs: 1. The controller exits power-up control wait once it receives communicated information. 2. The controller exits power-up control wait once the power-up control wait time expires.
Cycling fan operation	When the fan mode switch is in the auto position, the unit fan cycles off when there is no call for heating or cooling. The heating/cooling sources cycle on or off periodically with the unit fan to match the capacity according to pulse width modulation (PWM) logic.
Unoccupied operation	The fan cycles with capacity when the unit is in unoccupied mode. This occurs even if the unit is in continuous fan operation. While unoccupied, the fan cycles on or off with heating/cooling to provide varying amounts of heating or cooling to the space. to match the capacity diagnostics according to pulse-width-modulation (PWM) logic.
Fan mode off	When using the local fan mode switch to determine the fan operation, the off position controls the unit fan to off.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, and cool) to the controller. When “off” is communicated to the controller, the unit controls the fan to off. The unit is not capable of heating or cooling when the controller is in this mode.
Diagnostic present	A specific list of diagnostics affects fan operation. For more information, see Table 55 and Table 56, p. 92.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end devices, the valves may not work correctly.
Manual output test(a)	The controller includes a manual output test sequence to verify binary output operation and the associated wiring. However, based on the current step in the test sequence, the unit fan may not be powered on. Refer to “Manual Output Test,” page 89.
Unit wiring	The wiring between the controller outputs and the fan relays and contacts must be present and correct for normal fan operation. Refer to the specific unit wiring diagrams on the unit.

(a) Does not apply to the Tracer UC400 controller.

Table 58. Valves stay closed (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, and cool) to the controller. When off is communicated to the controller, the unit controls the fan to off. The unit is not capable of heating or cooling when the controller is in this mode.
Valve override	The controller can communicate a valve override request.This request affects the valve operation.
Manual output test	The controller includes a manual output test sequence to verify analog and binary output operation and the associated wiring. However, based on the current step in the test sequence, the valves may not be open. Refer to the "Manual Output Test," page 89.
Diagnostic present	A specific list of diagnostics affects valve operation. For more information, see Table 55 and Table 56, p. 92.
Sampling logic	The controller includes entering water temperature sampling logic that automatically invokes during 2-pipe or 4-pipe changeover. It determines when the entering water temperature is either too cool or too hot for the desired heating or cooling mode. Refer to "Entering Water Temperature Sampling Function," page 45.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the valves may not work correctly.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer ZN010, 510 controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to the unit wiring diagrams on the unit.

Table 59. Valves stay open (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Valve override	The controller can communicate a valve override request to affect the valve operation.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and the associated wiring. However, based on the current step in the test sequence, the valves may be open. Refer to the "Manual Output Test," page 89.
Diagnostic present	A specific list of diagnostics affects valve operation. For more information, see Table 55 and Table 56, p. 92.
Sampling logic	The controller includes entering water temperature sampling logic that automatically invokes during 2-pipe or 4-pipe changeover to determine if the entering water temperature is correct for the unit operating mode. Refer to "Entering Water Temperature Sampling Function," page 45.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the valves may not work correctly.
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to the unit wiring diagrams on the unit.

Table 60. Electric heat not operating (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Normal operation	The controller cycles electric heat on and off to meet the unit capacity requirements.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, cool) to the controller. When off is communicated to the controller, the units shuts off the electric heat.
Communicated disable	Numerous communicated requests may disable electric heat, including an auxiliary heat enable input and the heat/cool mode input. Depending on the state of the communicated request, the unit may disable electric heat.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated output wiring. However, based on the current step in the test sequence, the electric heat may not be on. Refer to the "Manual Output Test," page 89.
Diagnostic present	A specific list of diagnostics affects electric heat operation. For more information, see Table 55 and Table 56, p. 92.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the electric heat may not work properly.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer ZN010, 510 controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring	The wiring between the controller outputs and the electric heat contacts must be present and correct for normal electric heat operation. Refer to the unit wiring diagrams on the unit.

TRANE

Troubleshooting

Table 61. Fresh air damper stays closed (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Warm-up and cool-down	The controller includes both a warm-up and cool-down sequence to keep the fresh air damper closed during the transition from unoccupied to occupied. This is an attempt to bring the space under control as quickly as possible.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, cool) to the controller. When off is communicated to the controller, the unit closes the fresh air damper.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated output wiring. However, based on the current step in the test sequence, the fresh air damper may not be open. Refer to the "Manual Output Test," page 89.
Diagnostic present	A specific list of diagnostics effects fresh air damper operation. For more information, see Table 55 and Table 56, p. 92.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the damper may not work correctly.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer ZN010, 510 controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring	The wiring between the controller outputs and the fresh air damper must be present and correct for normal damper operation. Refer to the unit wiring diagrams on the unit.

Table 62. Fresh air damper stays open (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Normal operation	The controller opens and closes the fresh air damper based on the controller's occupancy mode and fan status. Normally, the fresh air damper is open during occupied mode when the fan is running and closed during unoccupied mode.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated wiring. However, based on the current step in the test sequence, the fresh air damper may be open. Refer to the "Manual Output Test," page 89.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the damper may not work correctly.
Unit wiring	The wiring between the controller outputs and the fresh air damper must be present and correct for normal damper operation. Refer to the unit wiring diagrams on the unit.

Table 63. Valves stay closed (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Requested mode off	You can communicate a desired operating mode (such as off, heat, and cool) to the controller. When off is communicated to the controller, the unit controls the fan off. There is no heating or cooling (valves are closed).
Power-up control wait	When power up control wait is enabled (non-zero time), the controller remains off until one of two conditions occurs: The controller exits power up control wait once it receives communicated information. The controller exits power up control wait once the power up control wait time expires.
Manual output test	The controller includes a manual output test sequence you can use to verify output operation and associated output wiring. However, based on the current step in the test sequence, the valve(s) may not be open. Refer to the "Manual Output Test," page 89.
Fan mode off	When a local fan mode switch (provided on the Trane zone sensor) determines the fan operation, the off position controls the unit off and valves to close.
Sampling logic	The controller includes entering water temperature sampling logic which is automatically invoked during 2-pipe and 4-pipe changeover when the entering water temperature is either too cool or too hot for the desired heating or cooling. Refer to "Entering Water Temperature Sampling Function," page 45.
Diagnostic present	A specific list of diagnostic affects valve operation. For more information, see Table 55 and Table 56, p. 92.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end devices, the valves may not work correctly. Example: A 2-pipe heat/cool changeover unit will not cool if the entering water temperature is too warm for cooling or if the entering water sensor is not present. The unit will not heat if the entering water temperature is too cool for heating.
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation.
Random start observed	After power up, the controller always observes a random start from 0 to 25 seconds. The controller remains off until the random start time expires.

Table 64. DX or electric outputs do not energize (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the end devices must be present and correct for normal operation.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end devices, the unit may not work correctly.
Diagnostic present	A specific list of diagnostic affects valve operation. For more information, see Table 55 and Table 56, p. 92.
Manual output test	The controller includes a manual output test sequence you can use to verify output operation and associated output wiring. However, based on the current step in the test sequence, the valve(s) may not be open. Refer to the "Manual Output Test," page 89.
Freeze avoidance	When the fan is off with no demand for capacity (0%) and the outdoor air temperature is below is below the freeze avoidance setpoint, the controller disables compressors and electric heat outputs. This includes unoccupied mode when there is no call for capacity or any other time the fan is off.
Normal operation	The controller energizes the outputs only as needed to meet the unit capacity requirements.

Diagnostics for Tracer UC400 Controller

Diagnostics are informational messages that indicate the operational status of the controller. In response to most diagnostics, the controller attempts to protect the equipment by enabling or disabling, or opening or closing, specific outputs. Other diagnostics provide information about the status of the controller, but have no effect on outputs. Multiple diagnostics can be present simultaneously. Diagnostic messages are viewed using the Tracer TU service tool or through a BAS.

Note: Tracer TU reports only active diagnostics.

Types of Diagnostics

Tracer UC400 Controller

Diagnostics are categorized according to the type of clearing method each uses and the type of information each provides.

The four categories are:

- Manual (latching) diagnostics
- Automatic (non-latching) diagnostics
- Smart reset diagnostics
- Informational diagnostics

Note: Clearing diagnostics refers to deleting diagnostics from the software; it does not affect the problem that generated the message. For help with diagnosing a problem, refer to the section, Table 65, p. 96.

Manual (Latching) Diagnostics

Manual diagnostics (also referred to as *latching*) cause the unit to shut down. Manual diagnostics can be cleared from the controller in one of the following ways:

- By using the Tracer TU service tool, latching diagnostics can be reset on the Alarms Status page or by temporarily overriding the Reset Diagnostic Request (bv/2) on the Binary Status page.
- Through a building automation system.
- By cycling power to the controller. When the 24 Vac power to the controller is cycled off and then on again, a power-up sequence occurs.

Automatic (Non-latching) Diagnostics

Automatic diagnostics clear automatically when the problem that generated the diagnostic is solved.

Smart Reset Diagnostics

Smart Reset Diagnostics are latching diagnostics that will auto-recover if the condition is corrected. After the controller detects the first smart reset diagnostic, the unit waits 30 minutes before initiating the smart reset function. If another diagnostic of this type occurs again within 24 hours after an automatic clearing, you must clear the diagnostic manually by using any of the ways shown for "Manual (Latching) Diagnostics."

Informational Diagnostics

Informational diagnostics provide information about the status of the controller. They do not affect machine operation. They can be cleared from the controller using the BAS or Tracer SC.

Table of Diagnostics

Tracer UC400 Controller

Table 65, p. 96 presents each diagnostic that can be generated by the Tracer UC400, its effect on outputs (consequences), and its type.

Note: The generic binary output is unaffected by diagnostics.

TRANE

Troubleshooting

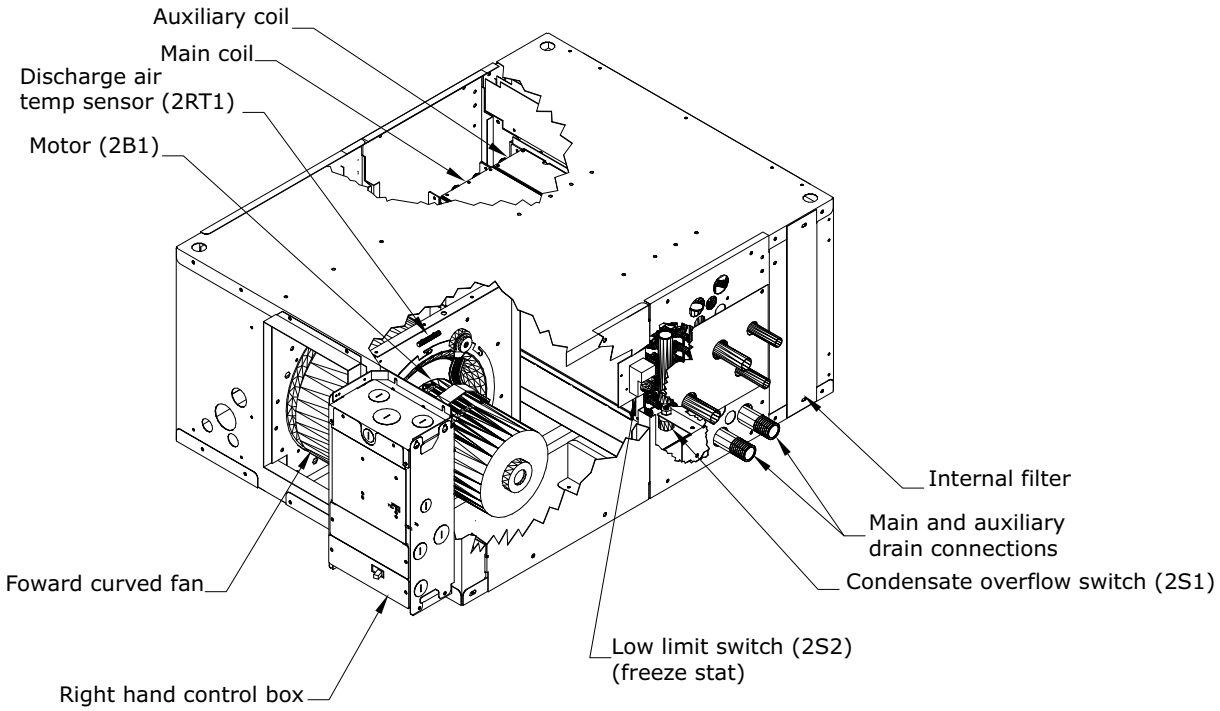
Table 65. Diagnostics (Tracer UC400 controller)

Diagnostic	Probable Cause	Consequences	Diagnostic Type
Filter change required	Fan run hours exceed the time set to indicate filter change	• Fan **unaffected** • Valves **unaffected** • Electric heat **unaffected**	Informational
Condensate overflow	The drain pan is full of water	• Fan **off** • Valves **closed** • Outdoor air damper **closed** • DX/electric heat **off**	Manual
Low coil temp detection	The leaving fluid temperature may be close to freezing	• Fan **off** • Valves **open** • Outdoor air damper **closed** • DX/electric heat **off**	Smart reset/Manual
Low airflow supply fan failure	The fan drive belt, contactor, or motor has failed.	• Fan **off** • Valves **closed** • Outdoor air damper **closed** • DX/electric heat **off**	Manual
Space temperature failure	Invalid or missing value for zone temperature	• Fan **off** • Valves **closed** • Outdoor air damper **closed** • DX/electric heat **off**	Automatic
Entering water temp failure	Invalid or missing value for zone temperature	• Fan **unaffected** (enabled) • Valves **unaffected** • Outdoor air damper **unaffected** • DX/electric heat **unaffected**	Automatic
Discharge air temp low limit	Discharge air temperature has fallen below the Discharge Air Temperature Low Limit	• Fan **off** • Valves **open** • Outdoor air damper **closed** • DX/electric heat **off**	Smart reset/manual
Discharge air temp failure	Invalid or missing value for discharge air temperature	• Fan **off** • Valves **closed** • Outdoor air damper **closed** • DX cooling/electric heat **off**	Automatic
Outdoor air temp failure	Invalid or missing value for outdoor air temperature	• Fan **unaffected** • Valved **unaffected** • Outdoor air damper **minimum position** • DX cooling/electric heat **unaffected**	Automatic
CO_2 sensor failure	Invalid or missing value for CO_2	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Informational
Generic AIP failure(a)	Invalid or missing value for generic analog input	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Informational
Local fan mode failure	Invalid or missing fan-speed switch (reverts to default fan speed)	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Automatic
Local setpoint failure	Invalid or missing value for zone temperature setpoint (reverts to default setpoint)	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Automatic
Generic temperature failure(a)	Invalid or missing generic temperature value	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Informational

(a) Alarm conditions must be manually configured.

Layout and Control Box Diagrams

Table 66. Right-hand control box with motor, condensate overflow, low-limit switch, outside air temp, fan stat, discharge air temp, and humidity sensor

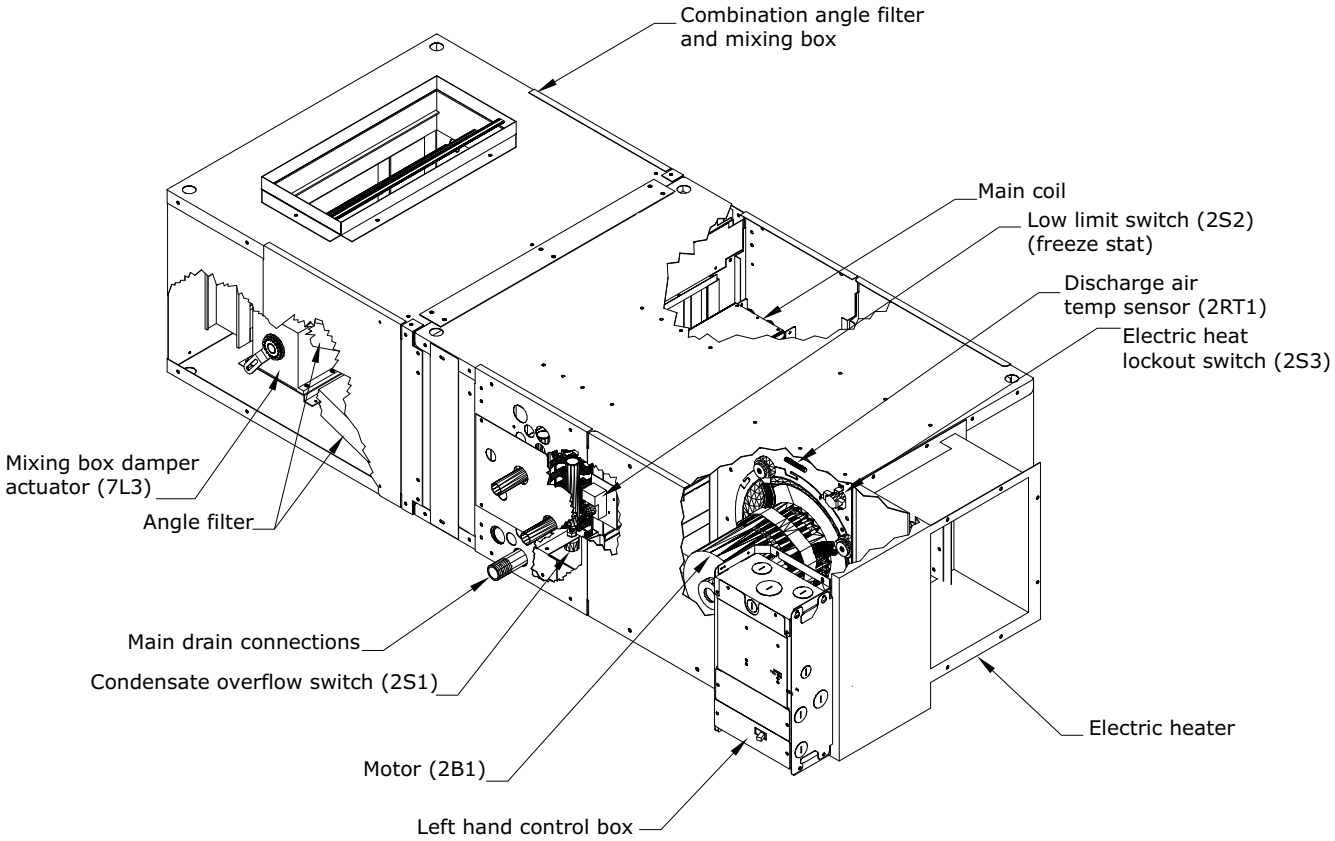


Outside air temp sensor remote mounted in outside air ductwork
Humidity sensor remote mounted on wall

TRANE

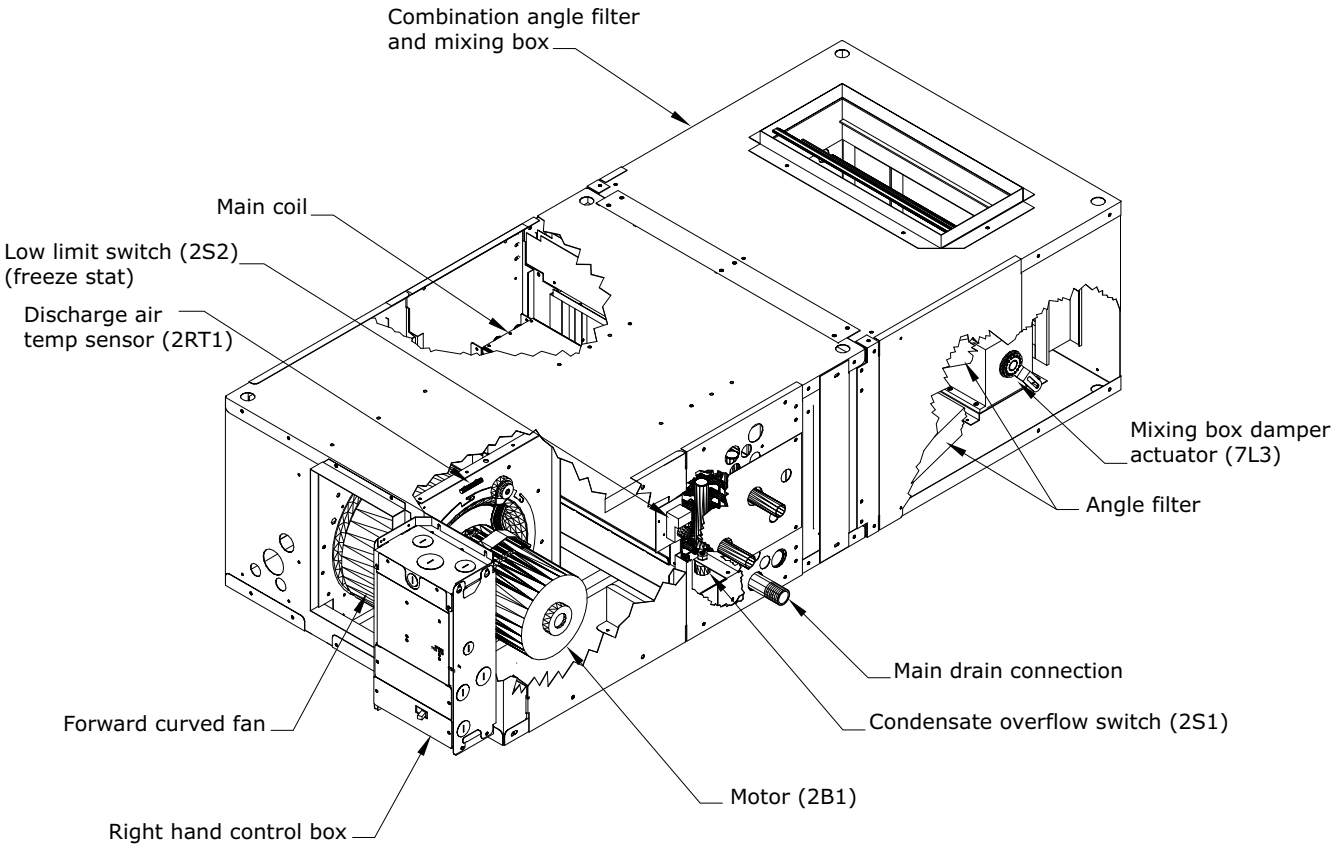
Layout and Control Box Diagrams

Table 67. Left-hand control box with motor, electric heat, condensate overflow, low-limit switch, outside air temp, discharge air temp, and angle filter/mixing box actuator



Outside air sensor located in outside air ductwork
Discharge air temp sensor field installed in ductwork

Table 68. Right-hand control box with motor, condensate overflow, low-limit switch, outside air temp, angle filter/ mixing box actuator, and discharge air temp



Layout and Control Box Diagrams

Table 69. Left-hand control box with motor, condensate overflow, low-limit switch, outside air temp, and discharge air temp

Outside air sensor located in outside air ductwork

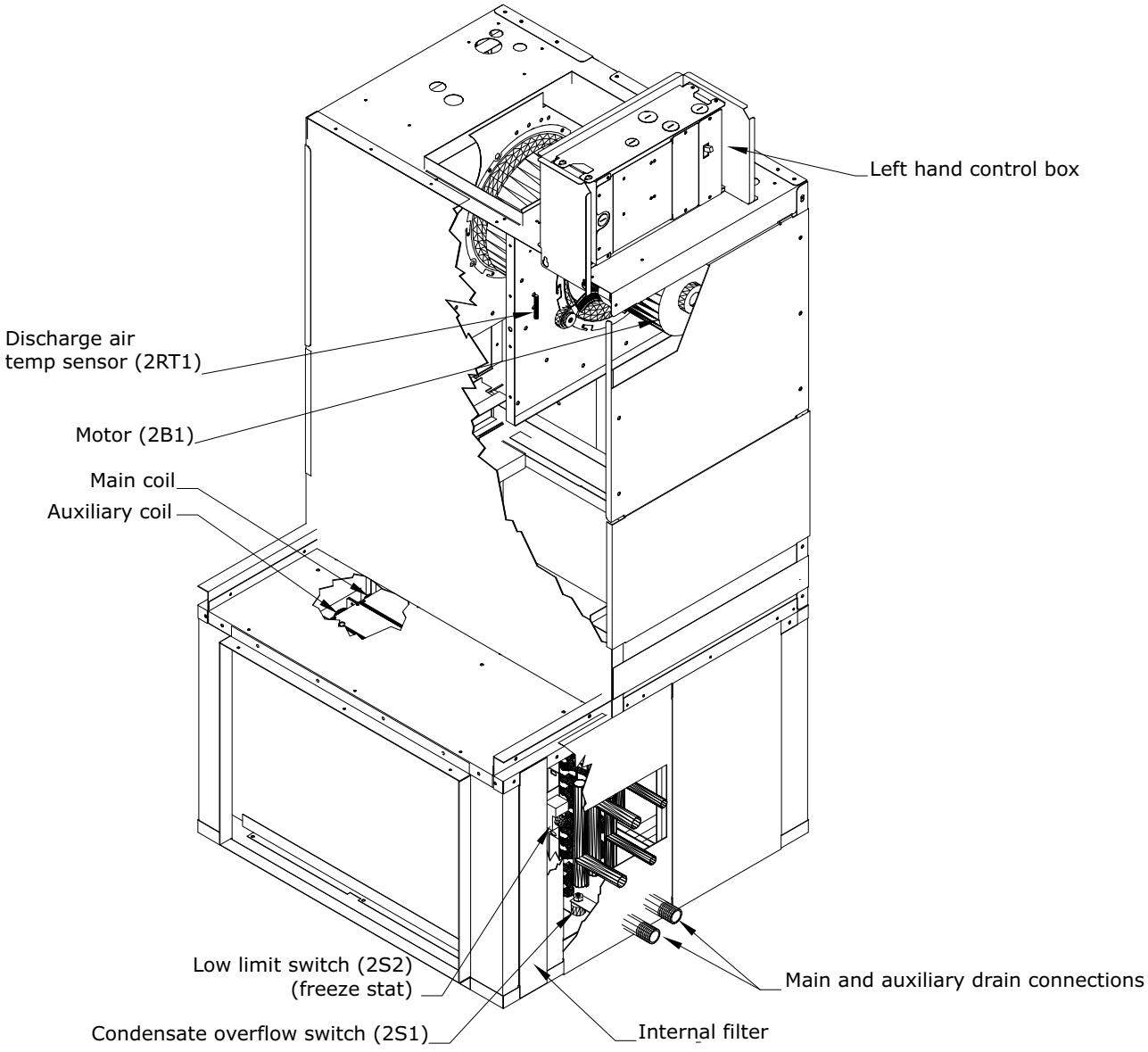
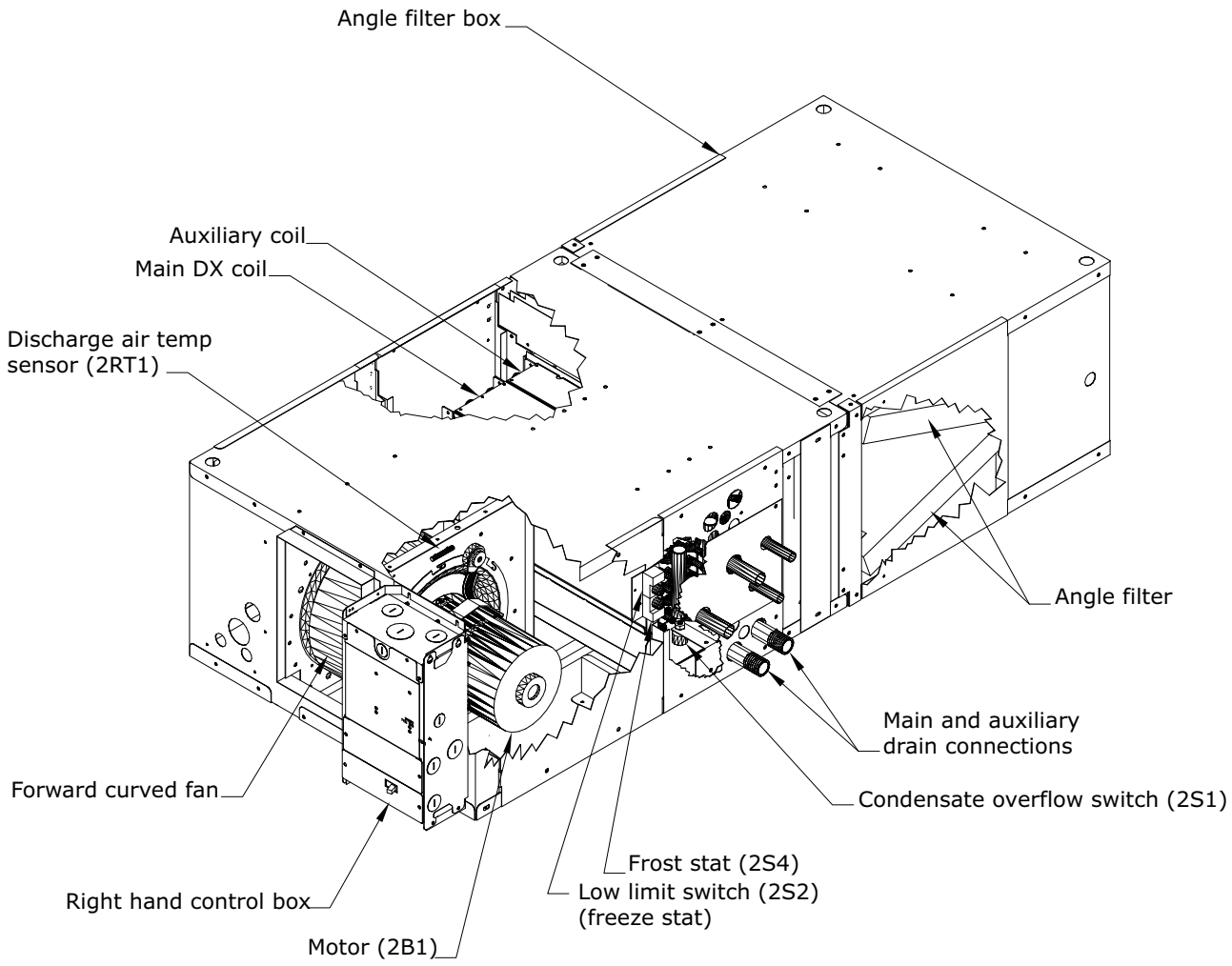


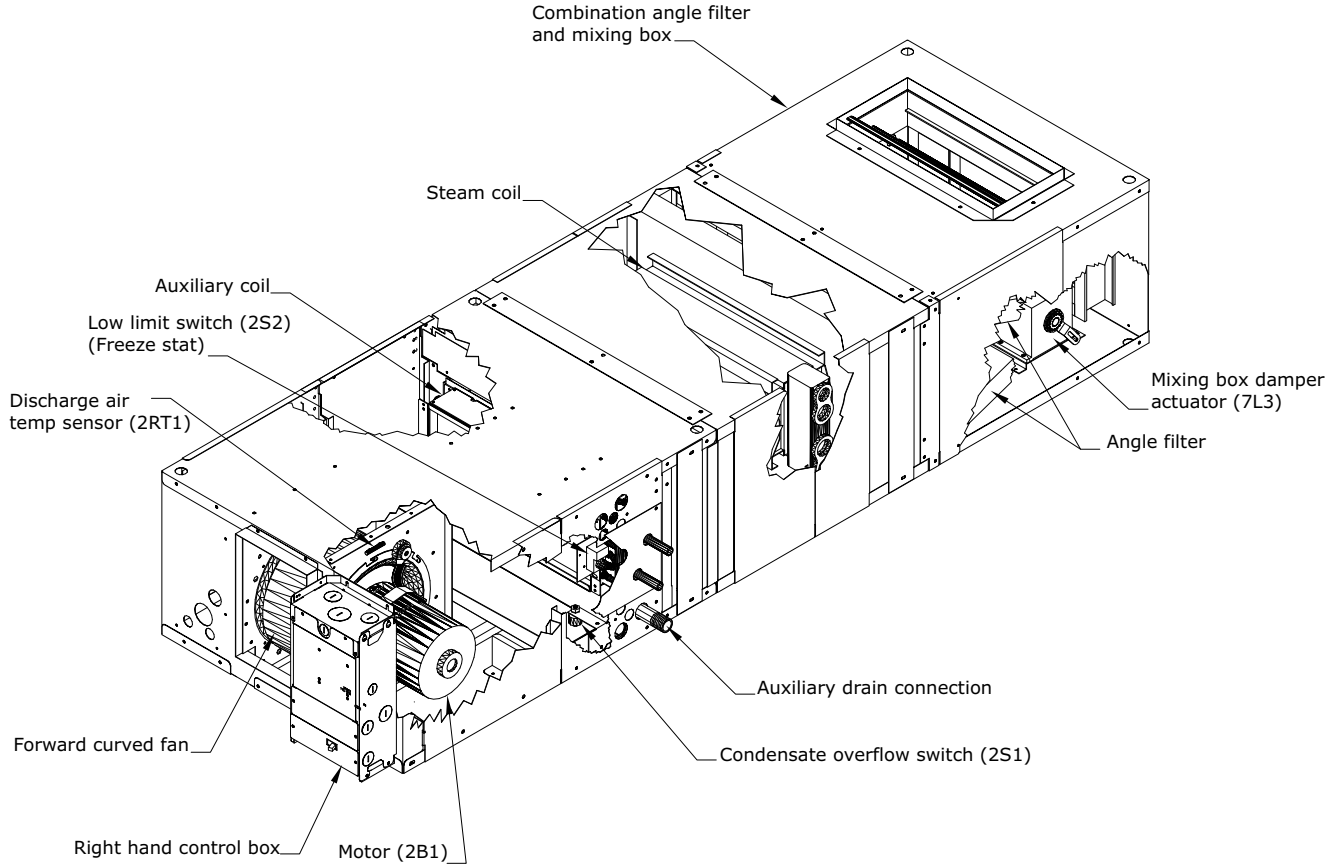
Table 70. Right-hand control box with motor, low-limit switch, froststat, outside air temp, angle filter section, and discharge air temp



Outside air temp sensor remote mounted in outside air ductwork

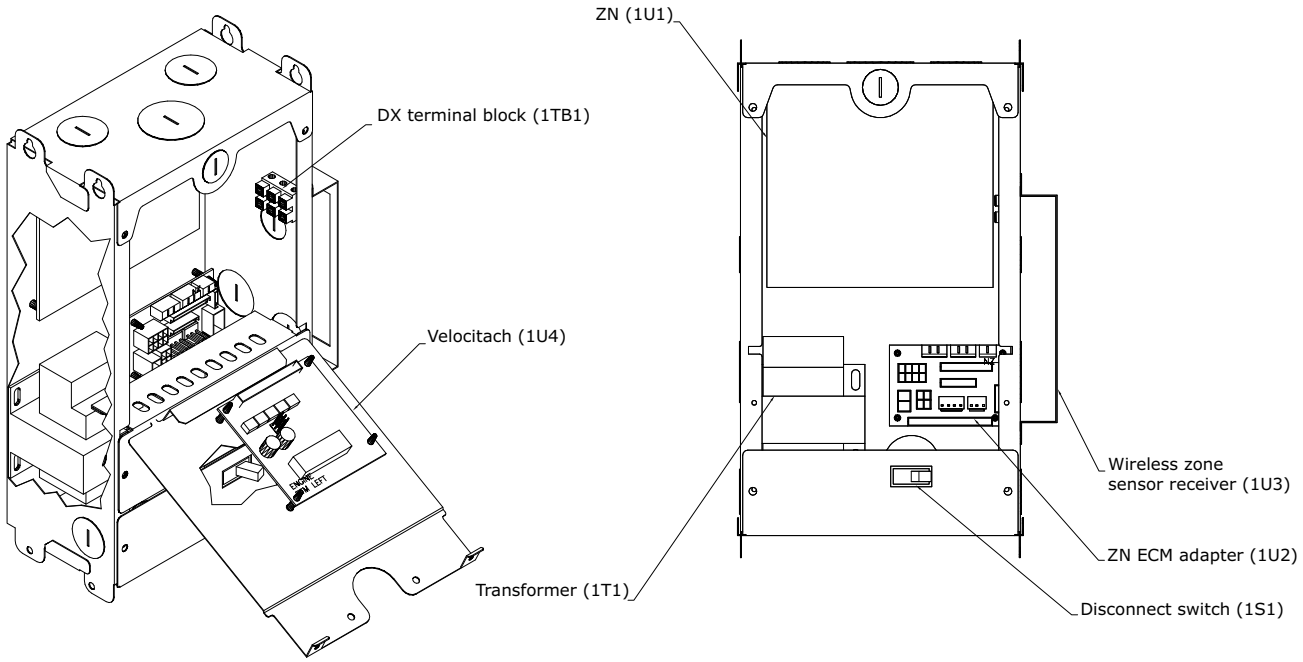
Layout and Control Box Diagrams

Table 71. Right-hand control box with motor, two-pipe cooling coil with modulating 2-way control valve, steam coil module with field-supplied 2-position valve/angle filter box/mixing box and actuator, low-limit switch, outside air temp, fan stat, and discharge air temp



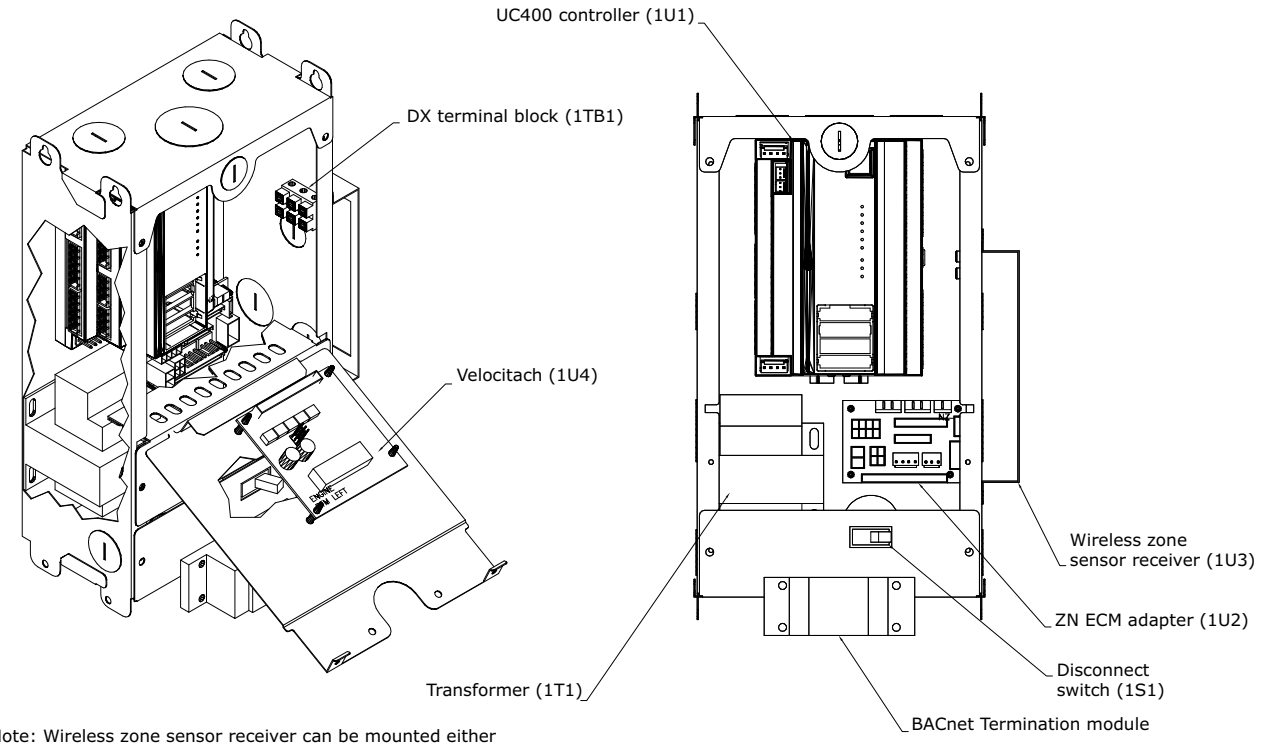
Outside air sensor located in outside air ductwork

Table 72. Control box for Tracer ZN010/ZN510/ZN 520, DX coil, wireless zone sensor



Note: Wireless zone sensor receiver can be mounted either left hand or right hand depending on unit arrangment.

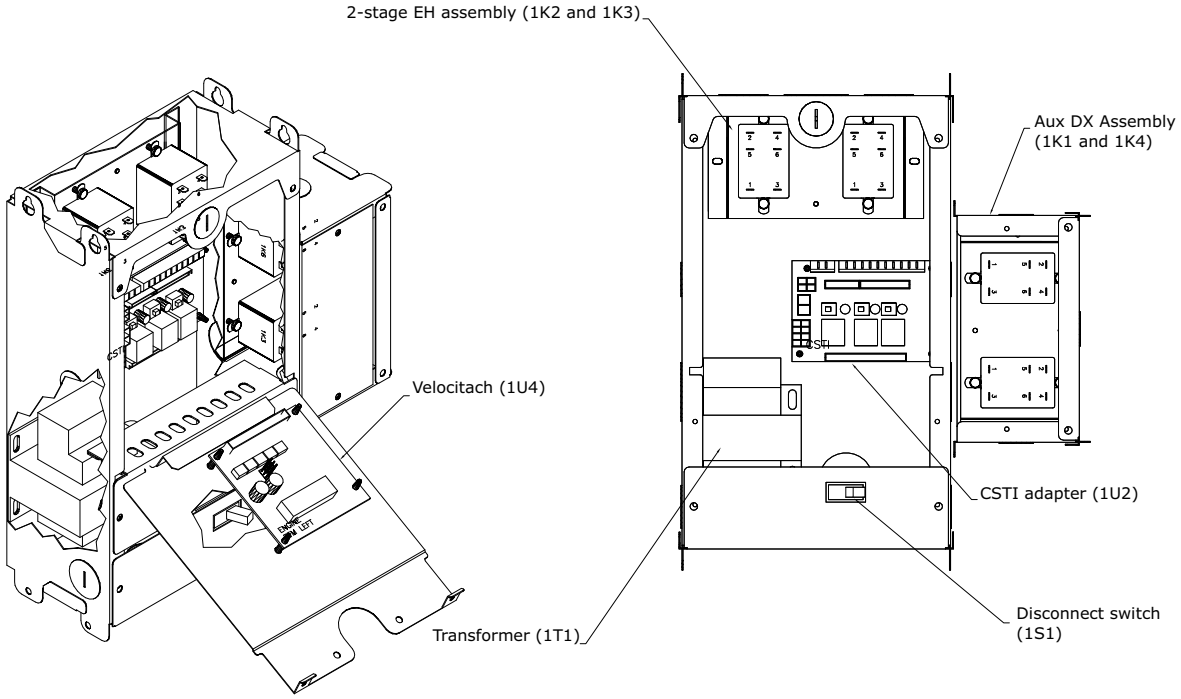
Table 73. Control box for Tracer UC400 with wireless zone sensor, BACnet termination



Note: Wireless zone sensor receiver can be mounted either left hand or right hand depending on unit arrangment.

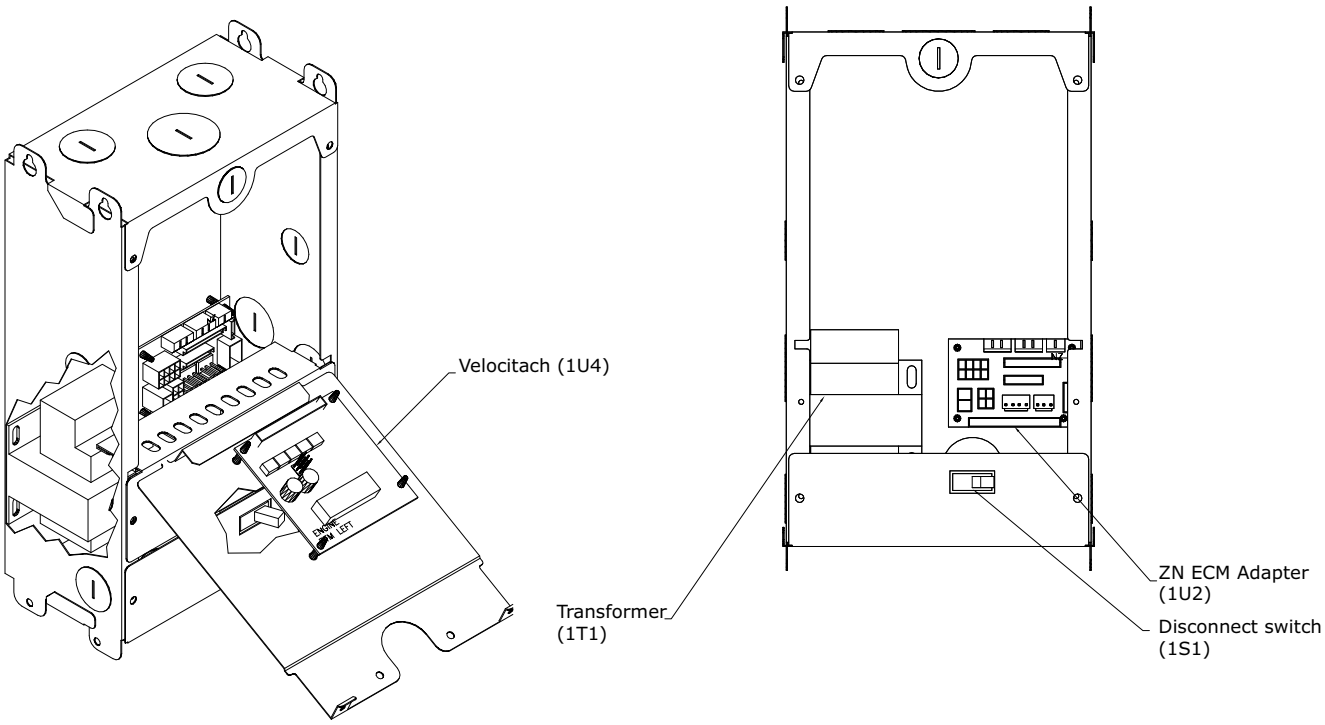
Layout and Control Box Diagrams

Table 74. Control box for CSTI with 2-stage EH and DX coil



Note: Aux DX assembly can be mounted either left hand or right hand depending on unit arrangment.

Table 75. Control box for FSS

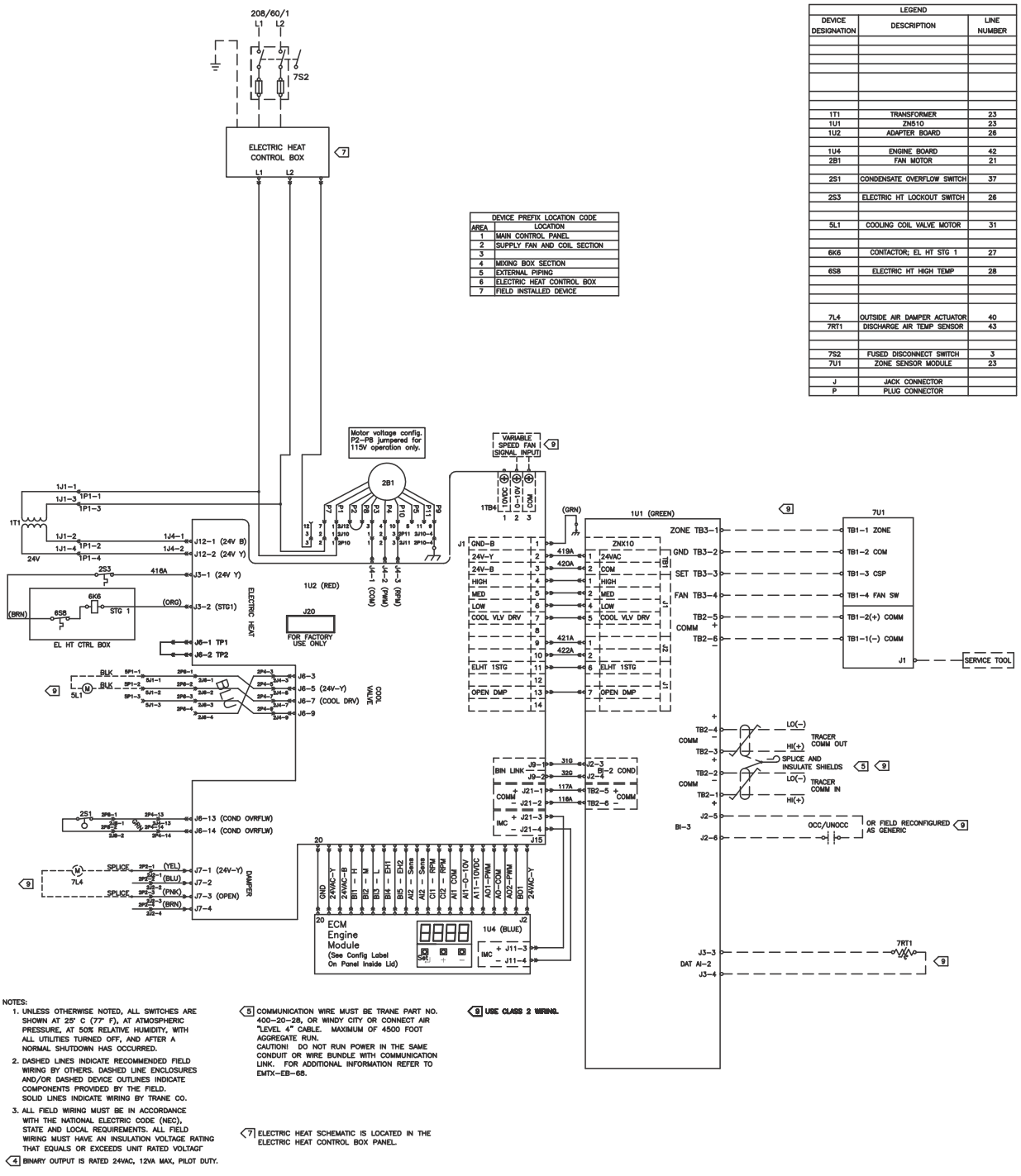


Wiring Diagrams

Two-Pipe BCXD with Tracer ZN510

- 208 volt/3-phase
- 2-position damper
- Single-state electric heat
- Condensate overflow
- Wall-mounted zone sensor

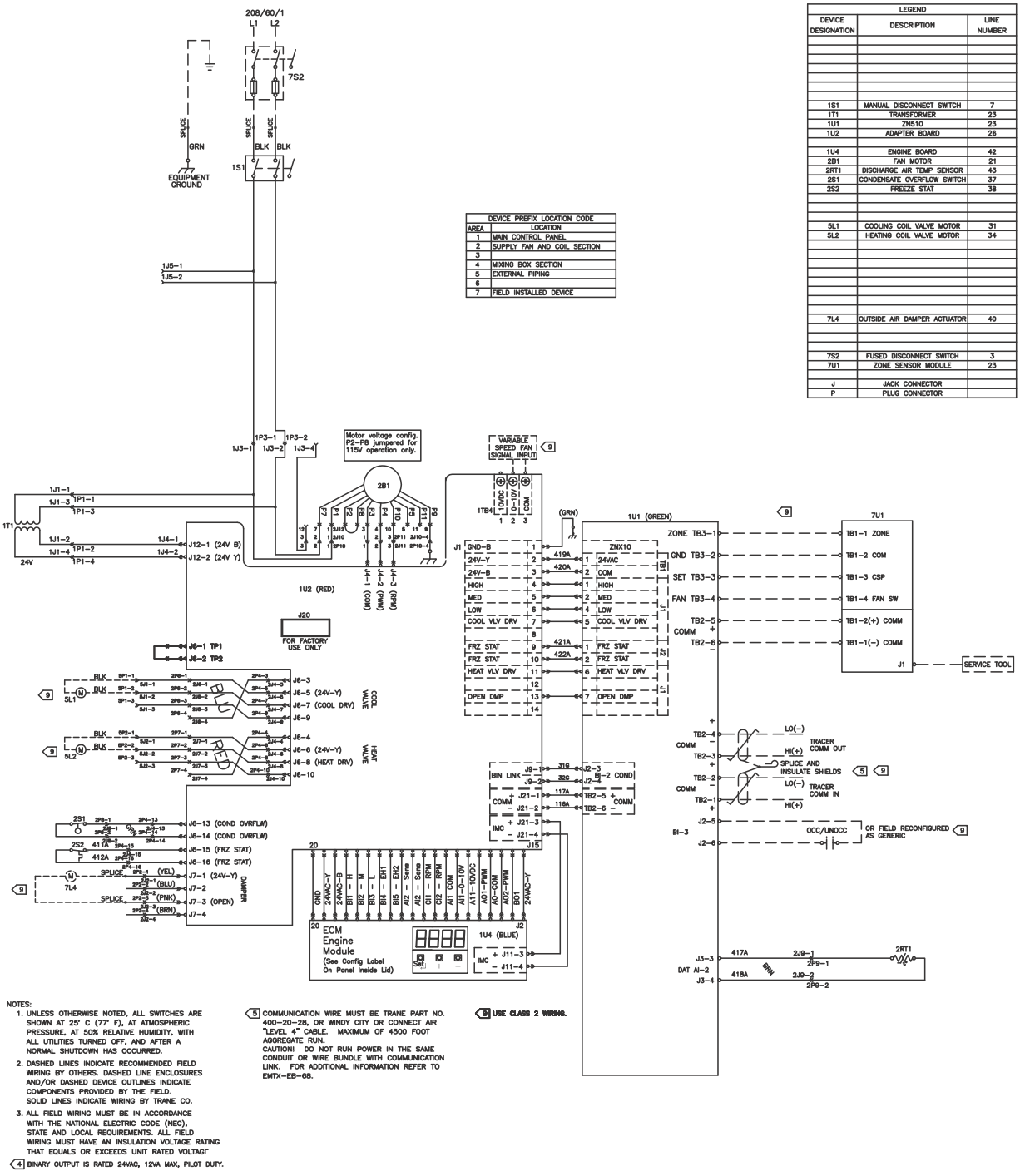
Figure 61. Two-pipe BCXD with Tracer ZN510



Four-Pipe BCXD with Tracer ZN510

- 208 volt/3-phase
- 2-position valves
- 2-position damper
- Condensate overflow
- Low-limit protection
- Wall-mounted zone sensor

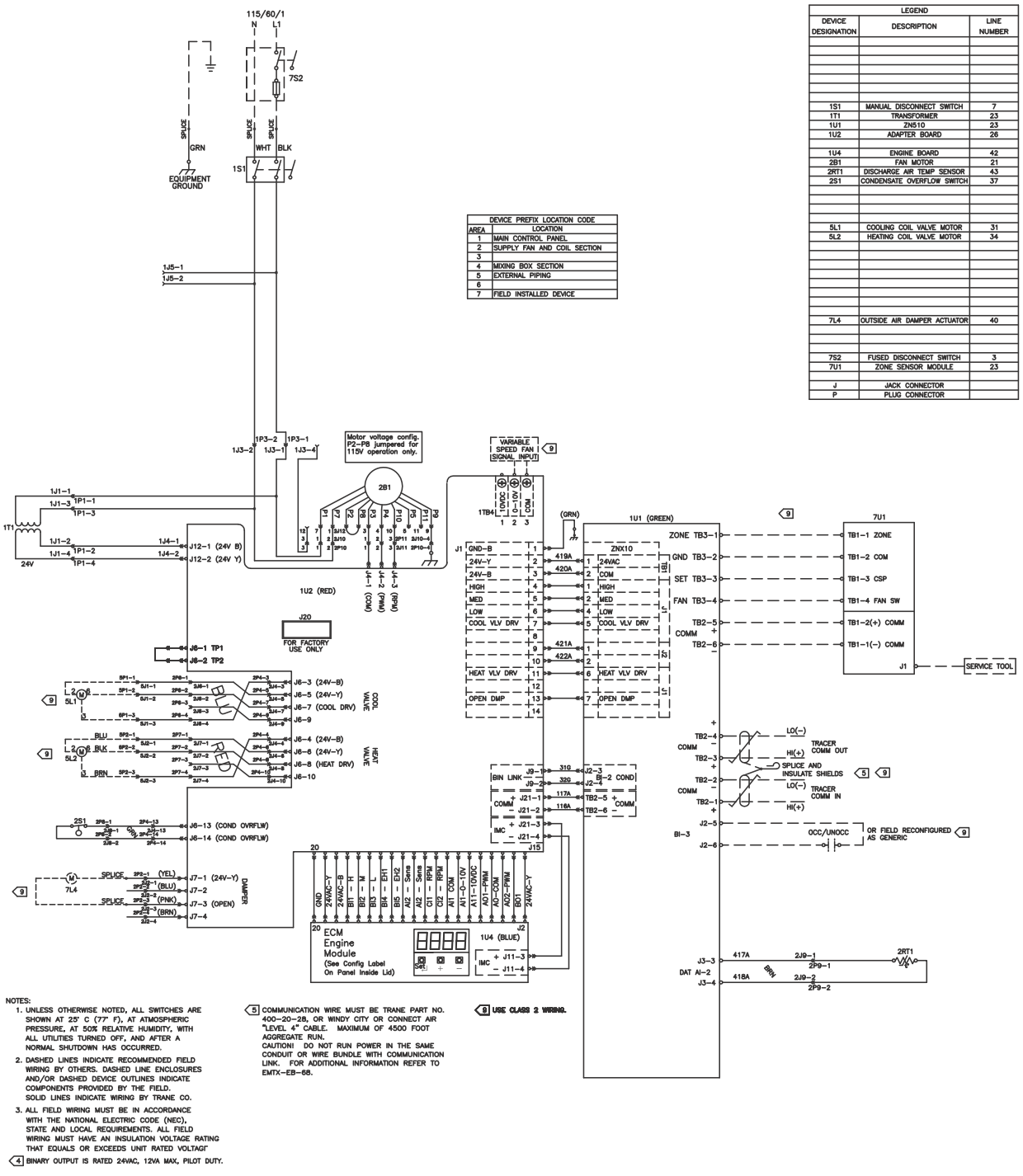
Figure 62. Four-pipe BCXD with Tracer ZN510



Four-Pipe BCXD with Tracer ZN510

- 115 volt/1-phase
- 2-position valves
- 2-position damper
- 2-speed motor
- Condensate overflow

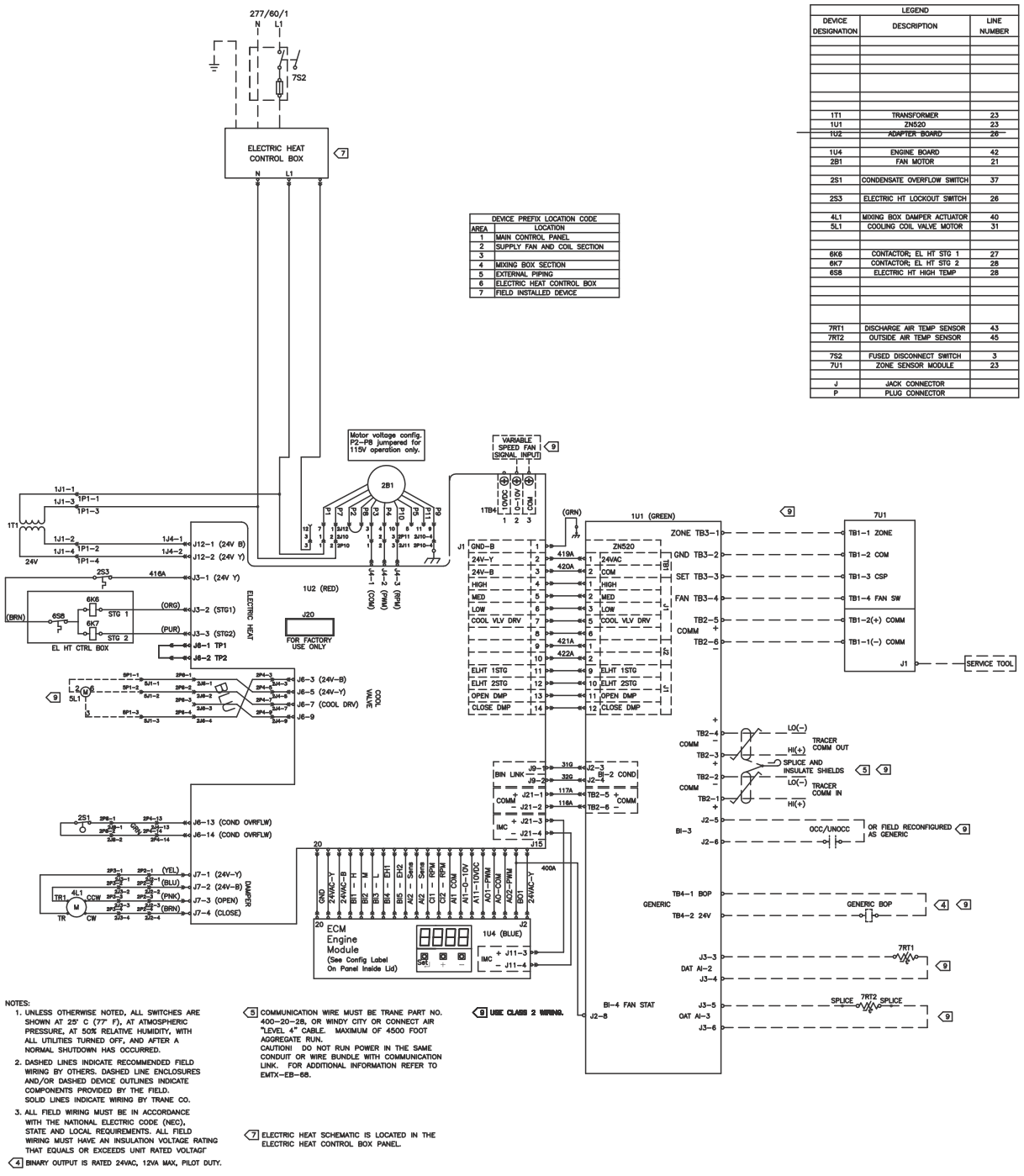
Figure 63. Four-pipe BCXD with Tracer ZN510



Two-Pipe BCXD with Tracer ZN520

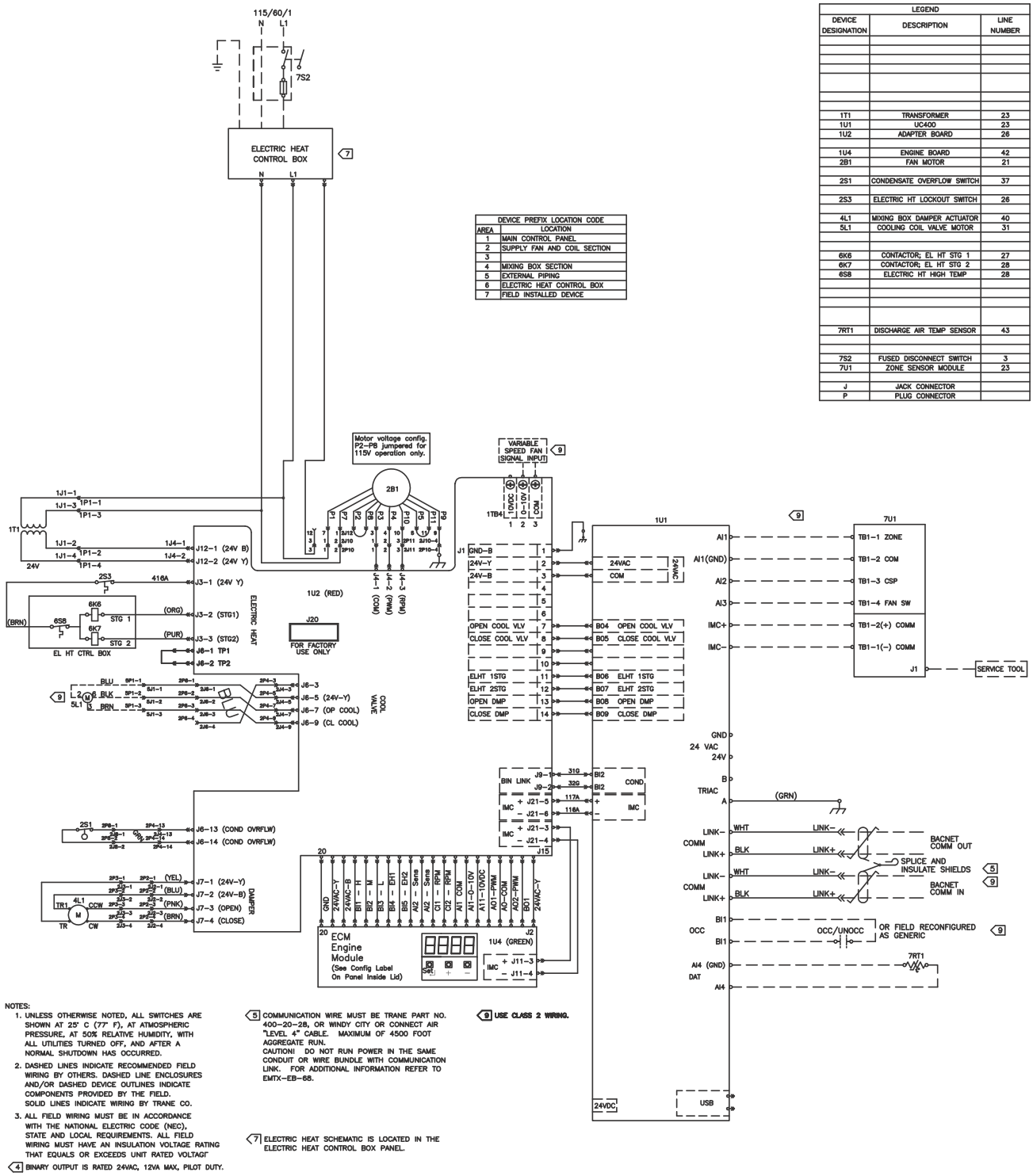
- 460 volt/3-phase
- 2-position valves
- Economizer damper
- 2-stage electric heat
- Fan status switch
- Condensate overflow
- Wall-mounted zone sensor

Figure 64. Two-pipe BCXD with Tracer ZN520



Two-Pipe BCXD with Tracer UC400

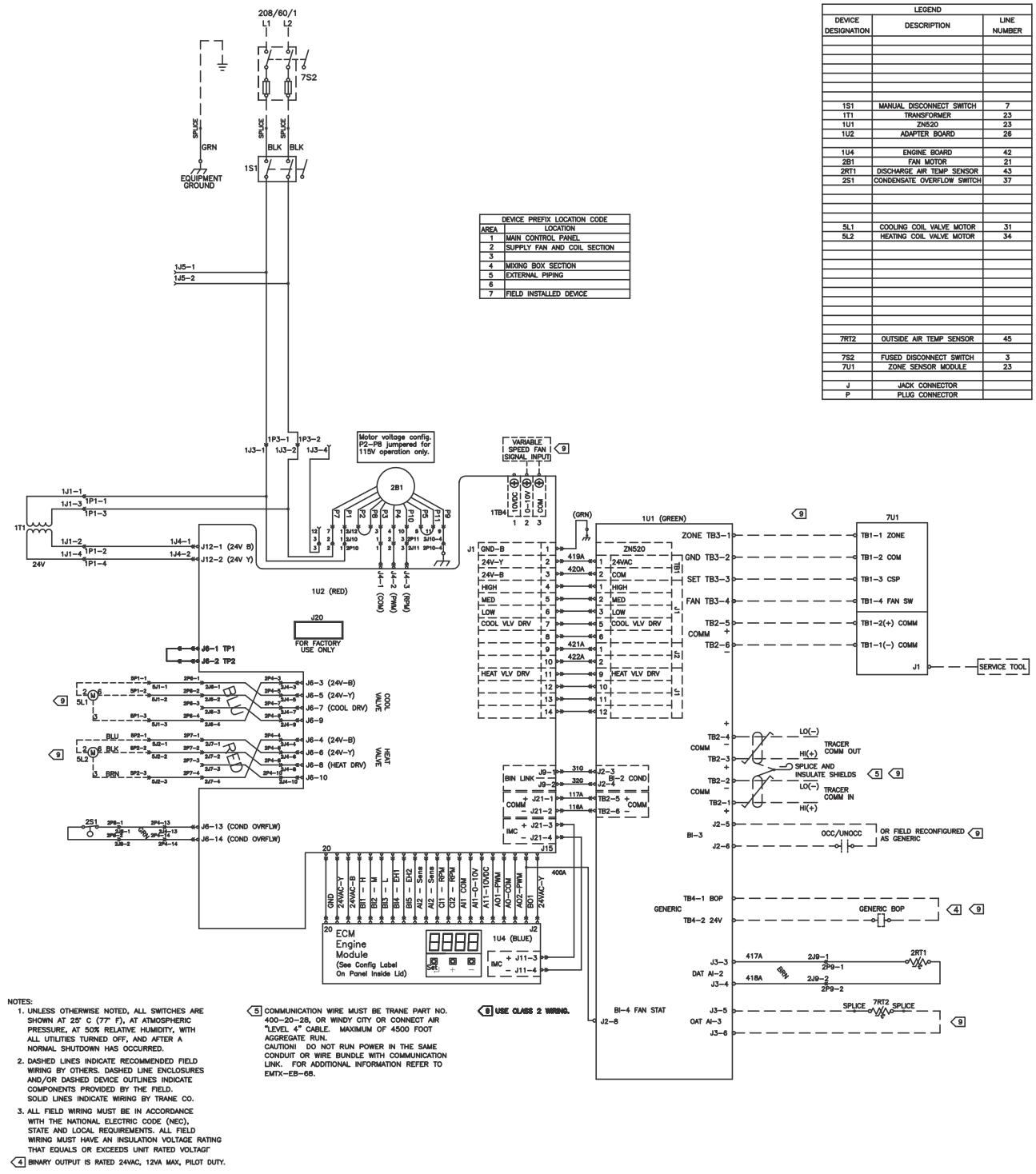
Figure 65. Two-pipe BCXD with Tracer UC400



Four-Pipe BCXD with Tracer ZN520

- 460 volt/3-phase
- 2-position valves
- Fan status switch
- Condensate overflow

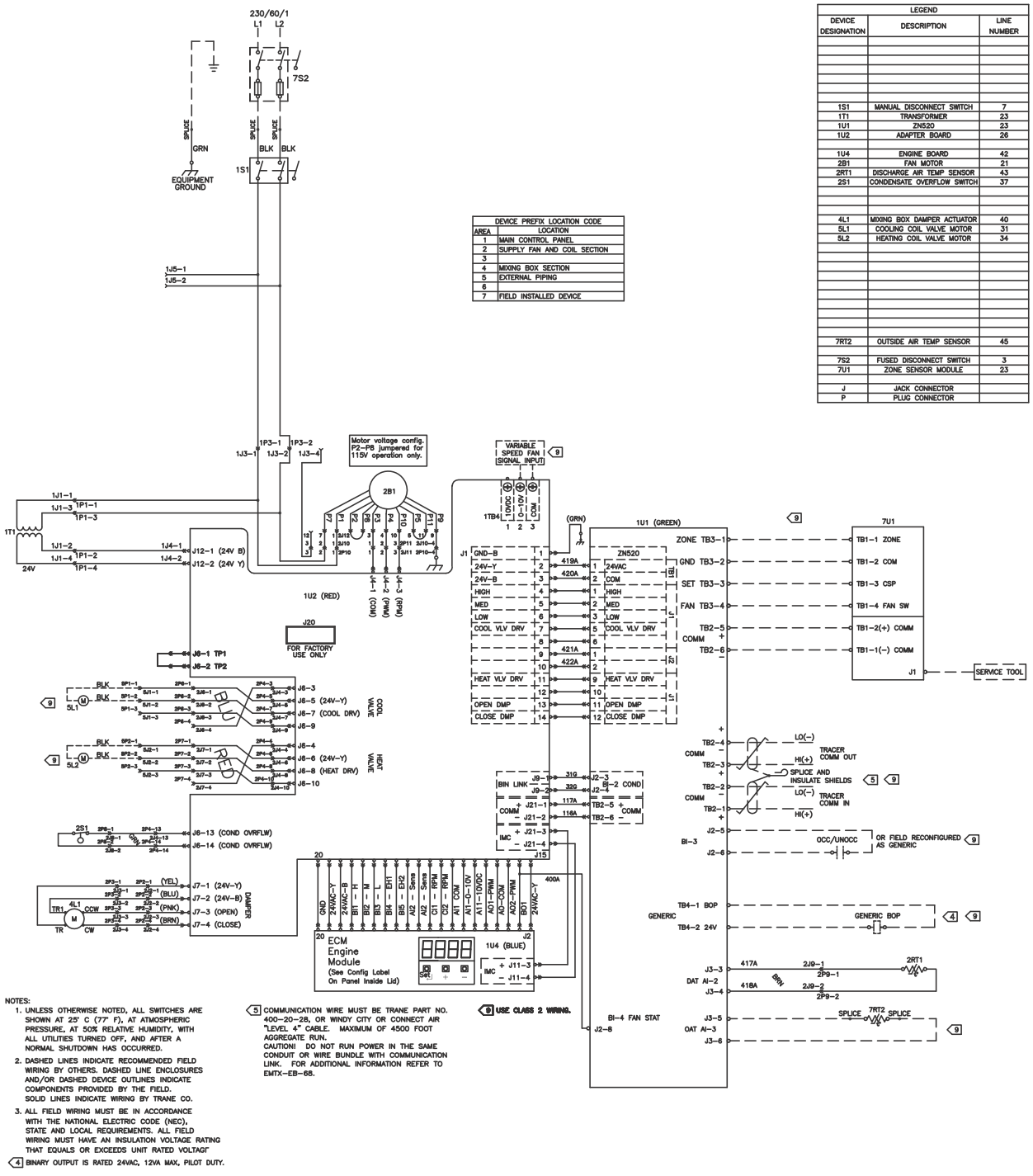
Figure 66. Four-pipe BCXD with Tracer ZN520



Four-Pipe BCXD with Tracer ZN520

- 460 volt/3-phase
- Economizer damper
- Fan status switch
- Condensate overflow
- Wall-mounted zone sensor

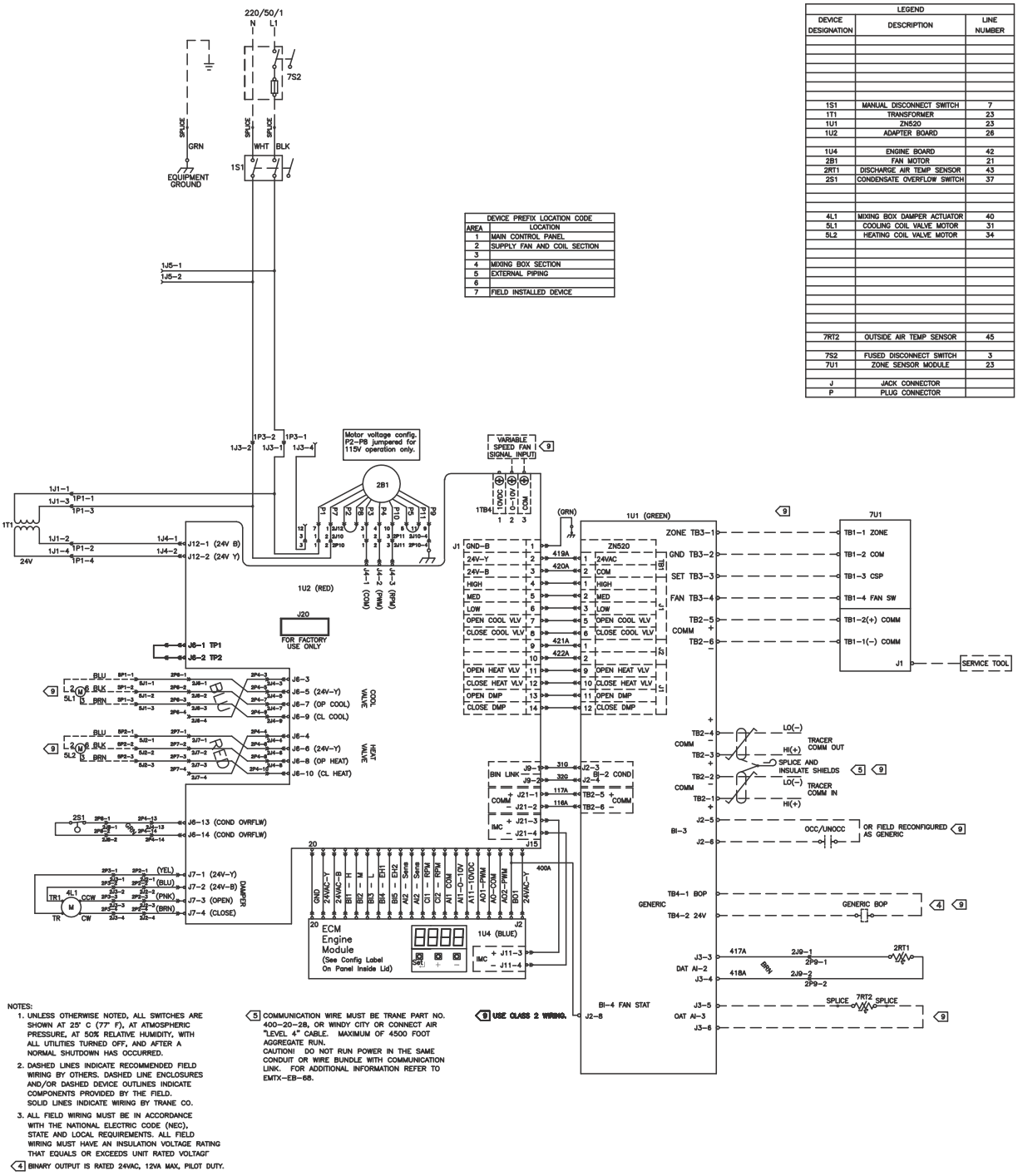
Figure 67. Four-pipe BCXD with Tracer ZN520



Four-Pipe BCXD with Tracer ZN520

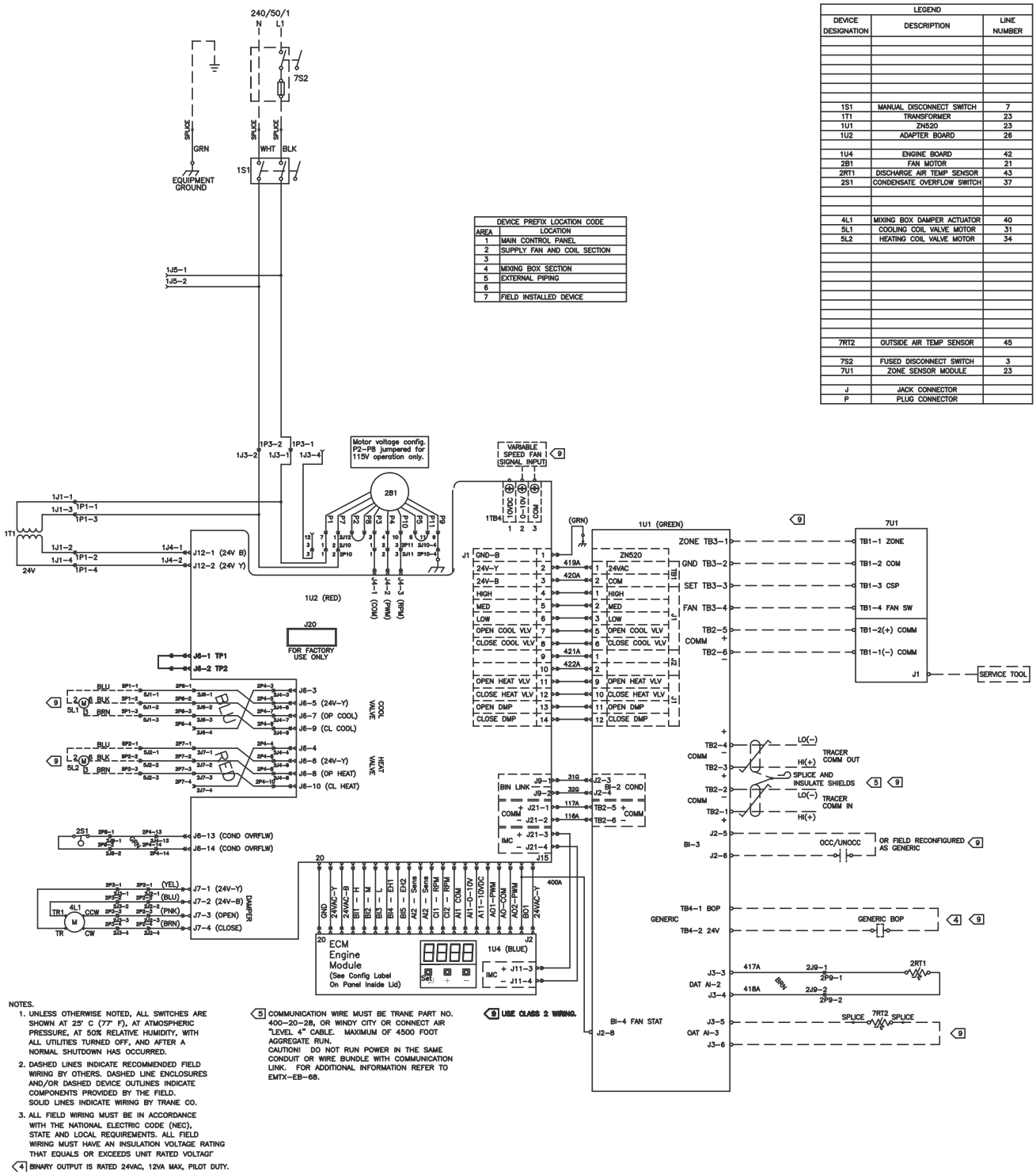
- 460 volt/3-phase
- 3-wire floating point valves
- Economizer damper
- Fan status switch
- Condensate overflow
- Wall-mounted zone sensor

Figure 68. Four-pipe BCXD with Tracer ZN520



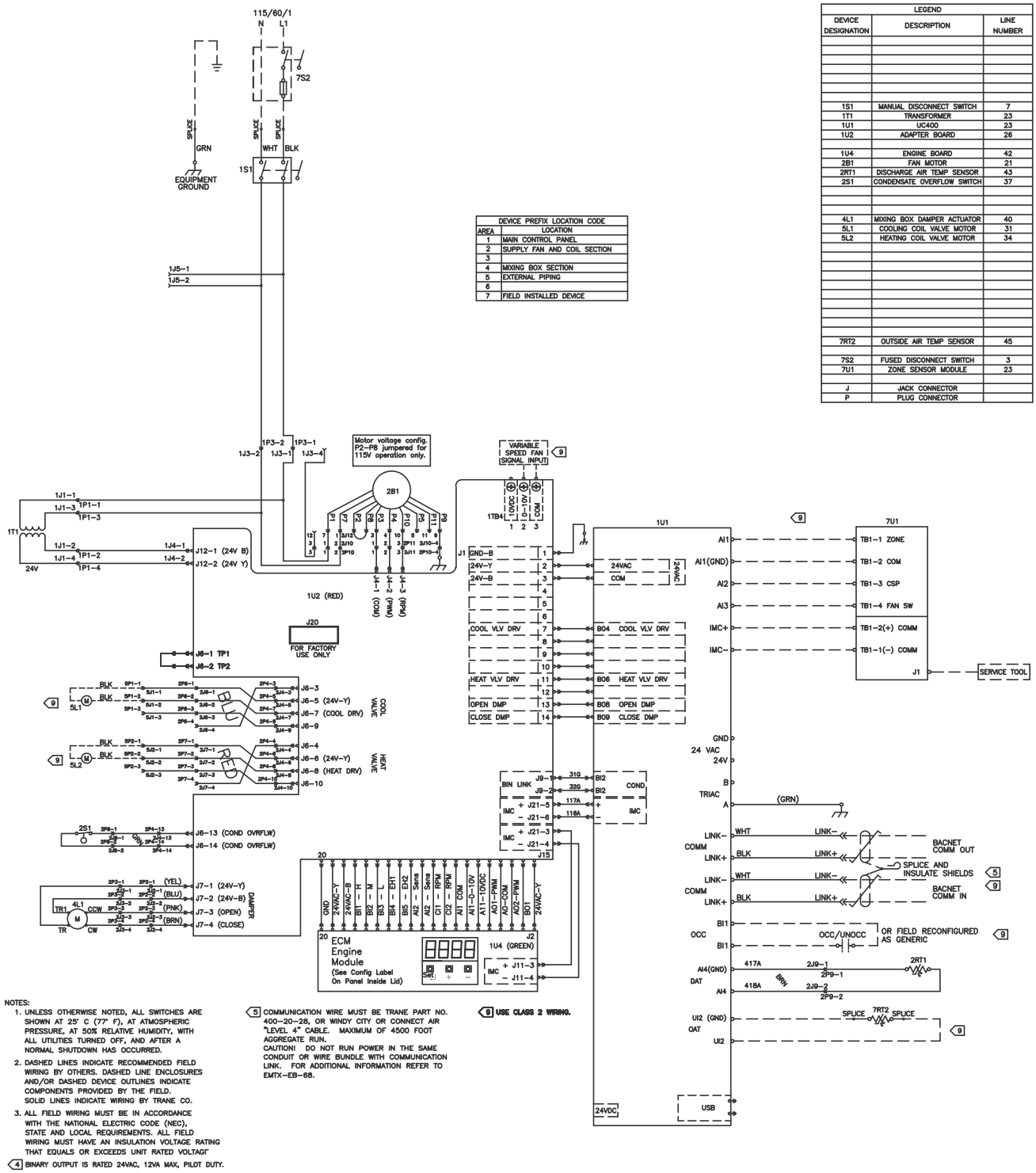
Four-Pipe BCXD with Tracer UC400

Figure 69. Four-pipe BCXD with Tracer UC400



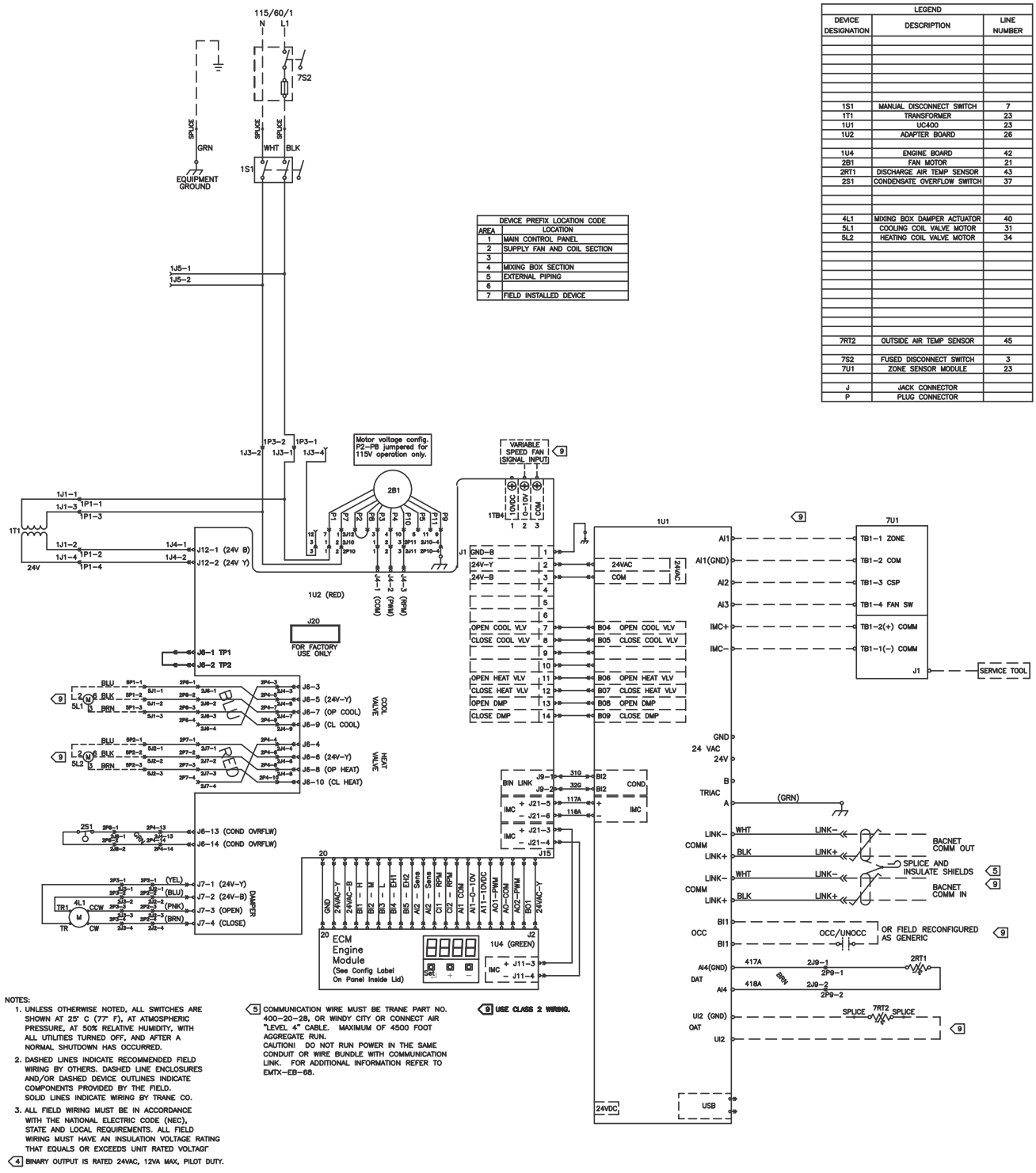
Four-Pipe BCXD with Tracer UC400 and Wall-Mounted Sensor

Figure 70. Four-pipe BCXD with Tracer UC400 and Wall-Mounted Sensor



Four-Pipe BCXD with Tracer UC400 and Modulating Valves

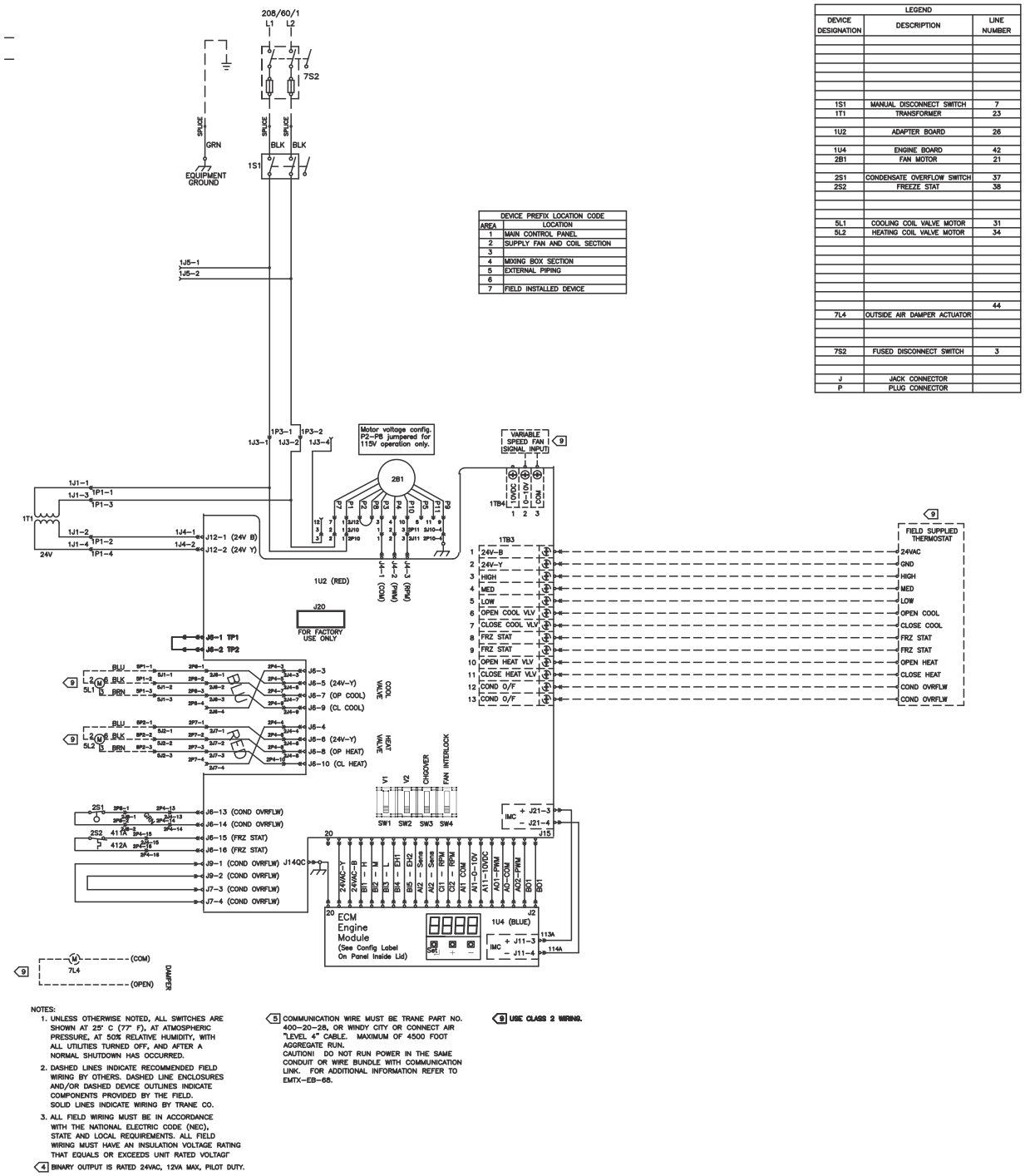
Figure 71. Four-pipe BCXD with Tracer UC400 and Modulating Valves



Four-Pipe BCXD with Control Interface

- 208 volt/3-phase
- 3-wire floating point valves
- 2-position damper
- Low limit protection
- Condensate overflow

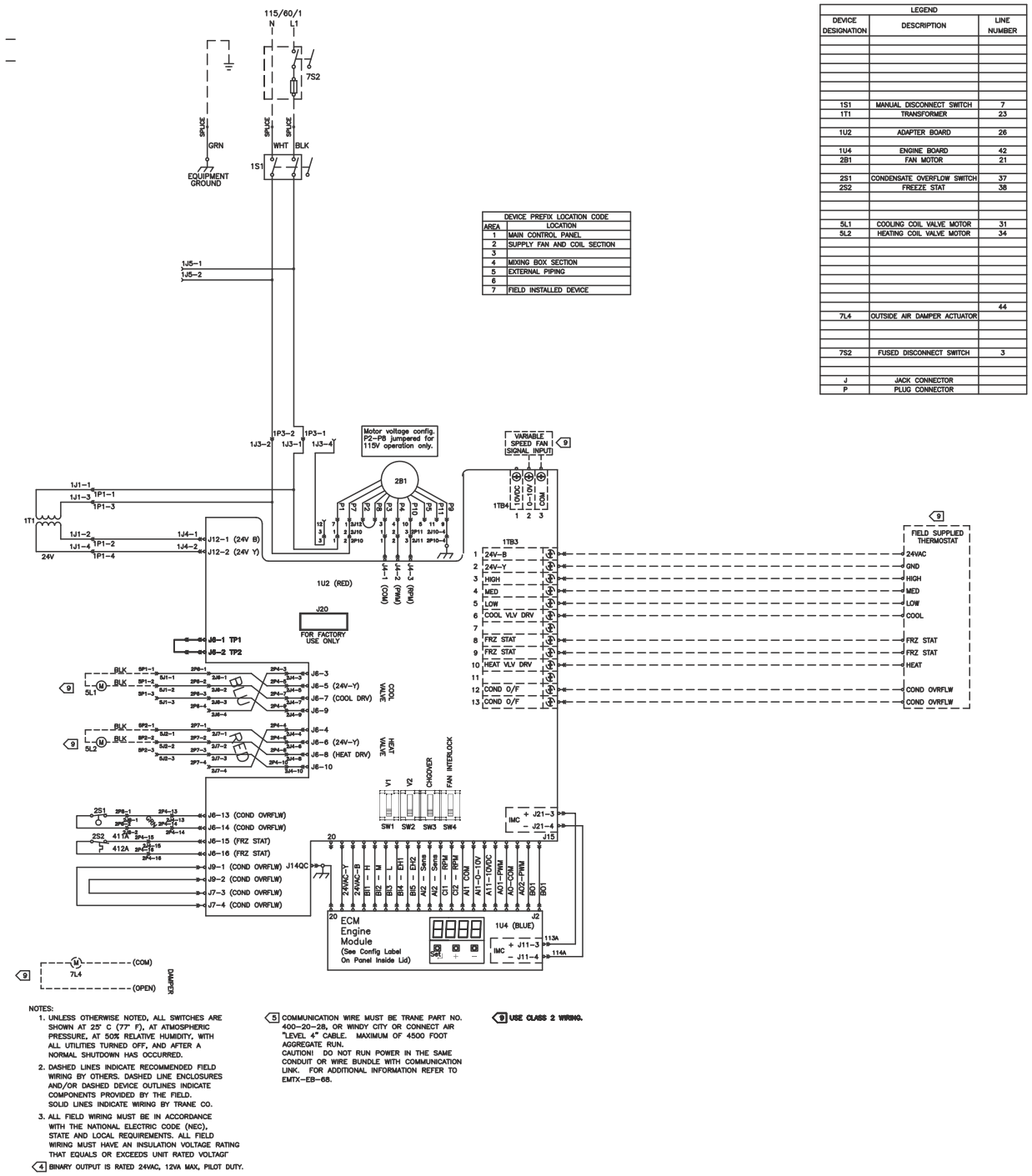
Figure 72. Four-pipe BCXD with Control Interface



Four-Pipe BCXD with Control Interface

- 115 volt/1-phase
- 2-position damper
- 2-speed motor
- Condensate overflow
- Low limit protection

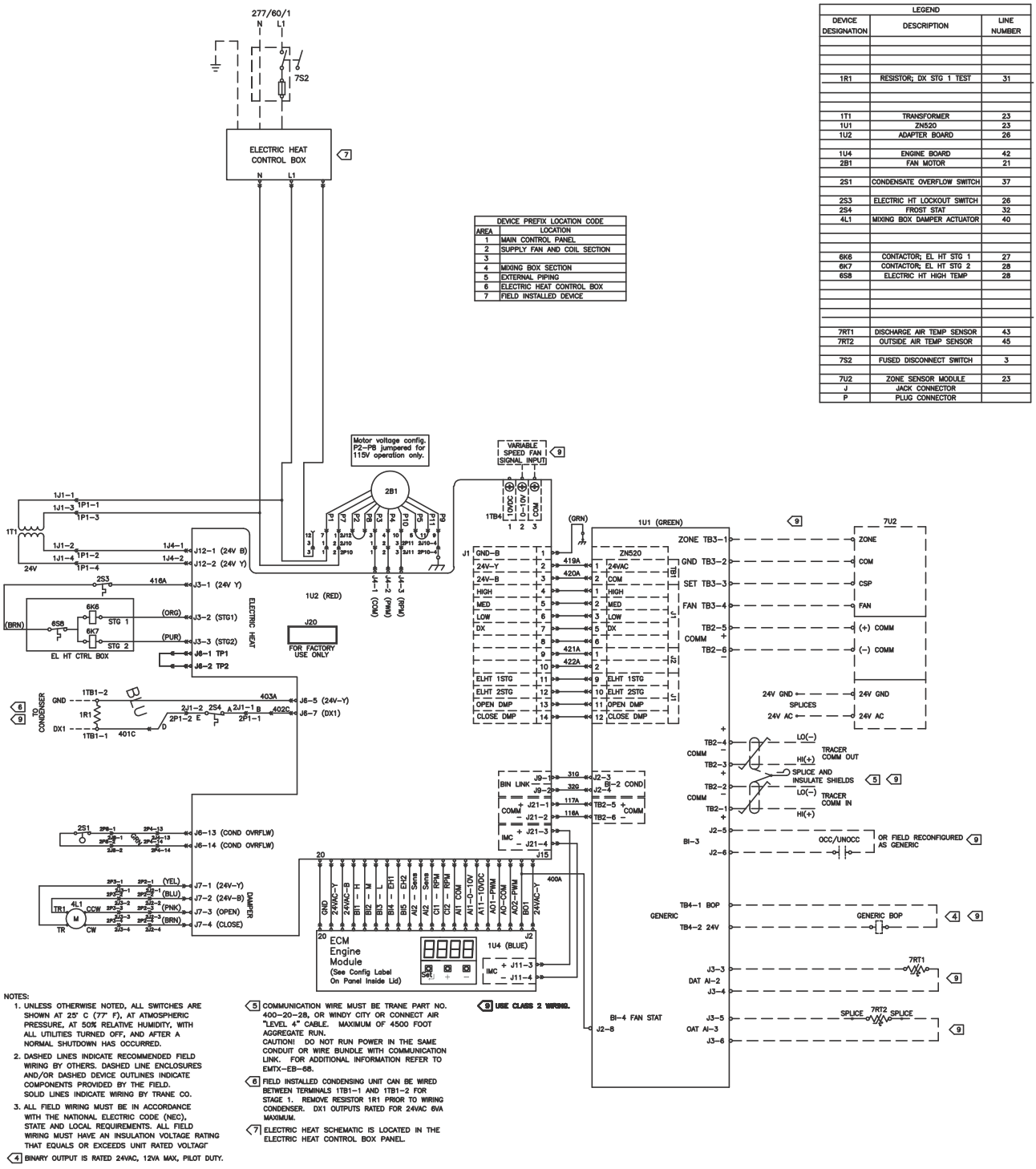
Figure 73. Four-pipe BCXD with Control Interface



BCXD with DX Coil and Tracer ZN520

- 277 volt/1-phase
- Economizer damper
- Condensate overflow
- Wall-mounted zone sensor

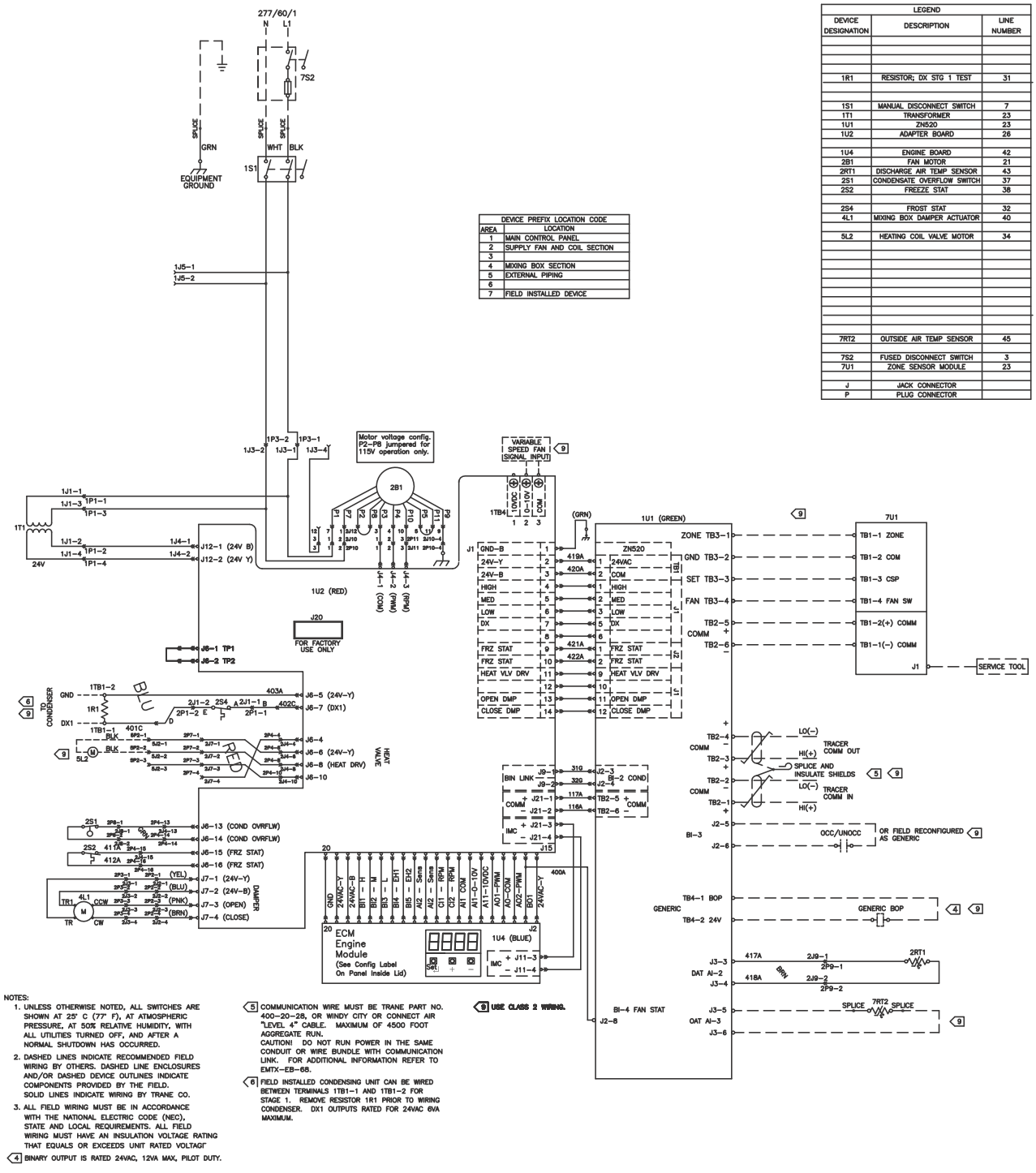
Figure 74. BCXD with DX Coil and Tracer ZN520



BCXD with DX Coil, Hydronic Heating, and Tracer ZN520

- 460 volt/3-phase
- Economizer damper
- Condensate overflow
- Wall-mounted zone sensor

Figure 75. BCXD with DX coil, hydronic heating, and Tracer ZN520



LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1R1	RESISTOR; DX STG 1 TEST	31
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U1	ZN520	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2RT1	DISCHARGE AIR TEMP SENSOR	43
2S1	CONDENSATE OVERFLOW SWITCH	37
2S2	FREEZE STAT	38
2S4	FROST STAT	32
4L1	MIXING BOX DAMPER ACTUATOR	40
5L2	HEATING COIL VALVE MOTOR	34
7RT2	OUTSIDE AIR TEMP SENSOR	45
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

NOTES:
1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
2. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. SOLID LINES INDICATE WIRING BY TRANE CO.
3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. ALL FIELD WIRING MUST HAVE AN INSULATION VOLTAGE RATING THAT EQUALS OR EXCEEDS UNIT RATED VOLTAGE.

4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400-20-28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX-EB-68.

6 FIELD INSTALLED CONDENSING UNIT CAN BE WIRED BETWEEN TERMINALS 1TB1-1 AND 1TB1-2 FOR STAGE 1. REMOVE RESISTOR 1R1 PRIOR TO WIRING CONDENSER. DX1 OUTPUTS RATED FOR 24VAC 6VA MAXIMUM.

9 USE CLASS 2 WIRING.

Trane optimizes the performance of homes and buildings around the world. A business of Ingersoll Rand, the leader in creating and sustaining safe, comfortable and energy efficient environments, Trane offers a broad portfolio of advanced controls and HVAC systems, comprehensive building services, and parts. For more information, visit www.Trane.com.

Trane has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice.

BCX-SVX001A-EN 23 Oct 2013
(NEW)

We are committed to using environmentally conscious print practices that reduce waste.

18-AC51D1-9-EN

Installer's Guide

Condensing Units

4TTR4018–060

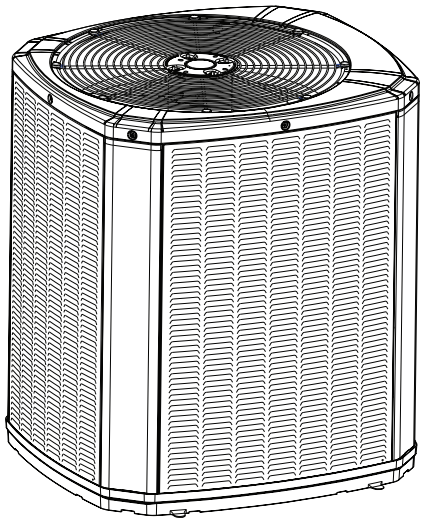
ALL phases of this installation must comply with NATIONAL, STATE AND LOCAL CODES

IMPORTANT — This Document is customer property and is to remain with this unit. Please return to service information pack upon completion of work.

These instructions do not cover all variations in systems or provide for every possible contingency to be met in connection with the installation. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to your installing dealer or local distributor.

Note: The manufacturer recommends installing only approved matched indoor and outdoor systems. All of the manufacture's split systems are A.H.R.I. rated only with TXV/EEV indoor systems. Some of the benefits of installing approved matched indoor and outdoor split systems are maximum efficiency, optimum performance and the best overall system reliability.

Table of Contents



Section 1. Safety

⚠ WARNING

This information is intended for use by individuals possessing adequate backgrounds of electrical and mechanical experience. Any attempt to repair a central air conditioning product may result in personal injury and/or property damage. The manufacture or seller cannot be responsible for the interpretation of this information, nor can it assume any liability in connection with its use.

⚠ WARNING

These units use R-410A refrigerant which operates at 50 to 70% higher pressures than R-22. Use only R-410A approved service equipment. Refrigerant cylinders are painted a “Rose” color to indicate the type of refrigerant and may contain a “dip” tube to allow for charging of liquid refrigerant into the system. All R-410A systems use a POE oil that readily absorbs moisture from the atmosphere. To limit this “hygroscopic” action, the system should remain sealed whenever possible. If a system has been open to the atmosphere for more than 4 hours, the compressor oil must be replaced. Never break a vacuum with air and always change the driers when opening the system for component replacement. For specific handling concerns with R-410A and POE oil reference Retrofit Bulletins SS-APG006-EN and APP-APG011-EN or APP-APG012-EN.

⚠ WARNING

UNIT CONTAINS R-410A REFRIGERANT!
R-410A operating pressures exceed the limit of R-22. Proper service equipment is required. Failure to use proper service tools may result in equipment damage or personal injury.

SERVICE

USE ONLY R-410A REFRIGERANT AND APPROVED POE COMPRESSOR OIL.

⚠ WARNING

Extreme caution should be exercised when opening the Liquid Line Service Valve. Turn counterclockwise until the valve stem just touches the rolled edge. No torque is required. Failure to follow this warning will result in abrupt release of system charge and may result in personal injury and /or property damage.

⚠ WARNING

LIVE ELECTRICAL COMPONENTS!
During installation, testing, servicing, and troubleshooting of this product, it may be necessary to work with live electrical components. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

⚠ CAUTION

If using existing refrigerant lines make certain that all joints are brazed, not soldered.

⚠ CAUTION

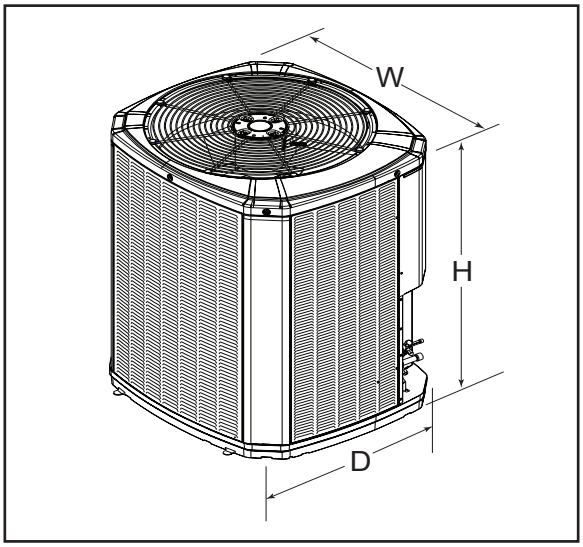
Scroll compressor dome temperatures may be hot. Do not touch the top of compressor; it may cause minor to severe burning.

Section 2. Unit Location Considerations

2.1 Unit Dimensions and Weight

Table 2.1

Unit Dimensions and Weight		
Models	H x D x W (in)	Weight* (lb)
4TTR4018L	29 x 26 x 29	133
4TTR4024/25L	29 x 26 x 29	133
4TTR4030/31L	29 x 30 x 33	156
4TTR4036/37L	33 x 30 x 33	156
4TTR4042/43L	29 x 34 x 37	184
4TTR4048L	29 x 34 x 37	189
4TTR4060L	37 x 34 x 37	211
* Weight values are estimated.		



When mounting the outdoor unit on a roof, be sure the roof will support the unit's weight.

Properly selected isolation is recommended to alleviate sound or vibration transmission to the building structure.

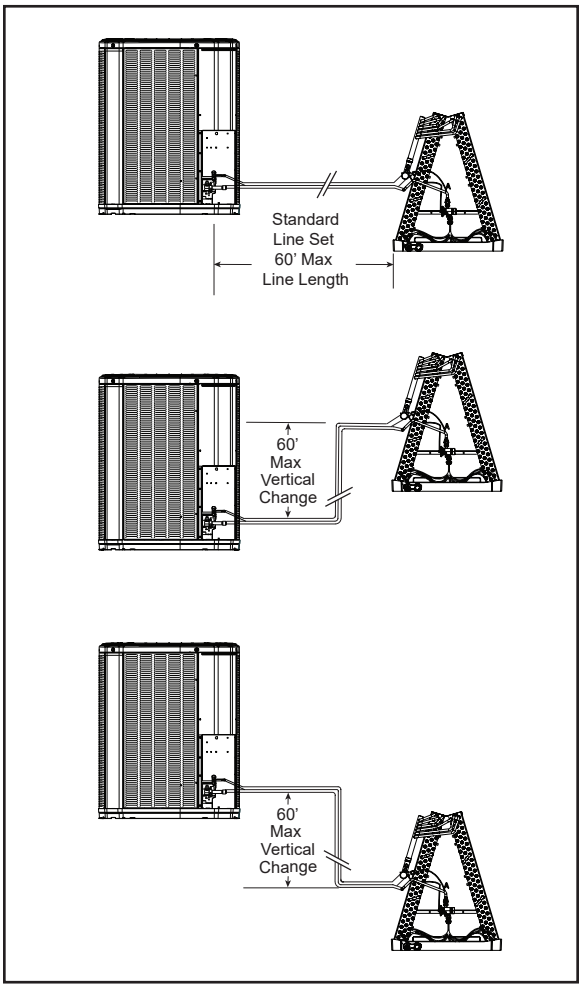
2.2 Refrigerant Piping Limits

1. The maximum length of refrigerant lines from outdoor to indoor unit should NOT exceed sixty (60) feet.

2. The maximum vertical change should not exceed sixty (60) feet.

3. Service valve connection diameters are shown in Table 5.1.

Note: For line lengths greater than sixty (60) feet, Refer to Refrigerant Piping Application Guide, SS-APG006-EN or Refrigerant Piping Software Program, 32-3312-03 (or latest revision).

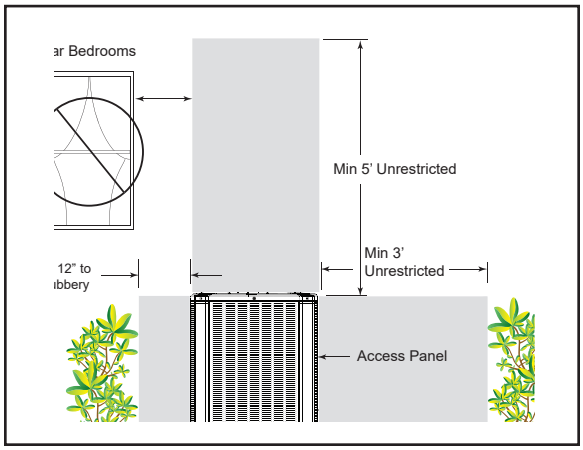


2.3 Suggested Locations for Best Reliability

Ensure the top discharge area is unrestricted for at least five (5) feet above the unit.

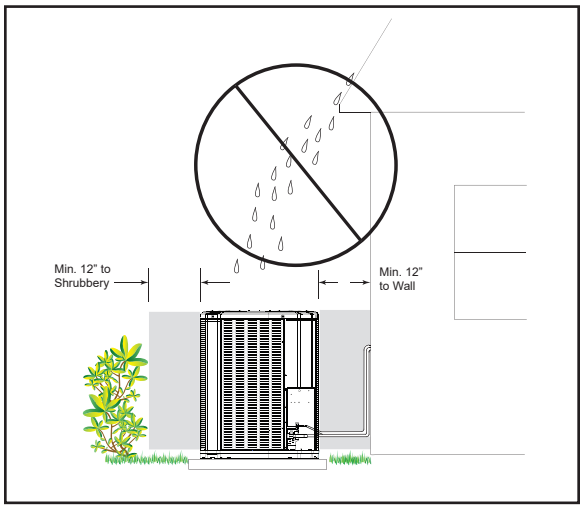
Three (3) feet clearance must be provided in front of the control box (access panels) and any other side requiring service.

Do not locate close to bedrooms as operational sounds may be objectionable.



Position the outdoor unit a minimum of 12” from any wall or surrounding shrubbery to ensure adequate airflow.

Outdoor unit location must be far enough away from any structure to prevent excess roof runoff water from pouring directly on the unit.



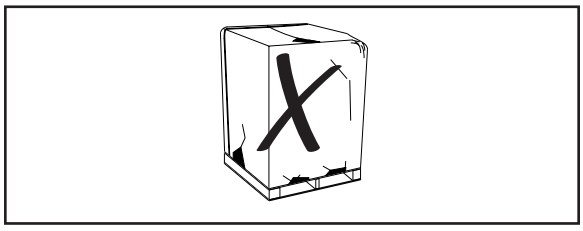
2.4 Coastal Considerations

If installed within one mile of salt water, including seacoasts and inland waterways, models without factory supplied Seacoast Salt Shields require the addition of BAYSEAC001 (Seacoast Kit) at installation time.

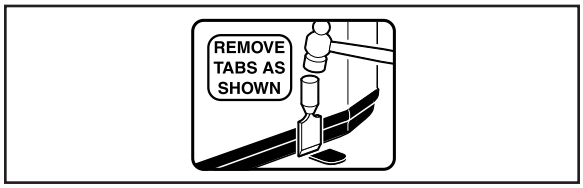
Section 3. Unit Preparation

3.1 Prepare The Unit For Installation

STEP 1 - Check for damage and report promptly to the carrier any damage found to the unit.



STEP 2 - To remove the unit from the pallet, remove tabs by cutting with a sharp tool.

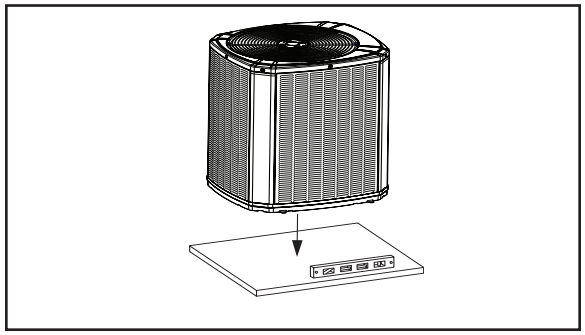


Section 4. Setting the Unit

4.1 Pad Installation

When installing the unit on a support pad, such as a concrete slab, consider the following:

- The pad should be at least 1” larger than the unit on all sides.
- The pad must be separate from any structure.
- The pad must be level.
- The pad should be high enough above grade to allow for drainage.
- The pad location must comply with National, State, and Local codes.



Section 5. Refrigerant Line Considerations

5.1 Refrigerant Line and Service Valve Connection Sizes

Table 5.1

	Line Sizes		Service Valve Connection Sizes	
Model	Vapor Line	Liquid Line	Vapor Line Connection	Liquid Line Connection
4TTR4018L	3/4	3/8	3/4	3/8
4TTR4024/25L	3/4	3/8	3/4	3/8
4TTR4030/31L	3/4	3/8	3/4	3/8
4TTR4036/37L	3/4	3/8	3/4	3/8
4TTR4042/43L	7/8	3/8	7/8	3/8
4TTR4048L	7/8	3/8	7/8	3/8
4TTR4060L	7/8	3/8	7/8	3/8

5.2 Factory Charge

Trane outdoor condensing units are factory charged with the system charge required for the outdoor condensing unit, fifteen (15) feet of tested connecting line, and the smallest indoor evaporative coil match. **If connecting line length exceeds fifteen (15) feet and/or a larger indoor evaporative coil is installed, then final refrigerant charge adjustment is necessary. See table for line length adders.**

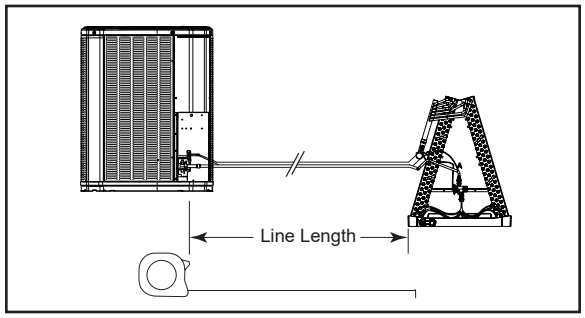
TUBING INFORMATION						
LINE TYPE		REFRIGERANT TO ADD AT SPECIFIED ADDITIONAL LENGTH				
Suction Line	**Liquid Line**	**20 ft**	**30 ft**	**40 ft**	**50 ft**	**60 ft**
3/4”	3/8"	3 oz	9 oz	15 oz	21 oz	27 oz
7/8"	3/8"	3 oz	9 oz	16 oz	22 oz	28 oz

5.3 Required Refrigerant Line Length

Determine required line length and lift. You will need this later in STEP 2 of Section 14.

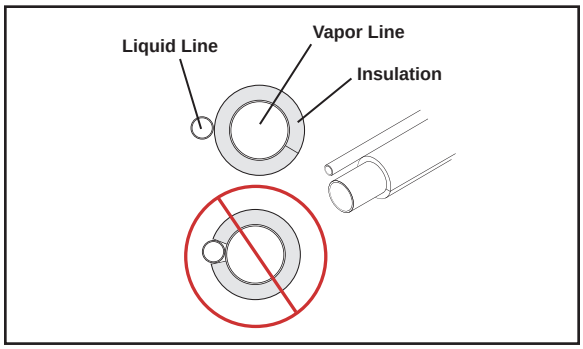
Total Line Length = _____ Ft.

Total Vertical Change (lift) = _____ Ft.



5.4 Refrigerant Line Insulation

Important: *The Vapor Line must always be insulated. DO NOT allow the Liquid Line and Vapor Line to come in direct (metal to metal) contact.*



5.5 Reuse Existing Refrigerant Lines

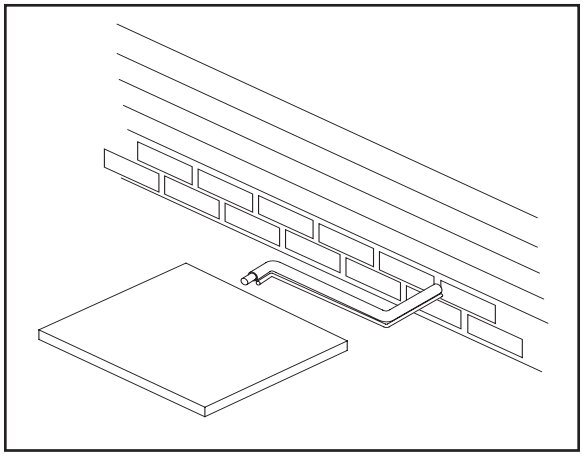
⚠ CAUTION

If using existing refrigerant lines make certain that all joints are brazed, not soldered.

For retrofit applications, where the existing indoor evaporator coil and/or refrigerant lines will be used, the following precautions should be taken:

- Ensure that the indoor evaporator coil and refrigerant lines are the correct size.
- Ensure that the refrigerant lines are free of leaks, acid, and oil.

Important: *For more information see publication number SS-APG006-EN.*



Section 6. Refrigerant Line Routing

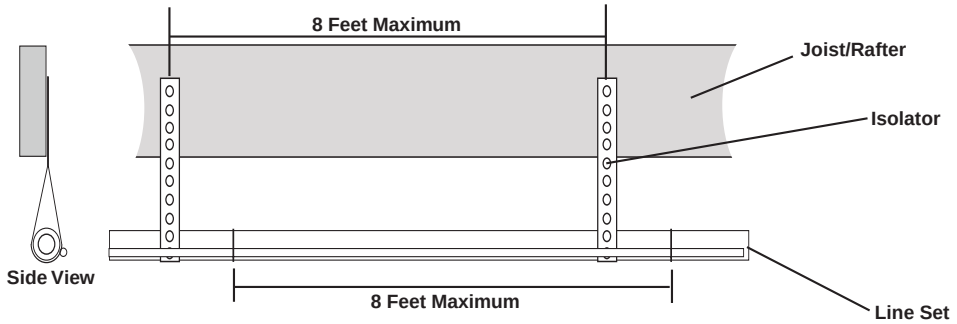
6.1 Precautions

Important: *Take precautions to prevent noise within the building structure due to vibration transmission from the refrigerant lines.*

Comply with National, State, and Local Codes when isolating line sets from joists, rafters, walls, or other structural elements.

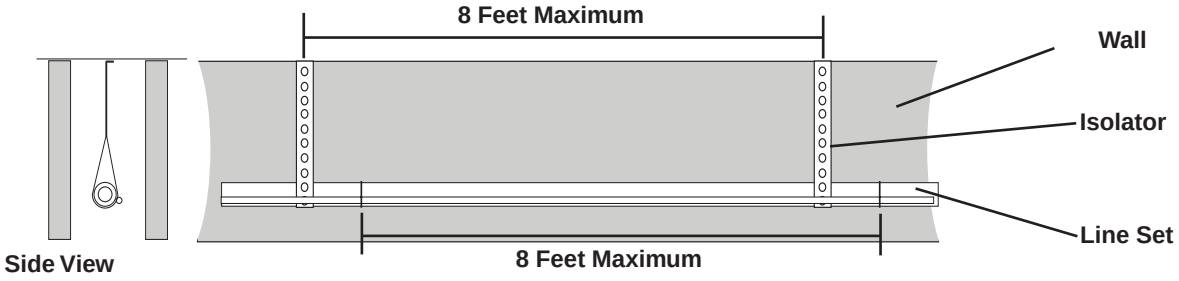
For Example:

- When the refrigerant lines have to be fastened to floor joists or other framing in a structure, use isolation type hangers.
- Isolation hangers should also be used when refrigerant lines are run in stud spaces or enclosed ceilings.
- Where the refrigerant lines run through a wall or sill, they should be insulated and isolated.
- Isolate the lines from all ductwork.
- Minimize the number of 90º turns.



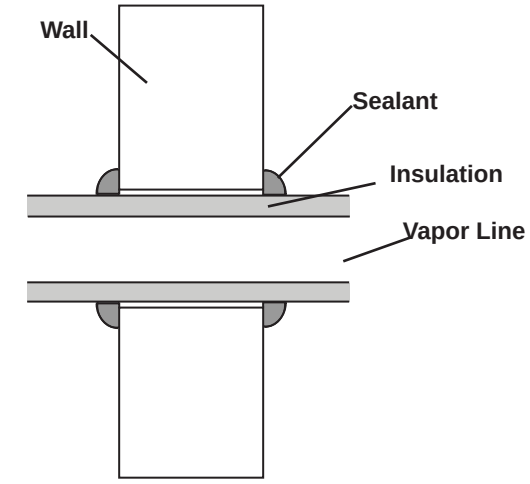
Secure Vapor line from joists using isolators every 8 ft. Secure Liquid Line directly to Vapor line using tape, wire, or other appropriate method every 8 ft.

Isolation From Joist/Rafter

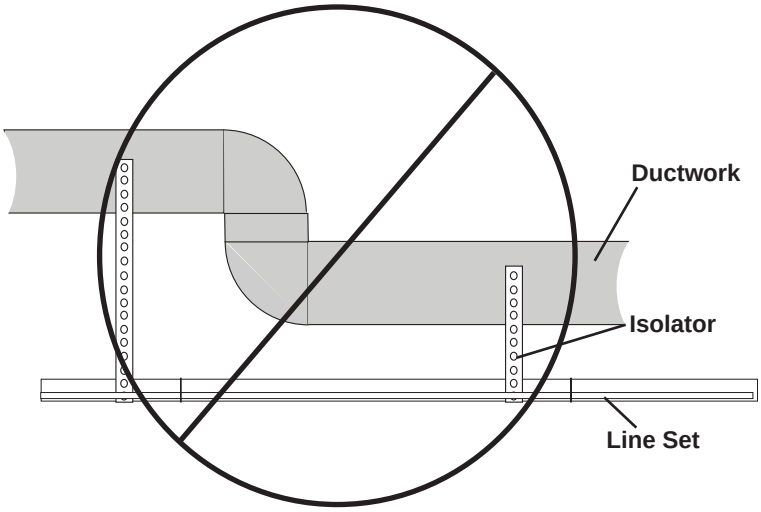


Secure Vapor Line using isolators every 8 ft. Secure Liquid Line directly to Vapor Line using tape, wire, or other appropriate method every 8 ft.

Isolation In Wall Spaces



Isolation Through Wall

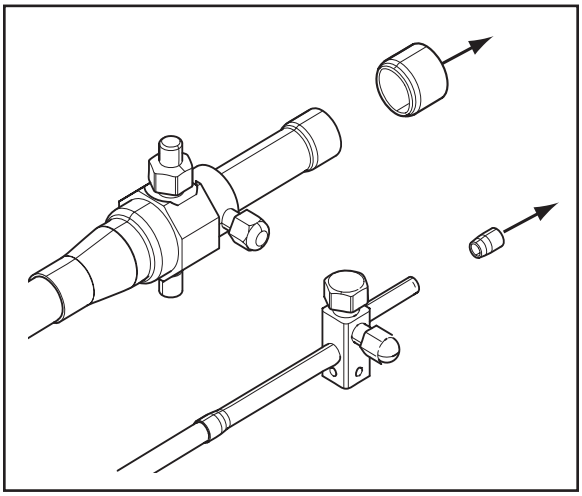


DO NOT hang line sets from ductwork

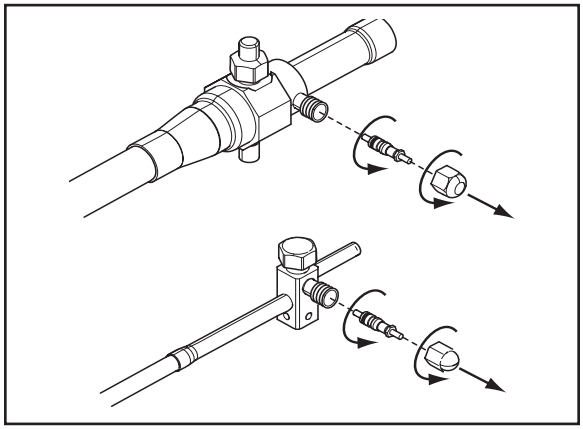
Section 7. Refrigerant Line Brazing

7.1 Braze The Refrigerant Lines

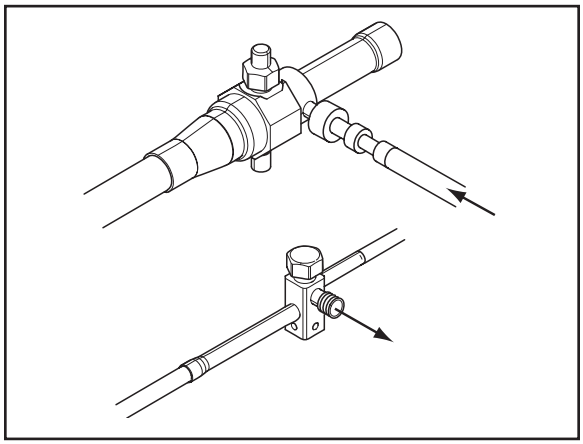
STEP 1 - Remove caps or plugs. Use a deburing tool to debur the pipe ends. Clean both internal and external surfaces of the tubing using an emery cloth.



STEP 2 - Remove the pressure tap cap and valve cores from both service valves.



STEP 3 - Purge the refrigerant lines and indoor coil with dry nitrogen.



STEP 4 - Wrap a wet rag around the valve body to avoid heat damage and continue the dry nitrogen purge.

Braze the refrigerant lines to the service valves.

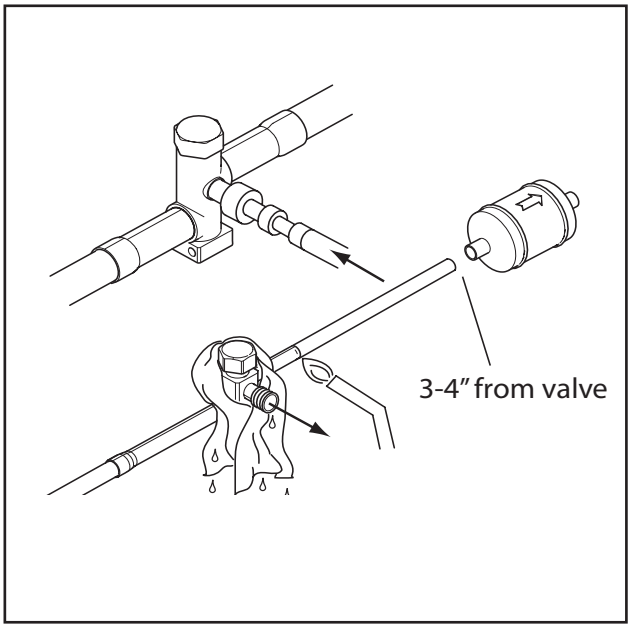
For units shipped with a field-installed external drier, check liquid line filter drier's directional flow arrow to confirm correct direction of refrigeration flow (away from outdoor unit and toward evaporator coil) as illustrated. Braze the filter drier to the Liquid Line.

Continue the dry nitrogen purge. Do not remove the wet rag until all brazing is completed.

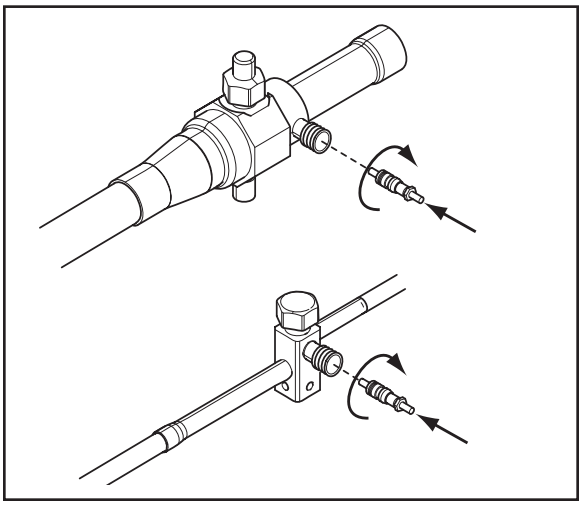
Important: Remove the wet rag before stopping the dry nitrogen purge.

Note: *Install drier in Liquid Line.*

NOTE: **Precautions should be taken to avoid heat damage to basepan during brazing. It is recommended to keep the flame directly off of the basepan.**



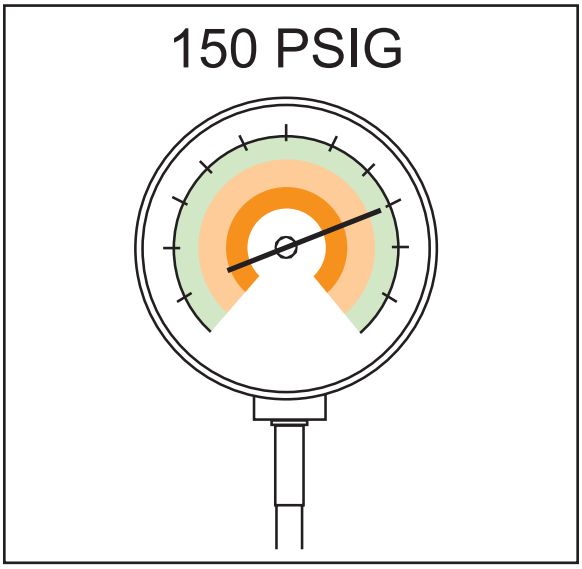
STEP 5 - Replace the pressure tap valve cores after the service valves have cooled.



Section 8. Refrigerant Line Leak Check

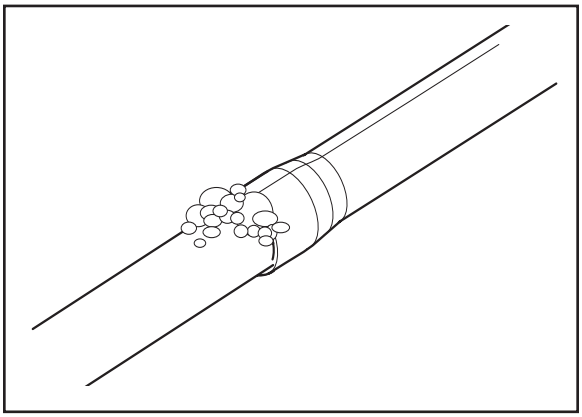
8.1 Check For Leaks

STEP 1 - Pressurize the refrigerant lines and evaporator coil to 150 PSIG using dry nitrogen.



STEP 2 - Check for leaks by using a soapy solution or bubbles at each brazed location.

Remove nitrogren pressure and repair any leaks before continuing.

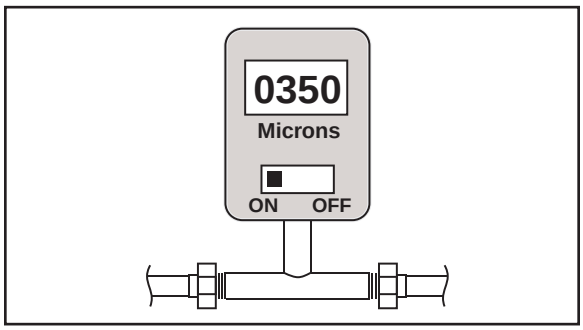


Section 9. Evacuation

9.1 Evacuate the Refrigerant Lines and Indoor Coil

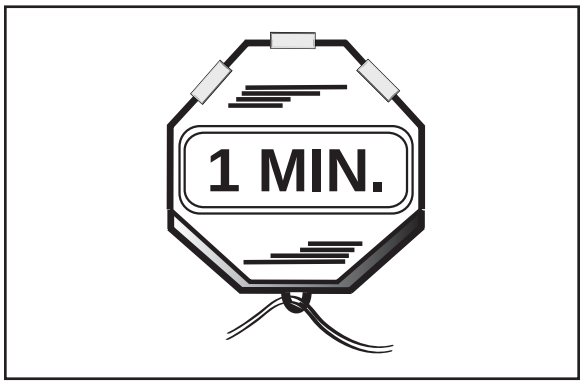
Important: *Do not open the service valves until the refrigerant lines and indoor coil leak check and evacuation are complete.*

STEP 1 - Evacuate until the micron gauge reads no higher than 350 microns, then close off the valve to the vacuum pump.



STEP 2 - Observe the micron gauge. Evacuation is complete if the micron gauge does not rise above 500 microns in one (1) minute.

Once evacuation is complete blank off the vacuum pump and micron gauge, and close the valves on the manifold gauge set.



Section 10. Service Valves

10.1 Open the Gas Service Valve

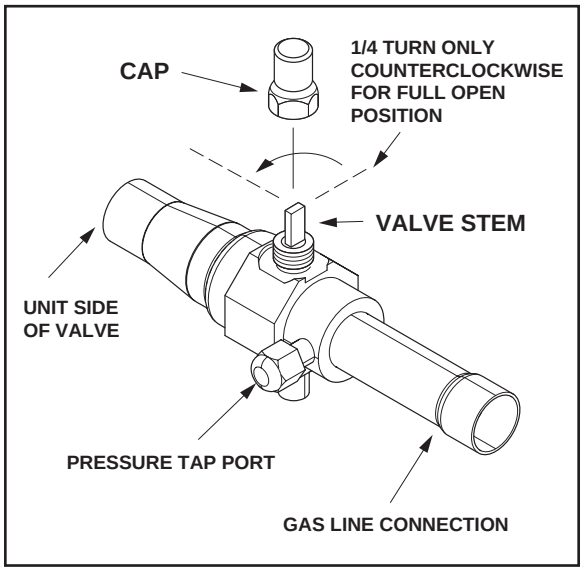
Important: *Leak check and evacuation must be completed before opening the service valves.*

NOTE: Do not vent refrigerant gases into the atmosphere

STEP 1 - Remove valve stem cap.

STEP 2 - Using an adjustable wrench, turn valve stem 1/4 turn counterclockwise to the fully open position.

STEP 3 - Replace the valve stem cap to prevent leaks. Tighten finger tight plus an additional 1/6 turn.



10.2 Open the Liquid Service Valve

⚠ WARNING

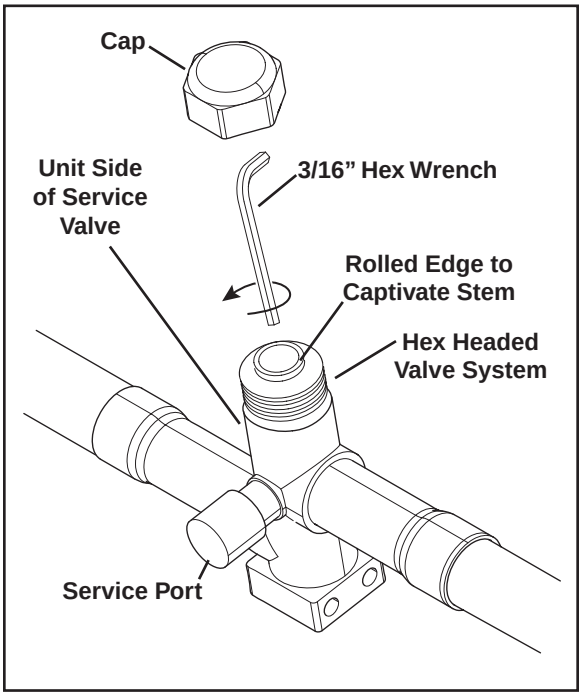
Extreme caution should be exercised when opening the Liquid Line Service Valve. Turn counterclockwise until the valve stem just touches the rolled edge. No torque is required. Failure to follow this warning will result in abrupt release of system charge and may result in personal injury and /or property damage.

Important: *Leak check and evacuation must be completed before opening the service valves.*

STEP 1 - Remove service valve cap.

STEP 2 - Fully insert 3/16” hex wrench into the stem and back out counterclockwise until valve stem just touches the rolled edge (approximately five (5) turns.)

STEP 3 - Replace the valve cap to prevent leaks. Tighten finger tight plus an additional 1/6 turn.



Section 11. Electrical - Low Voltage

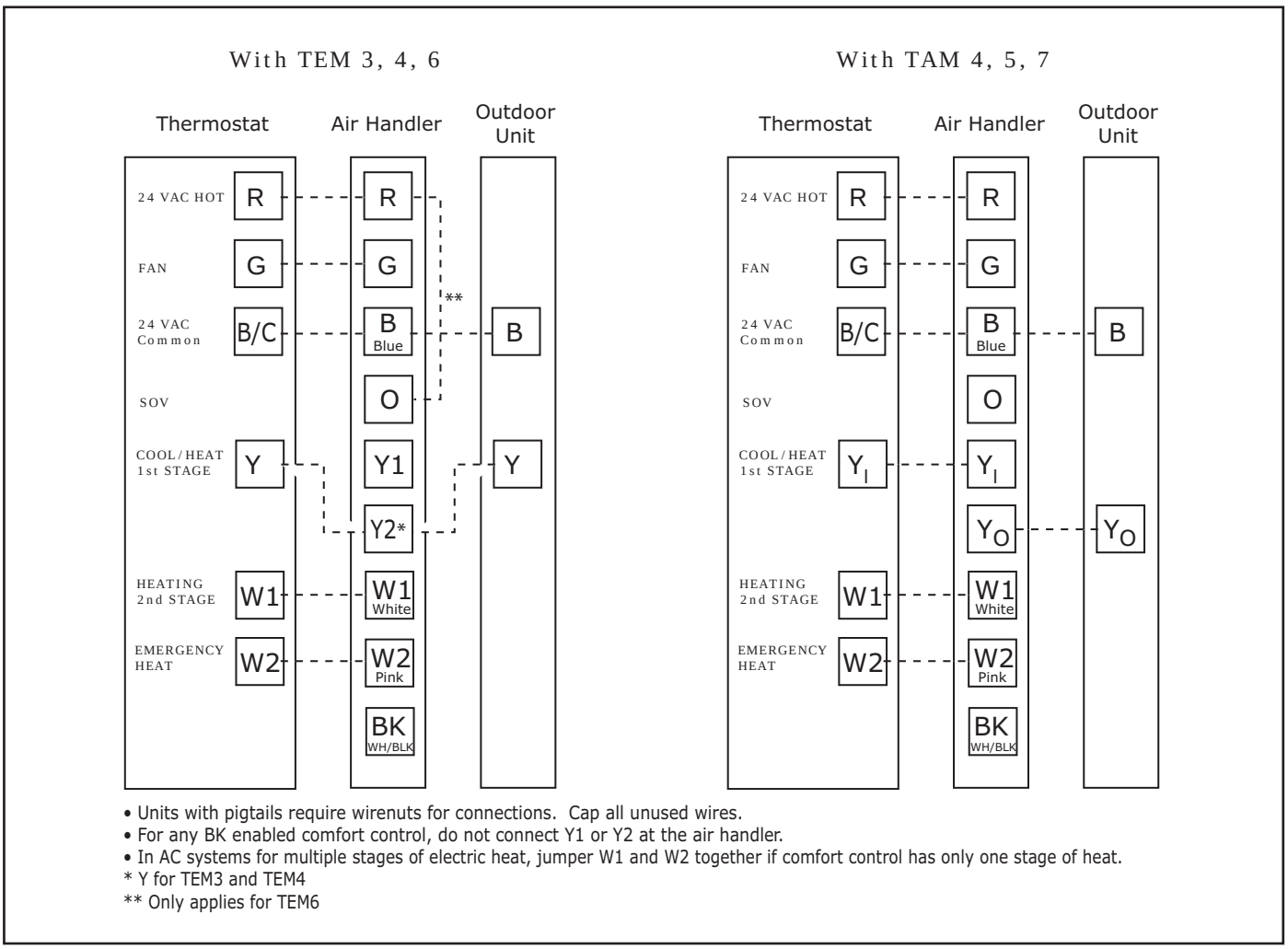
11.1 Low Voltage Maximum Wire Length

Table 11.1 defines the maximum total length of low voltage wiring from the outdoor unit, to the indoor unit, and to the thermostat.

Table 11.1

24 VOLTS	
WIRE SIZE	MAX. WIRE LENGTH
18 AWG	150 Ft.
16 AWG	225 Ft.
14 AWG	300 Ft.

11.2 Low Voltage Hook-up Diagrams



- Units with pigtails require wirenuts for connections. Cap all unused wires.
- For any BK enabled comfort control, do not connect Y1 or Y2 at the air handler.
- In AC systems for multiple stages of electric heat, jumper W1 and W2 together if comfort control has only one stage of heat.

* Y for TEM3 and TEM4

** Only applies for TEM6

Section 12. Electrical - High Voltage

12.1 High Voltage Power Supply

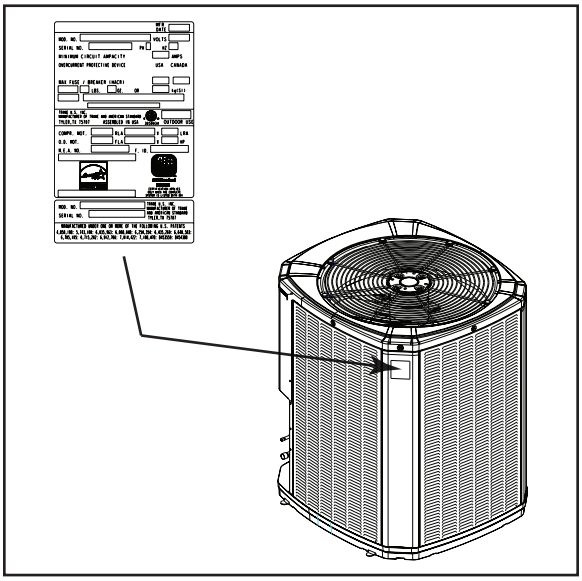
⚠ WARNING

LIVE ELECTRICAL COMPONENTS!
During installation, testing, servicing, and troubleshooting of this product, it may be necessary to work with live electrical components. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

The high voltage power supply must agree with the equipment nameplate.

Power wiring must comply with national, state, and local codes.

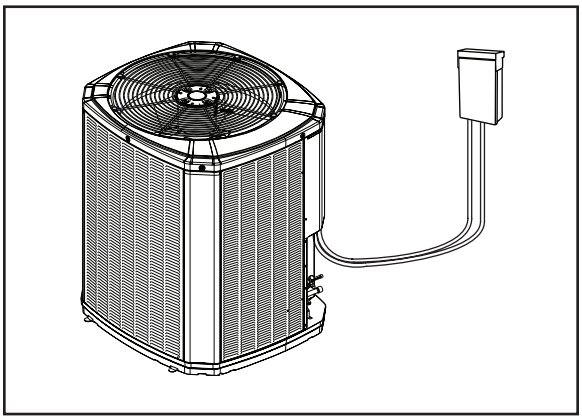
Follow instructions on unit wiring diagram located on the inside of the control box cover and in the Service Facts document included with the unit.



12.2 High Voltage Disconnect Switch

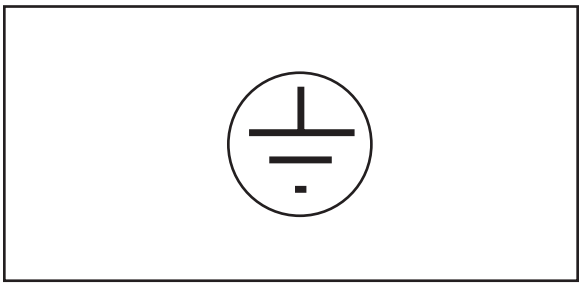
Install a separate disconnect switch at the outdoor unit.

For high voltage connections, flexible electrical conduit is recommended whenever vibration transmission may create a noise problem within the structure.



12.3 High Voltage Ground

Ground the outdoor unit per national, state, and local code requirements.

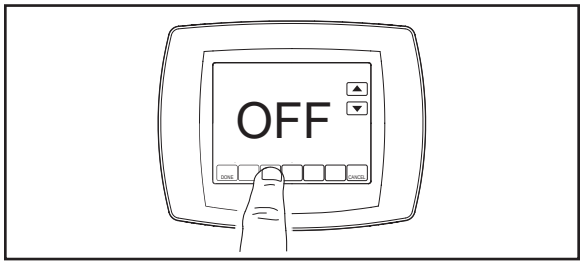


Section 13. Start Up

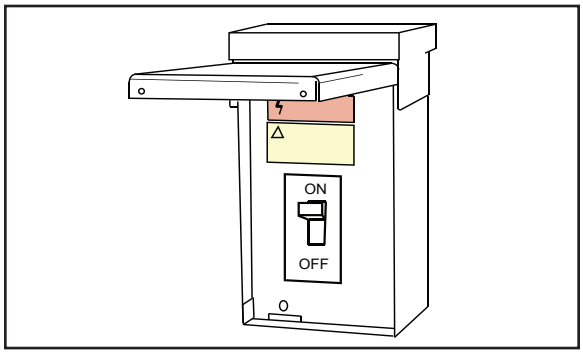
13.1 System Start Up

STEP 1 - Ensure Sections 7 through 12 have been completed.

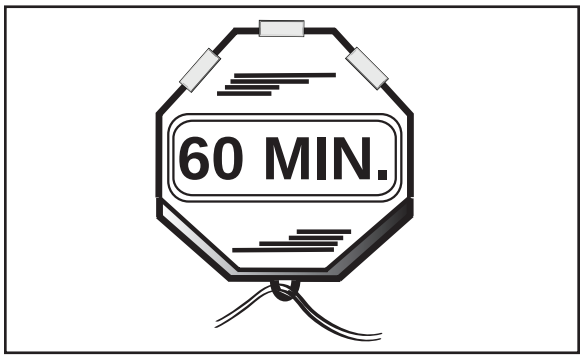
STEP 2 - Set System Thermostat to OFF.



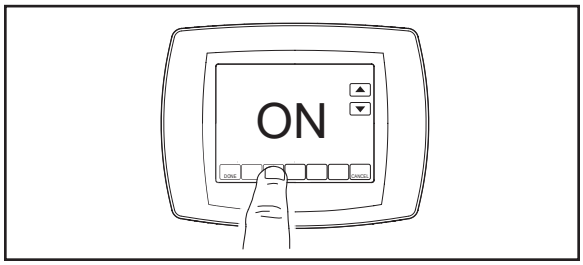
STEP 3 - Turn on disconnect(s) to apply power to the indoor and outdoor units.



STEP 4 - Wait one (1) hour before starting the unit if compressor crankcase heater accessory is used and the Outdoor Ambient is below 70ºF.



STEP 5 - Set system thermostat to ON.

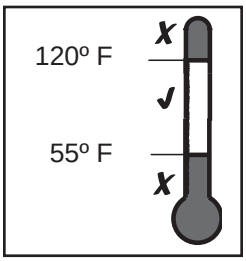


Section 14. System Charge Adjustment

14.1 Temperature Measurements

STEP 1 - Check the outdoor temperatures.

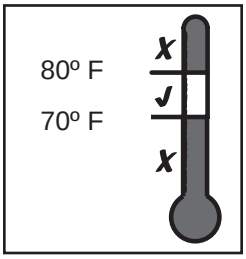
Subcooling (in cooling mode) is the only recommended method of charging above 55º F ambient outdoor temperature.



Outdoor Temp

For best results the indoor temperature should be kept between 70º F to 80º F.

Note: It is important to return in the spring or summer to accurately charge the system in the cooling mode when outdoor ambient temperature is above 55º F.



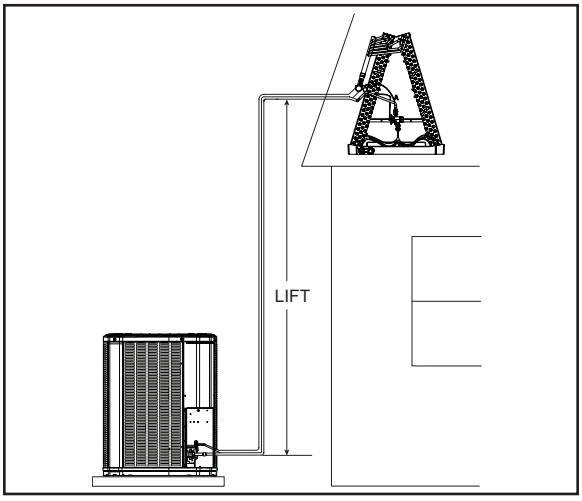
Indoor Temp

14.2 Subcooling Charging in Cooling (Above 55º F Outdoor Temp.)

STEP 1 - Use the refrigerant line total length and lift measurements from Section 5 and use line length adders as shown in Section 5.2 if required.

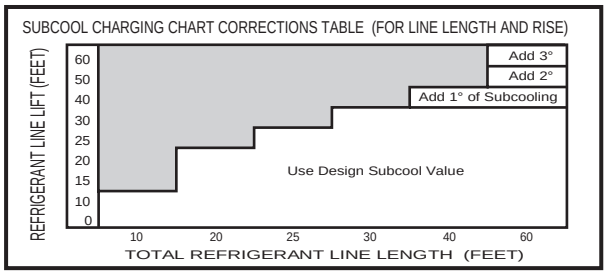
Total Line Length = _____ Ft.

Vertical Change (Lift) = _____ Ft.

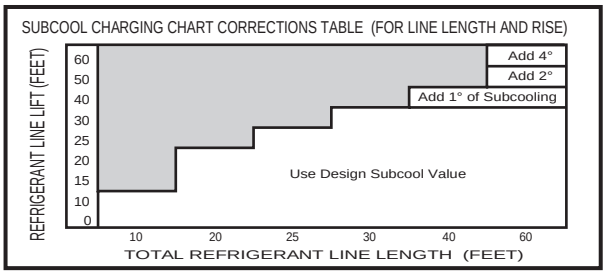


STEP 2 - Determine the final subcooling value using total Line Length and Lift measured in STEP 1 and the charts below.

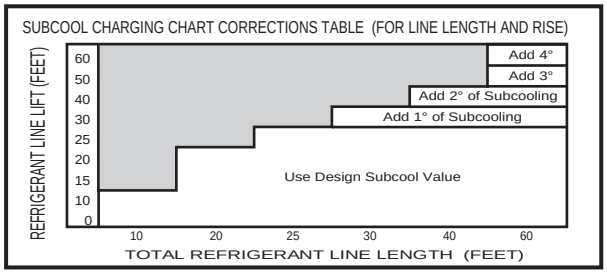
1 1/2 Ton



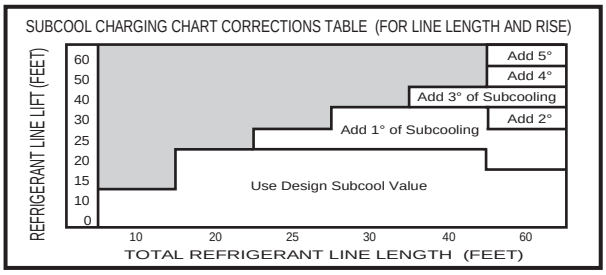
2 Ton



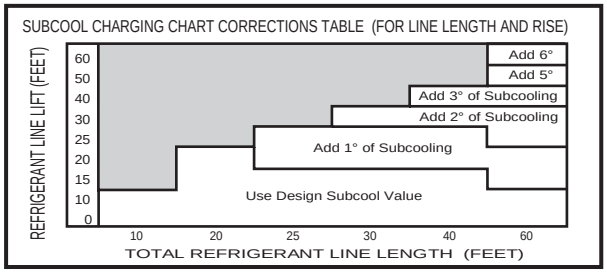
2 1/2 Ton



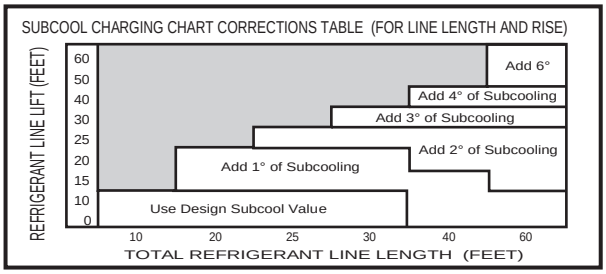
3 Ton



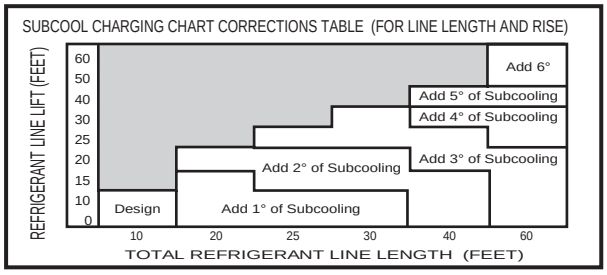
3 1/2 Ton



4 Ton



5 Ton



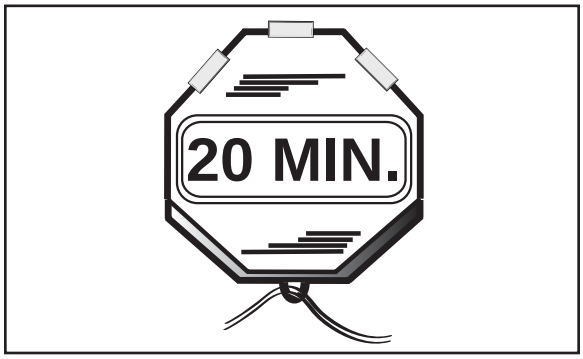
Design Subcooling Value = _____ º F
(from nameplate or Service Facts)

Subcooling Correction = _____ º F

Final Subcooling Value = _____ º F

STEP 3 - Stabilize the system by operating for a minimum of 20 minutes.

At startup, or whenever charge is removed or added, the system must be operated for a minimum of 20 minutes to stabilize before accurate measurements can be made.

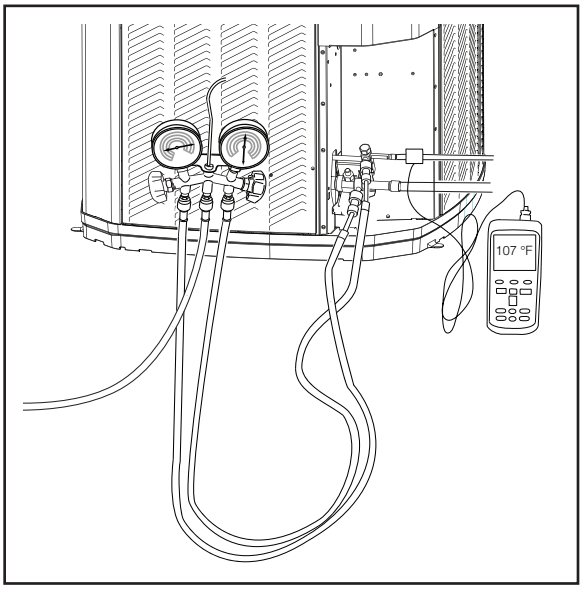


STEP 4 - Measure the liquid line temperature and pressure at the outdoor unit's service valve.

Measured Liquid Line Temp = _____ º F

Liquid Gage Pressure = _____ PSI

Final Subcooling Value = _____ º F



STEP 5 - Use the final subcooling value, refrigerant temperature and pressure from STEP 4, to determine the proper liquid gage pressure using Table 14.2.

Example: Assume a 12º F Final Subcooling value and liquid temp of 90º F.

1. Locate 12º F Final Subcooling in Table 14.2.
2. Locate the Liquid Temperarature (90º F) in the left column.
3. The Liquid Gage Pressure should be approximately 327 PSI. (This is the shown as the intersection of the Final Subcooling column and the Liquid Temperature row.

Table 14.2

R-410A REFRIGERANT CHARGING CHART							
LIQUID TEMP (ºF)	FINAL SUBCOOLING (ºF)						
	8	9	10	11	12	13	14
	LIQUID GAGE PRESSURE (PSI)						
55	179	182	185	188	191	195	198
60	195	198	201	204	208	211	215
65	211	215	218	222	225	229	232
70	229	232	236	240	243	247	251
75	247	251	255	259	263	267	271
80	267	271	275	279	283	287	291
85	287	291	296	300	304	309	313
90	309	313	318	322	327	331	336
95	331	336	341	346	351	355	360
100	355	360	365	370	376	381	386
105	381	386	391	396	402	407	413
110	407	413	418	424	429	435	441
115	435	441	446	452	458	464	470
120	464	470	476	482	488	495	501
125	495	501	507	514	520	527	533

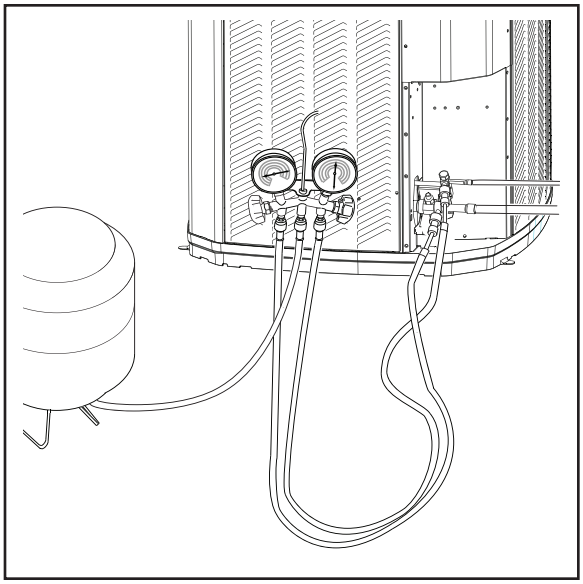
From Dwg. D154557P01 Rev. 3

STEP 6 - Adjust refrigerant level to attain proper gage pressure.

Add refrigerant if the Liquid Gage Pressure is lower than the chart value.

1. Connect gages to refrigerant bottle and unit as illustrated.
2. Purge all hoses.
3. Open bottle.
4. Stop adding refrigerant when liquid line temperature and Liquid Gage Pressure matches the charging chart Final Subcooling value.

Recover refrigerant if the Liquid Gage Pressure is higher than the chart value.



STEP 7 - Stabilize the system.

1. Wait 20 minutes for the system condition to stabilize between adjustments.

Note: When the Liquid Line Temperature and Gage Pressure approximately match the chart, the system is properly charged.

2. Remove gages.
3. Replace service port caps to prevent leaks. Tighten finger tight plus an additional 1/6 turn.

STEP 8 - Verify typical performance.

Refer to System Pressure Tables to verify typical performance.

(Example only - see Pressure Tables)

R-410A REFRIGERANT CHARGING CHART							
LIQUID TEMP (°F)	DESIGN SUBCOOLING (°F)						
	8	9	10	11	12	13	14
	LIQUID GAGE PRESSURE (PSI)						
55	179	182	185	188	191	195	198
60	195	198	201	204	208	211	215
65	211	215	218	222	225	229	232
70	229	232	236	240	243	247	251
75	247	251	255	259	263	267	271
80	267	271	275	279	283	287	291
85	287	291	296	300	304	309	313
90	309	313	318	322	327	331	336
95	331	336	341	346	351	355	360
100	355	360	365	370	376	381	386
105	381	386	391	396	402	407	413
110	407	413	418	424	429	435	441
115	435	441	446	452	458	464	470
120	464	470	476	482	488	495	501
125	495	501	507	514	520	527	533
Refer to Service Facts or Installer's Guide for charging method.							

OD 13/14 SEER AC only		18	24/25	30/31	36/37	42/43	48	60
OD Temp	ID Wet Bulb	Suction Pressure						
110	71	160	159	156	157	158	154	158
	67	154	152	150	149	150	148	148
	63	148	144	144	142	142	140	140
	59	142	137	138	135	135	132	132
100	71	156	155	152	153	154	152	154
	67	150	148	146	145	147	144	146
	63	144	141	140	138	138	136	138
	59	138	134	134	132	131	130	130
90	71	152	152	150	149	152	148	150
	67	146	145	144	143	143	142	142

STEP 9 - Record System Information for reference.

Record system pressures and temperatures after charging is complete.

Outdoor model number = _____

Measured Outdoor Ambient = _____ º F

Measured Indoor Ambient = _____ º F

Measured Liquid Line Temp = _____ º F

Measured Suction Line Temp = _____ º F

Liquid Gage Pressure = _____ PSI

Suction Gage Pressure = _____ PSI

Section 15. Checkout Procedures and Troubleshooting

15.1 Operational And Checkout Procedures

Final phases of this installation are the unit Operational and Checkout Procedures. To obtain proper performance, all units must be operated and charge adjustments made.

Important: *Perform a final unit inspection to be sure that factory tubing has not shifted during shipment. Adjust tubing if necessary so tubes do not rub against each other when the unit runs. Also be sure that wiring connections are tight and properly secured.*

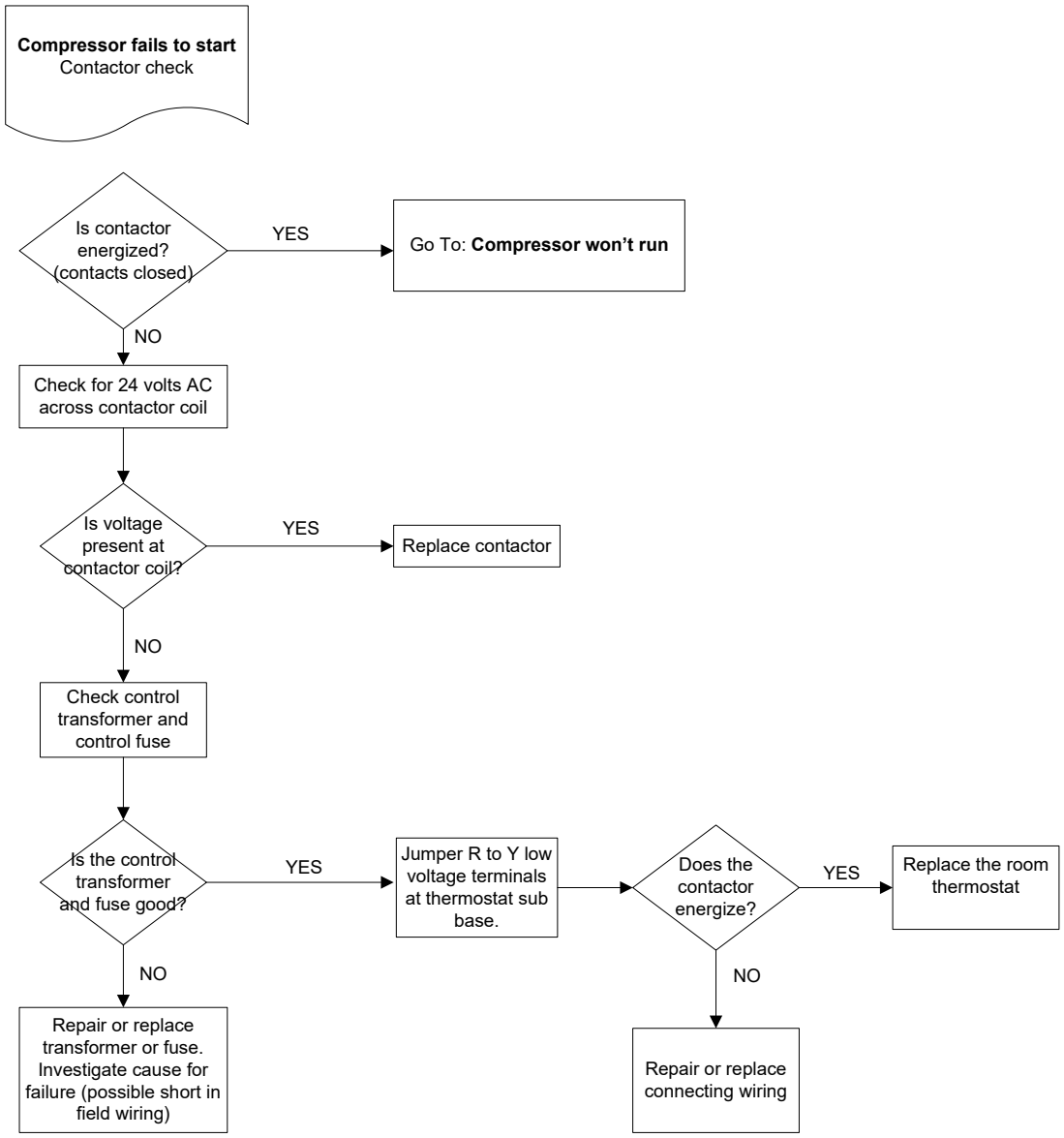
CHECKOUT PROCEDURE

After installation has been completed, it is recommended that the entire system be checked against the following list:

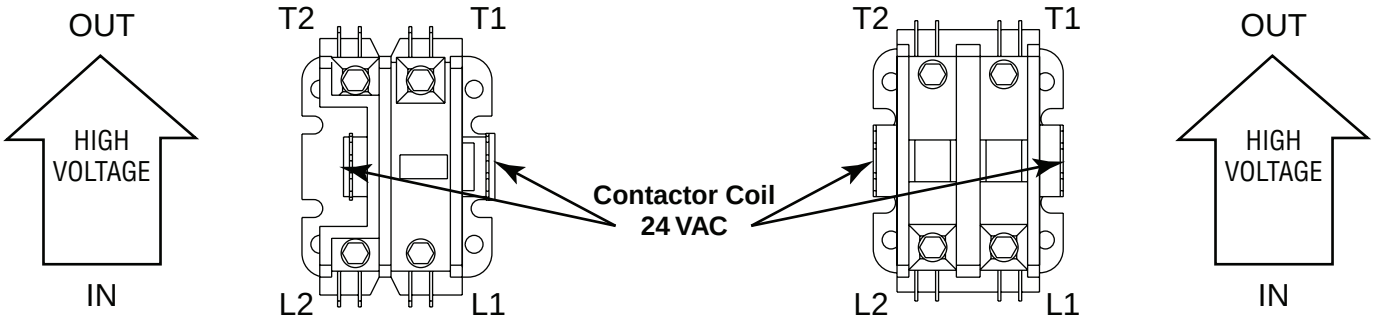
1. Leak check refrigerant lines. ..... [ ]
2. Properly insulate suction lines and fittings..... [ ]
3. Properly secure and isolate all refrigerant lines..... [ ]
4. Seal passages through masonry. If mortar is used, prevent mortar from coming into direct contact with copper tubing. ..... [ ]
5. Verify that all electrical connections are tight..... [ ]
6. Observe outdoor fan during on cycle for clearance and smooth operation..... [ ]
7. Be sure that indoor coil drain line drains freely. Pour water into drain pan..... [ ]
8. Be sure that supply registers and return grilles are open and unobstructed..... [ ]
9. Be sure that a return air filter is installed. ..... [ ]
10. Be sure that the correct airflow setting is used. (Indoor blower motor) ..... [ ]
11. Operate complete system in each mode to ensure safe operation. ..... [ ]

15.2 Troubleshooting

TROUBLESHOOTING

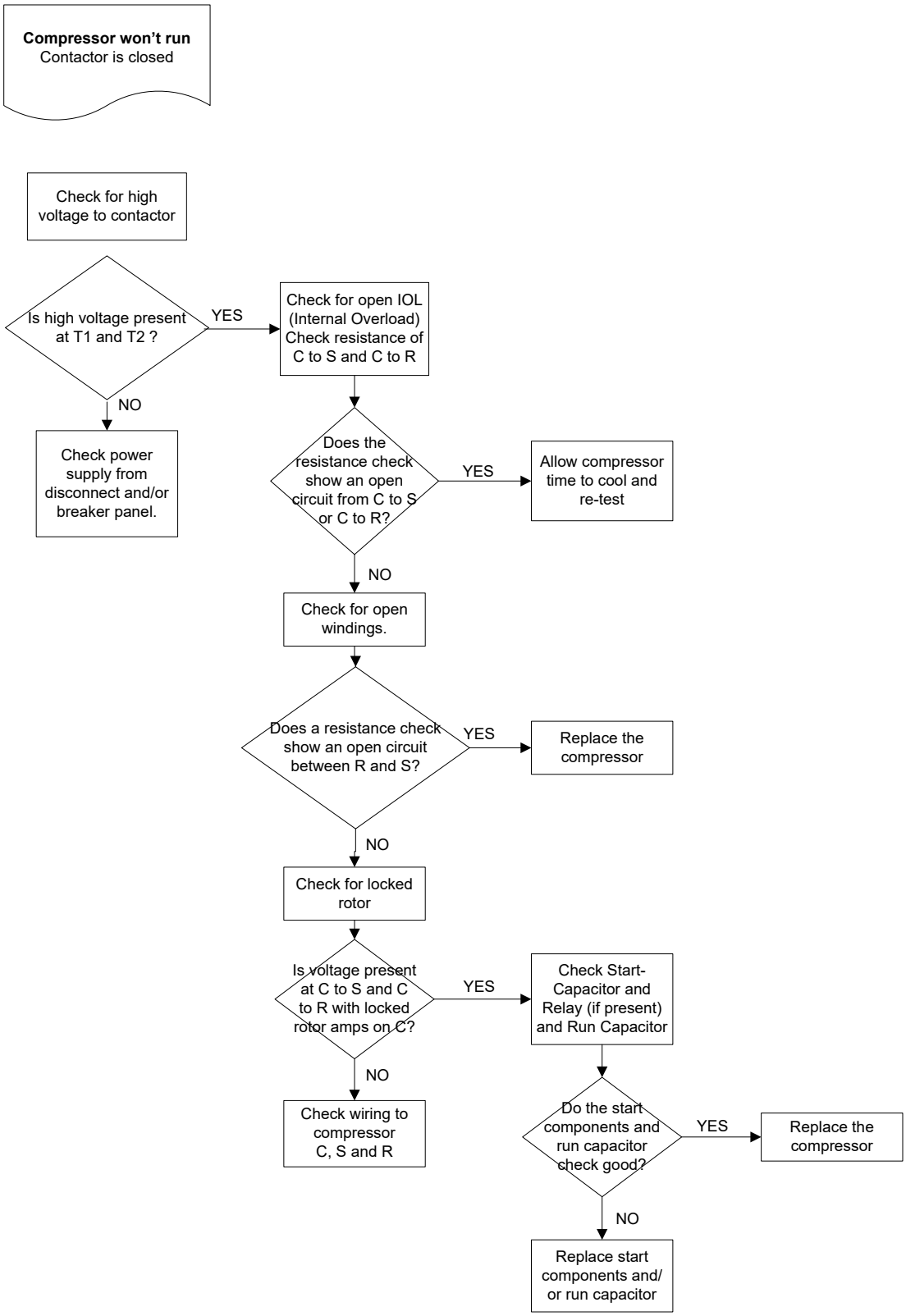


Single Pole Contactor (MS)* **Double Pole Contactor (MS)***



*Refer to Wiring Diagram to determine if a single pole or double pole contactor is used.

TROUBLESHOOTING

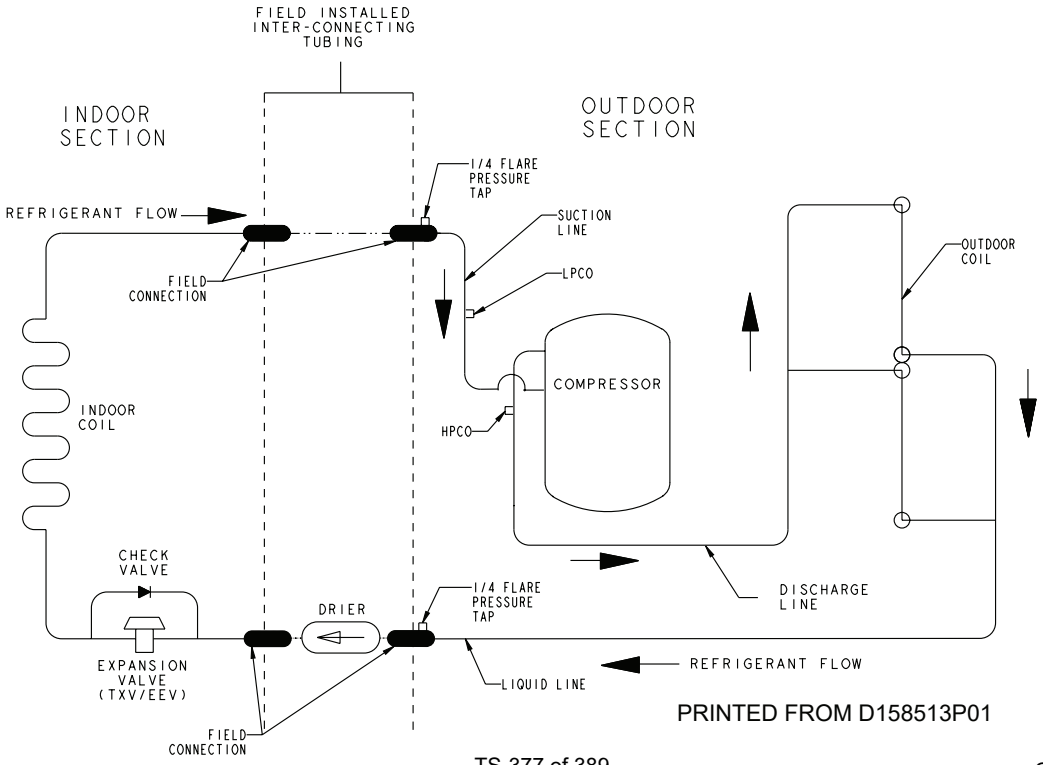


SYSTEM FAULTS		WHAT TO CHECK MODE	HIGH VOLTAGE POWER SUPPLY	COMPRESSOR WIRING	RUN CAPACITOR	START CAPACITOR	CONTACTOR START RELAY	CONTACTOR CONTACTS	LOW VOLTAGE WIRING	CONTROL TRANSFORMER	THERMOSTAT	CONTACTOR COIL	LOW VOLTAGE FUSE	STUCK COMPRESSOR	INEFFICIENT COMP.	REF. UNDERCHARGE	REF. OVERCHARGE	EXCESSIVE EVAP. LOAD	NONCONDENSABLES	O.D. AIR RECIRCULATION	RES. O.D. AIRFLOW	TXV/EEV STUCK OPEN	SUPERHEAT	RES. I.D. AIRFLOW	REF. CIR. RESTRICTIONS	SOV COIL DEFECTIVE	SOV LEAKING	CHECK VALVE DEFECTIVE	*DEFROST RELAY LEAKING	DEFROST CONTROL DEF.
REFRIGERANT CIRCUIT																													
Head Pressure Too High	C																P	P	S	P	S				S				
	H																P	P	S					P	S				
Head Pressure Too Low	C														S	P						S	S		S	S	S	P	
	H														S	P						S	S		S	S		P	
Suction Pressure Too High	C														S		P	P								P		P	
	H														S								S			P			
Suction Pressure Too Low	C															P							S	P	S		S		
	H															P				S	S		S		S				
Liquid Refrig. Floodback (TXV/EEV)	C																					P						P	
	H																					P						P	
Liquid Refrig. Floodback (Cap. Tube)	C																P			S	S		S	P					
	H																P			S	S		S				S		
I.D. Coil Frosting	C															P				S	S								
	H																												
Compressor Runs Inadequate or No Cooling/Htg	C														S	P		S	S				S	P	S	S	S	S	
	H														S	P			S				S	P	S	S		S	
ELECTRICAL																													
Compressor & O.D. Fan Won't Start	C	P	P						S	P	S	P	P																
	H	P	P						S	P	S	P	P																
Compressor Will Not Start But O.D. Fan Runs	C		P	S	P	S	S	S						P															
	H		P	S	P	S	S	S						P															
O.D. Fan Won't Start	C		P		P			S																					
	H		P		P			S																					
Compressor Hums But Won't Start	C				P	S	S	S						P															
	H				P	S	S	S						P															
Compressor Cycles on IOL	C		P	S	P	S	S	S						P	S	P	P	S		S	S		S			S			
	H		P	S	P	S	S	S						P	S	P	P	S		S			S	P		S			
I.D. Blower Won't Start	C	P	P						S	P	S		S																
	H	P	P						S	P	S		S																
DEFROST																													
Unit Won't Initiate Defrost	C																												
	H																									P		P	P
Defrost Terminates on Time	C																												
	H															P													P
Unit Icing Up	C																												
	H															P				S	S			S			P			P

C - Cooling H - Heating P - Primary Causes S - Secondary Causes * - 3 Phase Only

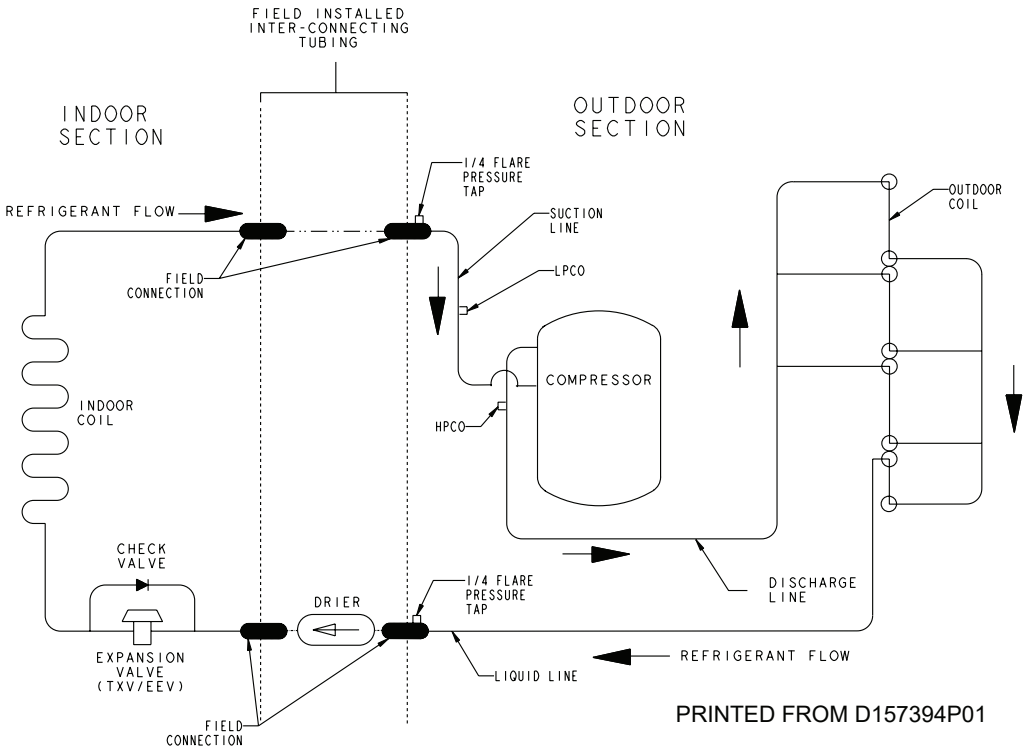
16.0 Refrigerant Circuits

1 1/2-Ton Units



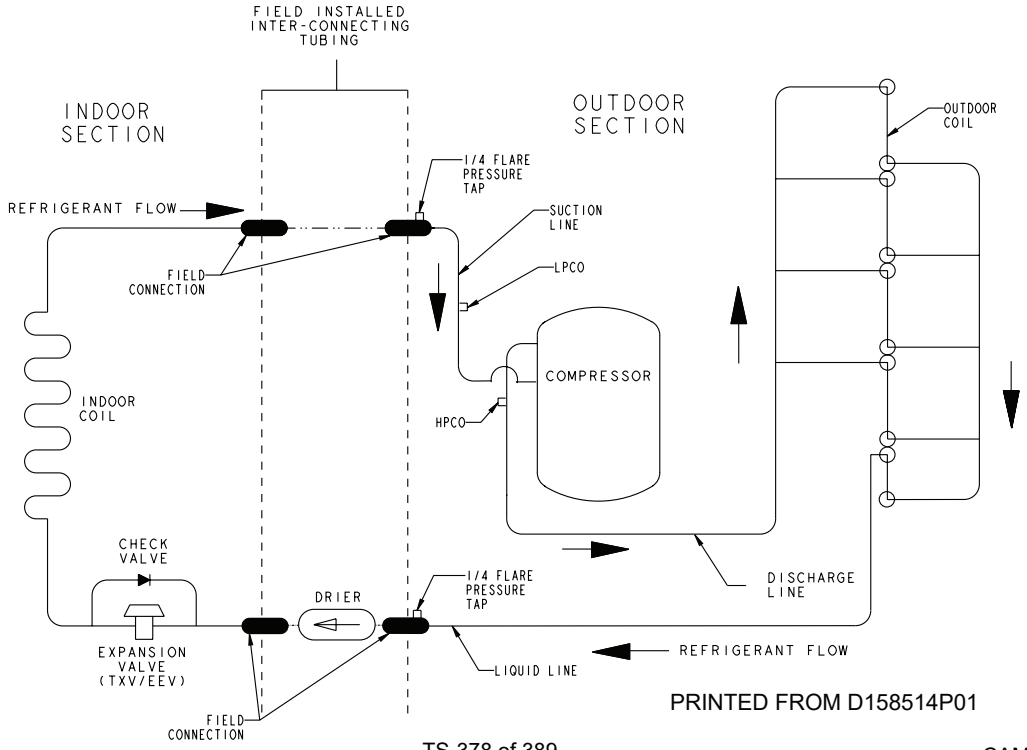
PRINTED FROM D158513P01

2, 2 1/2 & 3-Ton Units



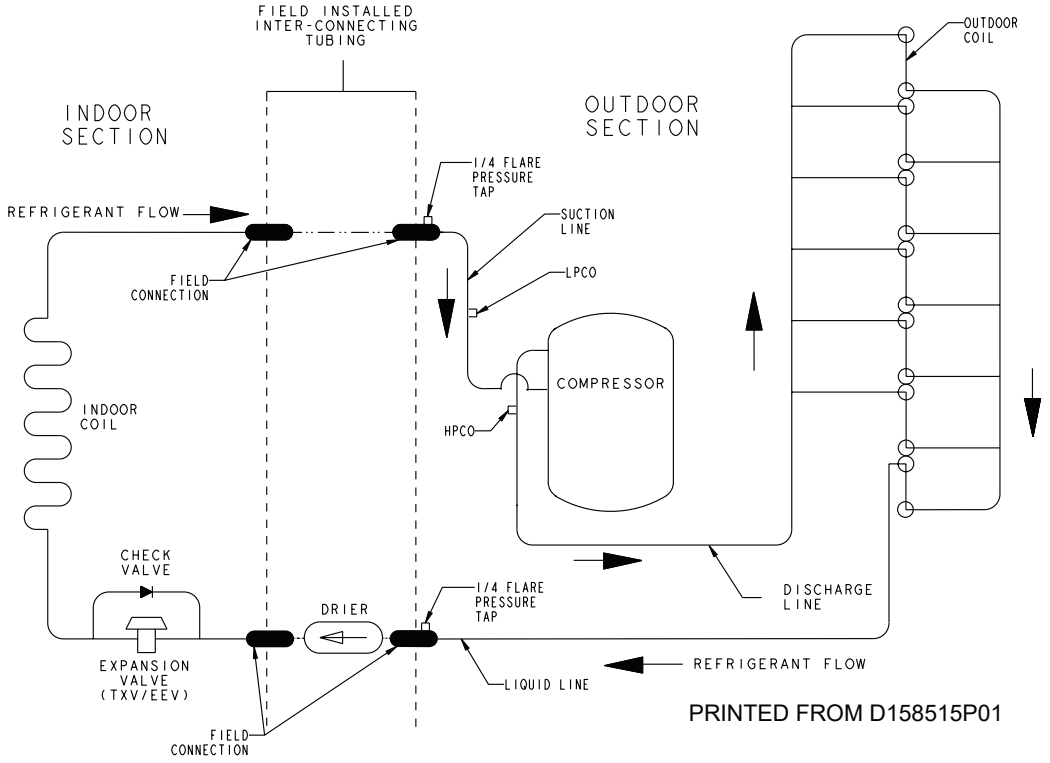
PRINTED FROM D157394P01

3 1/2 & 4-Ton Units



PRINTED FROM D158514P01

5-Ton Units



PRINTED FROM D158515P01

Intertek

6200 Troup Highway
Tyler, TX 75707
www.trane.com

The manufacturer has a policy of continuous product and product data improvement and it reserves the right to change design and specifications without notice.

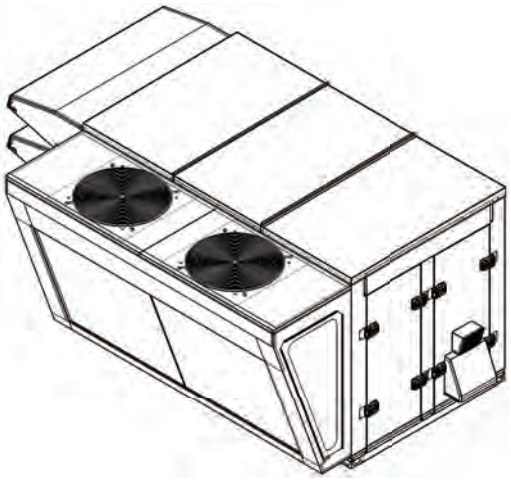
Representative-only illustrations included in this document.

07/15

Installation, Operation, and Maintenance

Horizon™ Outdoor Air Unit

Indirect Fired Gas/Electric Heat/Air Source Heat Pump
Model: OADG and OANG



Important: *Proper execution of the tasks outlined in this* Installation, Operation, and Maintenance *manual require and assume the technician has been certified as a start up technician for the Horizon Outdoor Air unit. This includes working knowledge of the Tracer TU program.*

⚠SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

⚠AVERTISSEMENT DE SÉCURITÉ

L'installation et l'entretien de cet équipement doivent être assurés exclusivement par du personnel qualifié. L'installation, la mise en service et l'entretien d'équipements de chauffage, de ventilation et de climatisation (CVC) présentent un danger et requièrent des connaissances et une formation spécifiques. Une installation, un réglage ou une modification inappropriés d'un équipement par une personne non qualifiée peut provoquer des blessures graves, voire la mort. Lors de toute intervention sur l'équipement, respectez les consignes de sécurité figurant dans la documentation, ainsi que sur les pictogrammes, autocollants et étiquettes apposés sur l'équipement..

November 2019 **OAU-SVX006C-EN**

TRANE

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠WARNING

Câblage sur site et mise à la terre corrects nécessaires!

Le non-respect de la réglementation peut entraîner des blessures graves, voire mortelles. Il est IMPÉRATIF de confier l'ensemble du câblage sur site à un électricien qualifié. Un câblage sur site mal installé ou mal mis à la terre constitue des risques D'INCENDIE et D'ÉLECTROCUTION. Pour éviter ces risques, il est IMPÉRATIF de respecter les obligations en matière de pose de câblage sur site et de mise à la terre tel que stipulé dans les règles du NEC et dans les réglementations électriques locales/nationales..

⚠WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS/SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠AVERTISSEMENT

Équipements de protection individuelle (EPI) obligatoires!

En cas d'équipement de protection individuelle inadapté au travail entrepris, les techniciens s'exposent à des risques de blessures graves voire mortelles. Afin de se prémunir d'éventuels risques électriques, mécaniques et chimiques, les techniciens DOIVENT respecter les consignes préconisées dans le présent manuel, sur les étiquettes et les autocollants, ainsi que les instructions suivantes:

- **Avant d'installer/réparer cette unité, les techniciens doivent IMPÉRATIVEMENT porter tout l'équipement de protection individuelle (EPI) recommandé pour le travail entrepris (exemples : gants/manchons résistants aux coupures, gants en caoutchouc butyl, lunettes de protection, casque de chantier/antichoc, protection contre les chutes, EPI pour travaux électriques et vêtements de protection contre les arcs électriques). Consulter SYSTÉMATIQUEMENT les fiches de données de sécurité et les directives de l'OSHA pour connaître la liste des EPI adaptés.**
- **Lors d'une intervention avec ou à proximité de produits chimiques dangereux, consulter SYSTÉMATIQUEMENT les fiches de données de sécurité appropriées et les directives de l'OSHA/du SGH (système général harmonisé de classification et d'étiquetage des produits chimiques) afin d'obtenir des renseignements sur les niveaux admissibles d'exposition personnelle, la protection respiratoire adaptée et les recommandations de manipulation.**
- **En cas de risque d'éclair, d'arc électrique ou de contact électrique avec un équipement électrique sous tension, et AVANT de réparer l'unité, les techniciens doivent IMPÉRATIVEMENT porter tout l'équipement de protection individuelle (EPI) conformément à l'OSHA, à la norme NFPA 70E ou à toute autre exigence propre au pays pour la protection contre les arcs électriques. NE JAMAIS COMMUTER, DÉBRANCHER ou EFFECTUER DE TEST DE TENSION SANS PORTER UN EPI POUR TRAVAUX ÉLECTRIQUES OU UN VÊTEMENT DE PROTECTION APPROPRIÉ CONTRE LES ARCS ÉLECTRIQUES. IL CONVIENT DE S'ASSURER QUE LES COMPTEURS ET ÉQUIPEMENTS ÉLECTRIQUES CORRESPONDENT À LA TENSION NOMINALE PRÉVUE.**

TRANE

Introduction

⚠WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Ingersoll Rand personnel must follow Ingersoll Rand Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. All policies can be found on the BOS site. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Ingersoll Rand personnel should always follow local regulations.**

⚠AVERTISSEMENT

Respecter les politiques EHS!

Le non-respect des consignes suivantes peut être à l'origine de blessures graves, voire mortelles..

- **Tous les membres du personnel du groupe Ingersoll Rand sont tenus de respecter les règles établies par Ingersoll Rand en matière d'environnement, d'hygiène et de sécurité (EHS) lors d'une intervention, notamment en cas de travaux à chaud, de risque d'électrocution et de chute, de procédures de verrouillage/mise hors service, de manipulation de fluide frigorigène, etc. Toutes les politiques sont disponibles sur le site BOS. Si les réglementations locales sont plus strictes que les règles imposées par le groupe, elles deviennent prioritaires.**
- **Le personnel extérieur au groupe Ingersoll Rand est, quant à lui, systématiquement tenu d'observer les réglementations en vigueur à l'échelle locale.**

⚠WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage. System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

⚠AVERTISSEMENT

Fluide frigorigène sous haute pression!

Tout manquement aux instructions indiquées ci-dessous peut provoquer une explosion pouvant causer des blessures graves voire mortelles ou des dommages matériels. Le système contient de l'huile et du fluide frigorigène sous haute pression. Avant d'ouvrir le circuit, récupérez le fluide frigorigène pour éliminer toute pression dans le circuit. Consultez la plaque constructeur de l'unité pour connaître le type de fluide frigorigène employé. Utilisez uniquement des fluides frigorigènes, substituts et additifs agréés.

⚠WARNING

Hazard of Explosion and Deadly Gases!

Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

⚠AVERTISSEMENT

Risque d'explosion et gaz mortels!

Le non-respect de toutes les consignes de manipulation des fluides frigorigènes peut entraîner la mort ou des blessures graves.
N'effectuez en aucune circonstance des opérations de brasage ou de soudage sur des conduites de fluide frigorigène ou des composants de l'unité sous pression ou pouvant contenir du fluide frigorigène. Récupérez systématiquement le fluide frigorigène en respectant les directives de la loi américaine sur la propreté de l'air (Agence fédérale pour l'environnement) ou toute autre réglementation nationale ou locale en vigueur. Après la récupération du fluide frigorigène, utilisez de l'azote déshydraté pour ramener le système à la pression atmosphérique avant de l'ouvrir pour procéder aux réparations. Les mélanges de fluide frigorigène et d'air sous pression peuvent devenir combustibles en présence d'une source d'inflammation et provoquer une explosion. La chaleur excessive découlant de travaux de soudage ou de brasage associée à la présence de vapeurs de fluide frigorigène peut entraîner la formation de gaz hautement toxiques et d'acides extrêmement corrosifs.

⚠WARNING

Hazard of Explosion and Deadly Gases!

Failure to follow instructions could result in death or serious injury.

If you smell gas:

1. **Open windows.**
2. **Don't touch electrical switches.**
3. **Extinguish any open flame.**
4. **Immediately call your gas supplier.**

⚠AVERTISSEMENT

Risque d'explosion et gaz mortels!

Le non-respect de toutes les consignes de sécurité ci-dessous peut entraîner la mort ou des blessures graves.

Si vous sentez une odeur de gaz:

1. **Ouvrez les fenêtres.**
2. **Ne touches à aucun interrupteur.**
3. **Éteignez toute flamme nue.**
4. **Avertissez immédiatement votre fournisseur de gaz.**

⚠WARNING

Hazardous Service Procedures!

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

⚠AVERTISSEMENT

Procédures d'entretien dangereuses!

Une installation, un réglage, une modification, une réparation ou un entretien incorrect peut entraîner des dommages matériels, des blessures ou la mort. Lisez attentivement les instructions d'installation, de fonctionnement et d'entretien avant de procéder à l'installation ou à l'entretien de cet équipement.

⚠WARNING

Hazard of Explosion and Deadly Gases!

Failure to follow instructions could result in death or serious injury.

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.

⚠AVERTISSEMENT

Risque d'explosion et gaz mortels!

Le non-respect de toutes les consignes de sécurité ci-dessous peut entraîner la mort ou des blessures graves.

Il est dangereux d'utiliser ou d'entreposer de l'essence ou autres liquides ou vapeurs inflammables dans des récipients ouverts à proximité de cet appareil.

Copyright

Trademarks

All trademarks referenced in this document are the trademarks of their respective owners.

Revision History

Added French language translations of warnings.

Table of Contents

TRANE

Table of Contents

TRANE

Model Number Descriptions

Horizon Outdoor Air Unit

Model: OADG and OANG

Digit 1, 2 — Unit Type

OA = Outdoor Air

Digit 3 — Cabinet Size

D = 1250–8000 cfm
N = 5000–25000 cfm

Digit 4 — Major Design Sequence

G = Revision 6

Digit 5, 6, 7 — Normal Gross Cooling Capacity (MBh)

000 = No DX Cooling
010 = 10 Tons High Efficiency
012 = 12 Tons High Efficiency
015 = 15 Tons High Efficiency
017 = 17 Tons High Efficiency
020 = 20 Tons High Efficiency
040 = 40 Tons High Efficiency
045 = 45 Tons High Efficiency
050 = 50 Tons High Efficiency
055 = 55 Tons High Efficiency
060 = 60 Tons High Efficiency
065 = 65 Tons High Efficiency
070 = 70 Tons High Efficiency
075 = 75 Tons High Efficiency
080 = 80 Tons High Efficiency

Digit 8 — Airflow Configuration

A = Vertical Discharge/No Return
B = Horizontal Discharge/No Return
C = Vertical Discharge/Vertical Return
D = Vertical Discharge/Horizontal Return/Exhaust
E = Horizontal Discharge/Vertical Return/Exhaust
F = Horizontal Discharge/Horizontal Return/Exhaust
G = Vertical Discharge/Vertical Return/Vertical Exhaust
H = Vertical Discharge/Vertical Return/Horizontal Exhaust
J = Vertical Discharge/Horizontal Return/Vertical Exhaust
K = Vertical Discharge/Horizontal Return/Horizontal Exhaust
L = Horizontal Discharge/Vertical Return/Vertical Exhaust
M = Horizontal Discharge/Vertical Return/Horizontal Exhaust
N = Horizontal Discharge/Horizontal Return/Vertical Exhaust
P = Horizontal Discharge/Horizontal Return/Horizontal Exhaust

Digit 9 — Voltage Selection

1 = 208/60/3
2 = 230–240/60/3
3 = 460/60/3
4 = 575/60/3

Digit 10 — Not Used

Digit 11 — Indoor Coil Type

0 = No Indoor Coil
C = DX 4-Row
D = DX 6-Row
F = Glycol/Chilled Water Coil—4-Row
G = Glycol/Chilled Water Coil—6-Row
H = Glycol/Chilled Water Coil with Cooney Freeze Block Technology—4-Row
J = Glycol/Chilled Water Coil with Cooney Freeze Block Technology—6-Row

Digit 12 — Reheat

0 = No Reheat
A = Fin and Tube Modulating HGRH

Digit 13 — Compressor

0 = No Compressor
A = Scroll Compressors
B = Digital Scroll—1st Circuit Only
C = Digital Scroll—1st Circuit and 2nd Circuit

Digit 14 — Outdoor Coil

0 = No Condenser
1 = Air-cooled Fin and Tube
3 = Water-cooled Copper/Nickel
4 = Water-cooled Copper/Steel
5 = ASHP Fin and Tube
7 = WSHP Copper/Nickel
8 = WSHP Copper/Steel

Digit 15 — Refrigerant Capacity Control

0 = No RCC Valve
1 = RCC Valve on 1st Circuit

Digit 16 — Heat Type—Primary

0 = No Heat
A = Indirect Fired NG (IF)—Standard Efficiency (80%)
B = Indirect Fired NG (IF)—High Efficiency (82%)
D = Indirect Fired LP (IF)—Standard Efficiency (80%)
E = Indirect Fired LP (IF)—High Efficiency (82%)
G = Hot Water
H = Electric—Staged
J = Electric—SCR Modulating

Digit 17 — Heat Capacity—Primary

		IF	ELEC	HOT WATER
0	=	No Heat		
A	=	50 MBh	5 kW	1 Row/10 FPI
B	=	75 MBh	10 kW	1 Row/12 FPI
C	=	100 MBh	15 kW	1 Row/14 FPI
D	=	125 MBh	20 kW	2 Row/10 FPI
E	=	150 MBh	24 kW	2 Row/12 FPI
F	=	200 MBh	28 kW	2 Row/14 FPI
G	=	250 MBh	32 kW	3 Row/10 FPI
H	=	300 MBh	40 kW	3 Row/12 FPI
J	=	350 MBh	48 kW	3 Row/14 FPI
K	=	400 MBh	60 kW	
L	=	500 MBh	68 kW	
M	=	500 MBh (Dual 250)	79 kW	
N	=	600 MBh	99 kW	
P	=	600 MBh (Dual 300)	111 kW	
R	=	800 MBh	119 kW	
S	=	800 MBh (Dual 400)	139 kW	
T	=	1000 MBh	159 kW	
U	=	1000 MBh (Dual 500)	179 kW	
V	=	1200 MBh	199 kW	
W	=		215 kW	
Y	=		230 kW	
Z	=		250 kW	

Digit 18 — Heat Type—Secondary

0 = No Secondary Heat
4 = Electric—Staged

Digit 19 — Heat Capacity—Secondary

0 = No Secondary Heat
A = 5 kW
B = 10 kW
C = 15 kW
D = 20 kW
E = 24 kW
F = 28 kW
G = 32 kW
H = 40 kW
J = 48 kW
K = 60 kW
L = 68 kW
M = 79 kW
N = 99 kW
P = 111 kW
R = 119 kW

Model Number Descriptions

Digit 20 — Not Used

Digit 21 — Supply Fan Motor

A = 1 hp—1800 rpm
B = 1 hp—3600 rpm
C = 1.5 hp—1800 rpm
D = 1.5 hp—3600 rpm
E = 2 hp—1800 rpm
F = 2 hp—3600 rpm
G = 3 hp—1800 rpm
H = 3 hp—3600 rpm
J = 5 hp—1800 rpm
K = 5 hp—3600 rpm
L = 7.5 hp—1800 rpm
M = 7.5 hp—3600 rpm
N = 10 hp—1800 rpm
P = 10 hp—3600 rpm
R = 15 hp—1800 rpm
S = 15 hp—3600 rpm
T = 20 hp—1800 rpm
U = 20 hp—3600 rpm

Digit 22 — Supply Fan Motor Type

1 = Direct Drive w/VFD
2 = Direct Drive (VFD by Others)
3 = Direct Drive w/Shaft Grounding Ring w/VFD

Digit 23, 24 — Supply Fan Wheel Diameter

AA = 12-in. Wheel
AB = 12-in.—60% Width Wheel
AC = 14-in. Wheel
AD = 14-in.—60% Width Wheel
AE = 16-in. Wheel
AF = 16-in.—60% Width Wheel
AG = 18-in. Wheel
AH = 18-in.—60% Width Wheel
AJ = 20-in. Wheel
AK = 20-in.—60% Width Wheel
AL = 22-in. Wheel
AM = 22-in.—60% Width Wheel
AN = 25-in. Wheel
AP = 25-in.—60% Width Wheel
BG = Dual 18-in. Wheel
BH = Dual 18-in.—60% Width Wheel
BJ = Dual 20-in. Wheel
BK = Dual 20-in.—60% Width Wheel
BL = Dual 22-in. Wheel
BM = Dual 22-in.—60% Width Wheel
BN = Dual 25-in. Wheel
BP = Dual 25-in.—60% Width Wheel

Digit 25 — Exhaust Fan Motor

0 = No Powered Exhaust
A = 1 hp—1800 rpm
B = 1 hp—3600 rpm
C = 1.5 hp—1800 rpm
D = 1.5 hp—3600 rpm
E = 2 hp—1800 rpm
F = 2 hp—3600 rpm
G = 3 hp—1800 rpm
H = 3 hp—3600 rpm
J = 5 hp—1800 rpm
K = 5 hp—3600 rpm
L = 7.5 hp—1800 rpm
M = 7.5 hp—3600 rpm
N = 10 hp—1800 rpm
P = 10 hp—3600 rpm
R = 15 hp—1800 rpm
S = 15 hp—3600 rpm
T = 20 hp—1800 rpm
U = 20 hp—3600 rpm

Digit 26 — Exhaust Fan Motor Type

0 = No Powered Exhaust
1 = Direct Drive w/VFD
2 = Direct Drive (VFD by Others)
3 = Direct Drive w/Shaft Grounding Ring w/VFD

Digit 27, 28 — Exhaust Fan Wheel Diameter

00 = No Powered Exhaust
AA = 12-in. Wheel
AB = 12-in.—60% Width Wheel
AC = 14-in. Wheel
AD = 14-in.—60% Width Wheel
AE = 16-in. Wheel
AF = 16-in.—60% Width Wheel
AG = 18-in. Wheel
AH = 18-in.—60% Width Wheel
AJ = 20-in. Wheel
AK = 20-in.—60% Width Wheel
AL = 22-in. Wheel
AM = 22-in.—60% Width Wheel
AN = 25-in. Wheel
AP = 25-in.—60% Width Wheel
BG = Dual 18-in. Wheel
BH = Dual 18-in.—60% Width Wheel
BJ = Dual 20-in. Wheel
BK = Dual 20-in.—60% Width Wheel
BL = Dual 22-in. Wheel
BM = Dual 22-in.—60% Width Wheel
BN = Dual 25-in. Wheel
BP = Dual 25-in.—60% Width Wheel

Digit 29 — Powered Exhaust Fan Motor (PFM) and Exhaust Dampers

0 = No Piezo Ring
1 = Supply Fan Piezo Ring
2 = Exhaust Fan Piezo Ring
3 = Supply Fan Piezo Ring and Exhaust Fan Piezo Ring

Digit 30 — Not Used

Digit 31 — Unit Controls

0 = No Controls
1 = Space Control
2 = Discharge Air Control
3 = Multi-Zone VAV
4 = Single-Zone VAV

Digit 32 — Building Interface

0 = No Controls
1 = BACnet®
3 = LON

Digit 33 — Filter Options

0 = No Filters
A = MERV-8, 30%
B = MERV-13, 80%
C = MERV-14, 95%
D = MERV-8 30%, MERV-13 80%
E = MERV-8 30%, MERV-14 95%

Digit 34 — Energy Recovery

0 = No Energy Recovery
1 = ERV—Composite Construction with Bypass for Frost Protection
2 = ERV—Composite Construction with Frost Protection w/VFD
3 = ERV—Aluminum Construction with Bypass for Frost Protection
4 = ERV—Aluminum Construction with Frost Protection w/VFD

Digit 35 — Energy Recover Option, Purge

0 = No Purge
1 = Purge

Digit 36 — Energy Recover Wheel Size

0 = No ERV
A = 3014
B = 3622
C = 4136
D = 4634
E = 5262
F = 5856
G = 6488
H = 6876
J = 74122
K = 81146
L = 86170
M = 92180

Digit 37 — Energy Recovery Option, Rotation Sensor

0 = No Rotation Sensor
1 = Rotation Sensor

Digit 38 — Damper Options

1 = 100% OA 2-Position Damper
2 = 100% OA 2-Position Damper w/RA 2-Position Damper
3 = Modulating OA and RA Dampers w/Economizer
4 = Modulating OA Damper

Digit 39 — Exhaust Dampers

0 = No Exhaust Dampers
A = Gravity Dampers
B = Isolation Dampers
C = Barometric Relief Dampers

Digit 40 — Not Used

Digit 41 — Electrical Options

0 = Terminal Block—No Factory Installed Disconnect
A = Non-Fused Disconnect
B = Fused Disconnect Switch
C = 65 SCCR Electrical Rating w/Non-Fused Disconnect
D = 65 SCCR Electrical Rating w/Fused Disconnect
E = 65 KAIC Electrical Rating w/Non-Fused Disconnect
F = 65 KAIC Electrical Rating w/Fused Disconnect
G = Dual Point Power
H = Dual Point Power 65 KAIC
J = Dual Point Power 65 SCCR

TRANE

Model Number Descriptions

Digit 42 — Corrosive Environment Package

0 = No Corrosive Package
A = Eco Coated Coils
B = S/S Interior
C = S/S Coil Casing
D = S/S Coil Casing with Eco Coated Coils
E = S/S Interior, Eco Coated Coils
F = Corrosion Resistant Package

Digit 43 — Outdoor Air Monitoring

0 = No Outdoor Air Monitoring
1 = Airflow Probes

Digit 44 — Condenser Fan Options

0 = No Condenser Fans
A = Standard Condenser Fan
B = Passive Head Pressure Control
C = Active Head Pressure Control
D = ECM Condenser Fans with Active Head Pressure Control
E = ECM Condenser Fans with Active Head Pressure Control for Sound Attenuation

Digit 45 — Compressor Sound Blankets and Sound Attenuation

0 = No Sound Attenuation Package
A = Compressor Sound Blankets
B = Compressor Sound Blankets with Sound Attenuation Condenser Fans

Digit 46 — Smoke Detector

0 = No Smoke Detector
1 = Supply Smoke Detector
2 = Return Smoke Detector
3 = Supply and Return Smoke Detector

Digit 47 — Hailguards

0 = No Hailguards
A = Hailguards

Digit 48 — Service Lights

0 = No Service Lights
A = Supply Fan Section Service Light
B = Exhaust Fan Section Service Light
C = Supply and Exhaust Fan Section Service Light

Digit 49 — UV Lights

0 = No UV Lights
1 = UV Lights

Digit 50 — Not Used

Digit 51 — Unit Installation Location

A = Outdoor
B = Indoor

Digit 52 — Convenience Outlet

0 = No Convenience Outlet
A = Convenience Outlet

Digit 53 — Controls Display

0 = No Display
1 = TD7 Factory Installed
2 = TD7 Remote Mounted

Digit 54 — Cooling Controls

0 = No ReliaTel™
A = ReliaTel™
B = ReliaTel™ with BCIR Card

Digit 55 — Face and Bypass on Indoor Coil

0 = No Face and Bypass

Digit 56 — Thermostat

0 = No Thermostat
1 = Thumbwheel Thermostat

Digit 57 — Altitude

0 = Sea Level to 1000 Feet
1 = 1001 to 2000 Feet
2 = 2001 to 3000 Feet
3 = 3001 to 4000 Feet
4 = 4001 to 5000 Feet
5 = 5001 to 6000 Feet
6 = 6001 to 7000 Feet
7 = Above 7000 Feet

Digit 58 — Condensate Overflow Switch

0 = No Condensate Overflow Switch
A = Condensate Overflow Switch

Digit 59 — Frostat

0 = No Frostat™
A = Frostat™ Installed

Digit 60 — Not Used

Digit 61 — Outdoor Coil Fluid Type

0 = None
1 = Water
2 = Ethylene Glycol
3 = Propylene Glycol
4 = Methanol
5 = Other

Digit 62 — Minimum Damper Leakage

0 = Standard
1 = Class 1A

Digit 63, 64, 65, 66, 67, 68, 69 — Reserved for Future Use