



U.S. Embassy Zagreb

Date: 7-July-2016

To: Prospective Quoters

Subject: Request for Quotations number **SHR900-16-Q0013**

Enclosed is a Request for Quotations (RFQ) for Zagreb CAC's – HVAC Equipment Replacement Project on Chancery Building of the US Embassy Zagreb. If you would like to submit a quotation, follow the instructions in Section J of the solicitation, complete the required portions of the attached document, and submit it to the address shown on the Standard Form 1449 that follows this letter.

We will hold a **site visit** (ref. Section C 52.236-27 SITE VISIT (FEB 1995)) on **Friday 15-July-2016 at 12:30pm at the Embassy**. Should you plan to participate in the visit, please make sure to register for entrance to the Embassy no later than **Wednesday 13-July-2016** at the following email address: todoricm@state.gov.

The U.S. Government intends to award a contract/purchase order to the responsible company submitting an acceptable quotation at the lowest price. We intend to award a contract/purchase order based on initial quotations, without holding discussions, although we may hold discussions with companies in the competitive range if there is a need to do so.

Quotations are due by Monday, 08-August-2016 at 16:00pm. All questions arising from documentation shall be submitted by 18-July-16 to email: todoricm@state.gov and nemeceka@state.gov with title: QUESTIONS - Zagreb CAC's – HVAC Equipment Replacement Project.

Summary on required information for a proposal to be considered complete

Please provide the following:

1. **SF 1442** (fill out 14- 20, Page 2)
2. **Section 2** provides **Instructions to Offerors** for **other information to be included in your quote (A-L Sections, including attachments)**
3. **Section 3** – please register at SAM (System for Award Management) <https://www.sam.gov/portal/SAM/> and enclose SAM registration confirmation in your quote; in order to register at SAM, you will need a DUNS number and a CAGE code (please see last page for instructions on how to obtain the DUNS number and CAGE code)

Sincerely,

Robert F. Doyle
Contracting Officer

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NO. SHR900-16-Q0013	TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (IFB) <input checked="" type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED 28-JUNE-2016	PAGE OF PAGES 1 2
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IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO. PR5392038	6. PROJECT NO.
7. ISSUED BY AMERICAN EMBASSY ZAGREB THOMASA JEFFERSONA 2 10010 ZAGREB, CROATIA	CODE	8. ADDRESS OFFER TO AMERICAN EMBASSY ZAGREB GENERAL SERVICES OFFICE THOMASA JEFFERSONA 2 10010 ZAGREB, CROATIA
9. FOR INFORMATION CALL: ➔	A. NAME Martina Todoric	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS) +385 1 661 2364

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder."

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

TITLE: Request for Quotations

Zagreb CAC's – HVAC Equipment Replacement Project on Chancery Building of the US Embassy Zagreb

SOLICITATION NO.: SHR900-16-Q0013

DATE OF ISSUE: 28-JUNE-2016

BIDS DUE ON: 8-AUGUST-2016

To ensure entrance to the compound for the site visit, please make sure to register your name with the Embassy Procurement Agent, Ms. Martina Todoric at todoricm@state.gov, tel. 01/661-2364 by noon on Wednesday, 13-JULY-2016. The site visit will be held at the Embassy on Friday, 15-JULY-2016 at 12:30pm.

11. The Contractor shall begin performance within 1 calendar days and complete it within 100 calendar days after receiving award, notice to proceed. This performance period is mandatory, negotiable. (See _____.)

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? <i>(If "YES," indicate within how many calendar days after award in Item 12B.)</i> <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	12B. CALENDAR DAYS 10
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ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 2 copies to perform the work required are due at the place specified in Item 8 by 4:00 p.m. (*hour*) local time **08/08/2016** (*date*). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee is, is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by referenced. Offers providing less than 90 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER (Must be fully completed by offeror)

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)	15. TELEPHONE NO. (Include area code)
CODE	16. REMITTANCE ADDRESS (Include only if different than Item 14)
FACILITY CODE	

17. The offeror agrees to perform the work at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government within 60 calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D)

AMOUNTS ➔

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)	B. SIGNATURE	C. OFFER DATE
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AWARD (To be completed by Government)

21.21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA 1990113-5799-47925073-6247-3660	
24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified)	ITEM ➔	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO <input type="checkbox"/> 10 U.S.C. 2304(c)() <input type="checkbox"/> 41 U.S.C. 253(c)()
26. ADMINISTERED BY Block 31	CODE	27. PAYMENT WILL BE MADE BY

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

<input type="checkbox"/> 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return ___ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.	<input type="checkbox"/> 29. AWARD (Contractor is not required to sign this document.) You
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30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)	31.A. NAME OF CONTRACTING OFFICER (TYPE OR PRINT) Robert F. Doyle		
30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE

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REQUEST FOR QUOTATIONS - CONSTRUCTION

A. PRICE

The Contractor shall complete all work, including furnishing all labor, material, equipment and services required under this purchase order for the following firm fixed price and within the time specified. This price shall include all labor, materials, all insurances, overhead and profit.

Total Price (including all labor, materials, overhead and profit)	
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A.1 VALUE ADDED TAX

VALUE ADDED TAX (VAT). The Contractor shall include VAT as a separate charge on the Invoice and as a separate line item in Section B.

B. SCOPE OF WORK

The character and scope of the work are set forth in the contract. The Contractor shall furnish and install all materials required by this contract.

In case of differences between small and large-scale drawings, the latter will govern. Where a portion of the work is drawn in detail and the remainder of the work is indicated in outline, the parts drawn in detail shall apply also to all other portions of the work.

C. PACKAGING AND MARKING

Mark materials delivered to the site as follows: N/A

D. INSPECTION AND ACCEPTANCE

The COR, or his/her authorized representatives, will inspect from time to time the services being performed and the supplies furnished to determine whether work is being performed in a satisfactory manner, and that all supplies are of acceptable quality and standards.

The Contractor shall be responsible for any countermeasures or corrective action, within the scope of this contract, which may be required by the Contracting Officer as a result of such inspection.

D.1 SUBSTANTIAL COMPLETION

(a) "*Substantial Completion*" means the stage in the progress of the work as determined and certified by the Contracting Officer in writing to the Contractor, on which the work (or a portion designated by the Government) is sufficiently complete and satisfactory. Substantial completion means that the property may be occupied or used for the purpose

for which it is intended, and only minor items such as touch-up, adjustments, and minor replacements or installations remain to be completed or corrected which:

- (1) do not interfere with the intended occupancy or utilization of the work, and
 - (2) can be completed or corrected within the time period required for final completion.
- (b) The "date of substantial completion" means the date determined by the Contracting Officer or authorized Government representative as of which substantial completion of the work has been achieved.

Use and Possession upon Substantial Completion - The Government shall have the right to take possession of and use the work upon substantial completion. Upon notice by the Contractor that the work is substantially complete (a Request for Substantial Completion) and an inspection by the Contracting Officer or an authorized Government representative (including any required tests), the Contracting Officer shall furnish the Contractor a Certificate of Substantial Completion. The certificate will be accompanied by a Schedule of Defects listing items of work remaining to be performed, completed or corrected before final completion and acceptance. Failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use upon substantial completion shall not be deemed an acceptance of any work under the contract.

D.2 FINAL COMPLETION AND ACCEPTANCE

D.2.1 "Final completion and acceptance" means the stage in the progress of the work as determined by the Contracting Officer and confirmed in writing to the Contractor, at which all work required under the contract has been completed in a satisfactory manner, subject to the discovery of defects after final completion, and except for items specifically excluded in the notice of final acceptance.

D.2.2 The "*date of final completion and acceptance*" means the date determined by the Contracting Officer when final completion of the work has been achieved, as indicated by written notice to the Contractor.

D.2.3 FINAL INSPECTION AND TESTS. The Contractor shall give the Contracting Officer at least five (5) days advance written notice of the date when the work will be fully completed and ready for final inspection and tests. Final inspection and tests will be started not later than the date specified in the notice unless the Contracting Officer determines that the work is not ready for final inspection and so informs the Contractor.

D.2.4 FINAL ACCEPTANCE. If the Contracting Officer is satisfied that the work under the contract is complete (with the exception of continuing obligations), the Contracting Officer shall issue to the Contractor a notice of final acceptance and make final payment upon:

- Satisfactory completion of all required tests,

- A final inspection that all items by the Contracting Officer listed in the Schedule of Defects have been completed or corrected and that the work is finally complete (subject to the discovery of defects after final completion), and
- Submittal by the Contractor of all documents and other items required upon completion of the work, including a final request for payment (Request for Final Acceptance).

E. DELIVERIES OR PERFORMANCE

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK
(APR 1984)

The Contractor shall be required to:

- commence work under this contract within 14 calendar days after the date the Contractor receives the notice to proceed,
- prosecute the work diligently, and,
- complete the entire work ready for use not later than 45 calendar days after receipt of NTP.

The time stated for completion shall include final cleanup of the premises and completion of punch list items.

52.211-12 LIQUIDATED DAMAGES - CONSTRUCTION (SEPT 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extension, the Contractor shall pay liquidated damages to the Government in the amount of **USD 200.00** for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Default clause.

CONTRACTOR'S SUBMISSION OF CONSTRUCTION SCHEDULES

(a) The time for submission of the schedules referenced in FAR 52.236-15, "Schedules for Construction Contracts", paragraph (a), is hereby modified to reflect the due date for submission as " **10** calendar days after receipt of an executed contract".

(b) These schedules shall include the time by which shop drawings, product data, samples and other submittals required by the contract will be submitted for approval.

(c) The Contractor shall revise such schedules (1) to account for the actual progress of the work, (2) to reflect approved adjustments in the performance schedule, and (3) as required by the Contracting Officer to achieve coordination with work by the Government and any separate contractors used by the Government. The Contractor shall submit a schedule, which sequences work so as to minimize disruption at the job site.

(d) All deliverables shall be in the English language and any system of dimensions (English or metric) shown shall be consistent with that used in the contract. No extension

of time shall be allowed due to delay by the Government in approving such deliverables if the Contractor has failed to act promptly and responsively in submitting its deliverables. The Contractor shall identify each deliverable as required by the contract.

(e) Acceptance of Schedule: When the Government has accepted any time schedule; it shall be binding upon the Contractor. The completion date is fixed and may be extended only by a written contract modification signed by the Contracting Officer. Acceptance or approval of any schedule or revision thereof by the Government shall not:

- (1) Extend the completion date or obligate the Government to do so,
- (2) Constitute acceptance or approval of any delay, or
- (3) Excuse the Contractor from or relieve the Contractor of its obligation to maintain the progress of the work and achieve final completion by the established completion date.

NOTICE OF DELAY

If the Contractor receives a notice of any change in the work, or if any other conditions arise which are likely to cause or are actually causing delays which the Contractor believes may result in late completion of the project, the Contractor shall notify the Contracting Officer. The Contractor's notice shall state the effect, if any, of such change or other conditions upon the approved schedule, and shall state in what respects, if any, the relevant schedule or the completion date should be revised. The Contractor shall give such notice promptly, not more than ten (10) days after the first event giving rise to the delay or prospective delay. Only the Contracting Officer may make revisions to the approved time schedule.

NOTICE TO PROCEED

(a) After receiving and accepting any bonds or evidence of insurance, the Contracting Officer will provide the Contractor a Notice to Proceed. The Contractor must then prosecute the work, commencing and completing performance not later than the time period established in the contract.

(b) It is possible that the Contracting Officer may elect to issue the Notice to Proceed before receipt and acceptance of any bonds or evidence of insurance. Issuance of a Notice to Proceed by the Government before receipt of the required bonds or insurance certificates or policies shall not be a waiver of the requirement to furnish these documents.

WORKING HOURS

All work shall be performed during regular working hours Monday thru Friday 8am - 4pm. Other hours, if requested by the Contractor, may be approved by the Contracting Officer's Representative (COR). The Contractor shall give 24 hours in advance to COR who will consider any deviation from the hours identified above. Changes in work hours, initiated by the Contractor, will not be a cause for a price increase.

PRECONSTRUCTION CONFERENCE

A preconstruction conference will be held 30 days after contract award at at American Embassy, Thomasa Jeffersona 2, 10010 Zagreb, Croatia to discuss the schedule,

submittals, notice to proceed, mobilization and other important issues that effect construction progress. See FAR 52.236-26, Preconstruction Conference.

DELIVERABLES - The following items shall be delivered under this contract:			
<u>Description</u>	<u>Quantity</u>	<u>Deliver Date</u>	<u>Deliver To</u>
Section G. Securities/Insurance	1	10 days after award	CO
Section E. Construction Schedule	1	10 days after award	COR
Section E. Preconstruction Conference	1	10 days after award	COR
Section G. Personnel Biographies	1	10 days after award	COR
Section F. Payment Request	1	Last calendar day of each month	COR
Section D. Request for Substantial Completion	1	15 days before inspection	COR
Section D. Request for Final Acceptance	1	5 days before inspection	COR

F. ADMINISTRATIVE DATA

652.242-70 CONTRACTING OFFICER'S REPRESENTATIVE (COR) (AUG 1999)

(a) The Contracting Officer may designate in writing one or more Government employees, by name or position title, to take action for the Contracting Officer under this contract. Each designee shall be identified as a Contracting Officer's Representative (COR). Such designation(s) shall specify the scope and limitations of the authority so delegated; provided, that the designee shall not change the terms or conditions of the contract, unless the COR is a warranted Contracting Officer and this authority is delegated in the designation.

(b) The COR for this contract is Embassy Facility Manager.

Payment: The Contractor's attention is directed to Section H, 52.232-5, "Payments Under Fixed-Price Construction Contracts". The following elaborates on the information contained in that clause.

Requests for payment, may be made no more frequently than monthly. Payment requests shall cover the value of labor and materials completed and in place, including a prorated portion of overhead and profit.

After receipt of the Contractor's request for payment, and on the basis of an inspection of the work, the Contracting Officer shall make a determination as to the amount, which is then due. If the Contracting Officer does not approve payment of the full amount applied for, less the retainage allowed by in 52.232-5, the Contracting Officer shall advise the Contractor as to the reasons.

Under the authority of 52.232-27(a), the 14 day period identified in FAR 52.232-27(a)(1)(i)(A) is hereby changed to 30 days.

Invoices shall be sent to:
American Embassy Zagreb Financial Management Office Thomasa Jeffersona 2 10010 Zagreb, Croatia

The Contractor shall show Value Added Tax (VAT) as a separate item on invoices submitted for payment.

G. SPECIAL REQUIREMENTS

G.1.0 PERFORMANCE/PAYMENT PROTECTION - The Contractor shall furnish some form of payment protection as described in 52.228-13 in the amount of 50% of the contract price.

G.1.1 The Contractor shall provide the information required by the paragraph above within ten (10) calendar days after award. Failure to timely submit the required security may result in rescinding or termination of the contract by the Government. If the contract is terminated, the Contractor will be liable for those costs as described in FAR 52.249-10, Default (Fixed-Price Construction), which is included in this purchase order.

G.1.2 The bonds or alternate performance security shall guarantee the Contractor's execution and completion of the work within the contract time. This security shall also guarantee the correction of any defects after completion, the payment of all wages and other amounts payable by the Contractor under its subcontracts or for labor and materials, and the satisfaction or removal of any liens or encumbrances placed on the work.

G.1.3 The required securities shall remain in effect in the full amount required until final acceptance of the project by the Government. Upon final acceptance, the penal sum of the performance security shall be reduced to 10% of the contract price. The security shall remain in effect for one year after the date of final completion and acceptance, and the Contractor shall pay any premium required for the entire period of coverage.

G.2.0 INSURANCE - The Contractor is required by FAR 52.228-5, "Insurance - Work on a Government Installation" to provide whatever insurance is legally necessary. The Contractor shall at its own expense provide and maintain during the entire performance period the following insurance amounts:

G.2.1 GENERAL LIABILITY (includes premises/operations, collapse hazard, products, completed operations, contractual, independent contractors, broad form property damage, personal injury) :

(1) BODILY INJURY, ON OR OFF THE SITE, IN U.S. DOLLARS	
Per Occurrence	\$1,000,000.00
Cumulative	\$1,000,000.00
(2) PROPERTY DAMAGE, ON OR OFF THE SITE, IN U.S. DOLLARS	
Per Occurrence	\$1,000,000.00
Cumulative	\$1,000,000.00

G.2.2 The foregoing types and amounts of insurance are the minimums required. The Contractor shall obtain any other types of insurance required by local law or that are ordinarily or customarily obtained in the location of the work. The limit of such insurance shall be as

provided by law or sufficient to meet normal and customary claims.

G.2.3 The Contractor agrees that the Government shall not be responsible for personal injuries or for damages to any property of the Contractor, its officers, agents, servants, and employees, or any other person, arising from and incident to the Contractor's performance of this contract. The Contractor shall hold harmless and indemnify the Government from any and all claims arising therefrom, except in the instance of gross negligence on the part of the Government.

G.2.4 The Contractor shall obtain adequate insurance for damage to, or theft of, materials and equipment in insurance coverage for loose transit to the site or in storage on or off the site.

G.2.5 The general liability policy required of the Contractor shall name "the United States of America, acting by and through the Department of State", as an additional insured with respect to operations performed under this contract.

G.3.0 DOCUMENT DESCRIPTIONS

G.3.1 SUPPLEMENTAL DOCUMENTS: The Contracting Officer shall furnish from time to time such detailed drawings and other information as is considered necessary, in the opinion of the Contracting Officer, to interpret, clarify, supplement, or correct inconsistencies, errors or omissions in the Contract documents, or to describe minor changes in the work not involving an increase in the contract price or extension of the contract time. The Contractor shall comply with the requirements of the supplemental documents, and unless prompt objection is made by the Contractor within 20 days, their issuance shall not provide for any claim for an increase in the Contract price or an extension of contract time.

G.3.1.1. RECORD DOCUMENTS. The Contractor shall maintain at the project site:

- (1) a current marked set of Contract drawings and specifications indicating all interpretations and clarification, contract modifications, change orders, or any other departure from the contract requirements approved by the Contracting Officer; and,
- (2) a complete set of record shop drawings, product data, samples and other submittals as approved by the Contracting Officer.

G.3.1.2. "As-Built" Documents: After final completion of the work, but before final acceptance thereof, the Contractor shall provide:

- (1) a complete set of "as-built" drawings, based upon the record set of drawings, marked to show the details of construction as actually accomplished; and,
- (2) record shop drawings and other submittals, in the number and form as required by the specifications.

G.4.0 LAWS AND REGULATIONS - The Contractor shall, without additional expense to the Government, be responsible for complying with all laws, codes, ordinances, and regulations applicable to the performance of the work, including those of the host country, and with the lawful orders of any governmental authority having jurisdiction. Host country authorities may not enter the construction site without the permission of the Contracting Officer. Unless otherwise directed by the Contracting Officer, the Contractor shall comply with the more stringent of the requirements of such laws, regulations and orders and of the contract. In the event of a conflict between the contract and such laws, regulations and orders, the Contractor shall promptly advise the Contracting Officer of the conflict and of the Contractor's proposed course of action for resolution by the Contracting Officer.

G.4.1 The Contractor shall comply with all local labor laws, regulations, customs and practices pertaining to labor, safety, and similar matters, to the extent that such compliance is not inconsistent with the requirements of this contract.

G.4.2 The Contractor shall give written assurance to the Contracting Officer that all subcontractors and others performing work on or for the project have obtained all requisite licenses and permits.

G.4.3 The Contractor shall submit proper documentation and evidence satisfactory to the Contracting Officer of compliance with this clause.

G.5.0 CONSTRUCTION PERSONNEL - The Contractor shall maintain discipline at the site and at all times take all reasonable precautions to prevent any unlawful, riotous, or disorderly conduct by or among those employed at the site. The Contractor shall ensure the preservation of peace and protection of persons and property in the neighborhood of the project against such action. The Contracting Officer may require, in writing that the Contractor remove from the work any employee that the Contracting Officer deems incompetent, careless, insubordinate or otherwise objectionable, or whose continued employment on the project is deemed by the Contracting Officer to be contrary to the Government's interests.

G.5.1 If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately give notice, including all relevant information, to the Contracting Officer.

G.5.2 After award, the Contractor has ten calendar days to submit to the Contracting Officer a list of workers and supervisors assigned to this project for the Government to conduct all necessary security checks. It is anticipated that security checks will take 14 days to perform. For each individual the list shall include:

Full Name
Place and Date of Birth
Current Address
Identification number (OIB)

Certificate of not being under investigation by the Municipal Court (Uvjerenje o nevođenju postupka s Općinskog suda, zavisno o mjestu stanovanja)
Certificate of no criminal conviction by the Ministry of Justice (Potvrda o nekažnjavanju iz Ministarstva pravosuđa, uprave i lokalne samouprave – Uprava za kazneno pravo, Odjel za kaznenu evidenciju)

Failure to provide any of the above information may be considered grounds for rejection and/or resubmittal of the application. Once the Government has completed the security screening and approved the applicants a badge will be provided to the individual for access to the site. This badge may be revoked at any time due to the falsification of data, or misconduct on site.

G.5.3 The Contractor shall provide an English speaking supervisor on site at all times. This position is considered as key personnel under this purchase order.

G.6.0 Materials and Equipment - All materials and equipment incorporated into the work shall be new and for the purpose intended, unless otherwise specified. All workmanship shall be of good quality and performed in a skillful manner that will withstand inspection by the Contracting Officer.

G.7.0 SPECIAL WARRANTIES

G.7.1 Any special warranties that may be required under the contract shall be subject to the stipulations set forth in 52.246-21, "Warranty of Construction", as long as they are not in conflict.

G.7.2 The Contractor shall obtain and furnish to the Government all information required to make any subcontractor's, manufacturer's, or supplier's guarantee or warranty legally binding and effective. The Contractor shall submit both the information and the guarantee or warranty to the Government in sufficient time to permit the Government to meet any time limit specified in the guarantee or warranty, but not later than completion and acceptance of all work under this contract.

G.8.0 EQUITABLE ADJUSTMENTS

Any circumstance for which the contract provides an equitable adjustment that causes a change within the meaning of paragraph (a) of the "Changes" clause shall be treated as a change under that clause; provided, that the Contractor gives the Contracting Officer prompt written notice (within 20 days) stating:

- (a) the date, circumstances, and applicable contract clause authorizing an equitable adjustment and
- (b) that the Contractor regards the event as a changed condition for which an equitable adjustment is allowed under the contract

The Contractor shall provide written notice of a differing site condition within 10 calendar days of occurrence following FAR 52.236-2, Differing Site Conditions.

G.9.0 ZONING APPROVALS AND PERMITS

The Government shall be responsible for:

- obtaining proper zoning or other land use control approval for the project
- obtaining the approval of the Contracting Drawings and Specifications
- paying fees due for the foregoing; and,
- for obtaining and paying for the initial building permits.

H. CLAUSES

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): <http://www.acquisition.gov/far/> or <http://farsite.hill.af.mil/vffara.htm>. Please note these addresses are subject to change.

If the Federal Acquisition Regulation (FAR) is not available at the locations indicated above, use the Department of State Acquisition website at <http://www.statebuy.state.gov/> to access links to the FAR. You may also use an internet “search engine” (for example, Google, Yahoo, Excite) to obtain the latest location of the most current FAR.

The following Federal Acquisition Regulation clause(s) is/are incorporated by reference (48 CFR CH. 1):

<u>CLAUSE</u>	<u>TITLE AND DATE</u>
52.202-1	DEFINITIONS (NOV 2013)
52.204-9	PERSONAL IDENTITY VERIFICATION OF CONTRACTOR PERSONNEL (JAN 2011)
52.204-10	REPORTING EXECUTIVE COMPENSATION AND FIRST-TIER SUBCONTRACT AWARDS (OCT 2015)
52.204-12	DATA UNIVERSAL NUMBERING SYSTEM NUMBER MAINTENANCE (DEC 2012)
52.204-13	SYSTEM FOR AWARD MANAGEMENT MAINTENANCE (JULY 2013)
52.204-19	INCORPORATION BY REFERENCE OF REPRESENTATIONS AND CERTIFICATIONS (DEC 2014)
52.209-6	PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED OR PROPOSED FOR DEBARMENT (OCT 2015)
52.209-9	UPDATES OF INFORMATION REGARDING RESPONSIBILITY MATTERS (JULY 2013)
52.213-4	TERMS AND CONDITIONS –SIMPLIFIED ACQUISITIONS (OTHER THAN COMMERCIAL ITEMS) (FEB 2016)
52.216-7	ALLOWABLE COST AND PAYMENT (JUN 2013)

52.222-1 NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997)

52.222-19 CHILD LABOR – COOPERATION WITH AUTHORITIES AND REMEDIES (FEB 2016)

52.222-50 COMBATING TRAFFICKING IN PERSONS (FEB 2009)

52.223-18 ENCOURAGING CONTRACTOR POLICIES TO BAN TEXT MESSAGING WHILE DRIVING (AUG 2011)

52.225-13 RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (JUNE 2008)

52.225-14 INCONSISTENCY BETWEEN ENGLISH VERSION AND TRANSLATION OF CONTRACT (FEB 2000)

52.228-4 WORKERS’ COMPENSATION AND WAR-HAZARD INSURANCE OVERSEAS (APR 1984)

52.228-5 INSURANCE - WORK ON A GOVERNMENT INSTALLATION (JAN 1997)

52.228-11 PLEDGES OF ASSETS (JAN 2012)

52.228-13 ALTERNATIVE PAYMENT PROTECTION (JULY 2000)

52.228-14 IRREVOCABLE LETTER OF CREDIT (NOV 2014)

52.229-6 TAXES - FOREIGN FIXED-PRICE CONTRACTS (FEB 2013)

52.229-7 TAXES- FIXED PRICE CONTRACTS WITH FOREIGN GOVERNMENTS (FEB 2013)

52.232-5 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (MAY 2014)

52.232-8 DISCOUNTS FOR PROMPT PAYMENT (FEB 2002)

52.232-11 EXTRAS (APR 1984)

52.232-18 AVAILABILITY OF FUNDS (APR 1984)

52.232-22 LIMITATION OF FUNDS (APR 1984)

52.232-25 PROMPT PAYMENT (JULY 2013)

52.232-27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (MAY 2014)

- 52.232-33 PAYMENT BY ELECTRONIC FUNDS TRANSFER - SYSTEM FOR AWARD MANAGEMENT (JULY 2013)
- 52.232-34 PAYMENT BY ELECTRONIC FUNDS TRANSFER – OTHER THAN SYSTEM FOR AWARD MANAGEMENT (JULY 2013)
- 52.233-1 DISPUTES (MAY 2014) *Alternate I (DEC 1991)*
- 52.233-3 PROTEST AFTER AWARD (AUG 1996)
- 52.236-2 DIFFERING SITE CONDITIONS (APR 1984)
- 52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984)
- 52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)
- 52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)
- 52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)
- 52.236-8 OTHER CONTRACTS (APR 1984)
- 52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)
- 52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)
- 52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)
- 52.236-12 CLEANING UP (APR 1984)
- 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)
- 52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)
- 52.236-21 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)
- 52.236-26 PRECONSTRUCTION CONFERENCE (FEB 1995)
- 52.242-14 SUSPENSION OF WORK (APR 1984)
- 52.243-4 CHANGES (JUN 2007)
- 52.243-5 CHANGES AND CHANGED CONDITIONS (APR 1984)

- 52.244-6 SUBCONTRACTS FOR COMMERCIAL ITEMS (FEB 2016)
- 52.245-2 GOVERNMENT PROPERTY INSTALLATION OPERATION SERVICES (APR 2012)
- 52.245-9 USE AND CHARGES (APR 2012)
- 52.246-12 INSPECTION OF CONSTRUCTION (AUG 1996)
- 52.246-17 WARRANTY OF SUPPLIES OF A NONCOMPLEX NATURE (JUN 2003)
- 52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)
- 52.249-2 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (APR 2012) *Alternate I (SEPT 1996)*
- 52.249-10 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984)
- 52.249-14 EXCUSABLE DELAYS (APR 1984)

The following Department of State Acquisition Regulation (DOSAR) clause(s) is/are set forth in full text:

652.204-70 DEPARTMENT OF STATE PERSONAL IDENTIFICATION CARD ISSUANCE PROCEDURES (MAY 2011)

(a) The Contractor shall comply with the Department of State (DOS) Personal Identification Card Issuance Procedures for all employees performing under this contract who require frequent and continuing access to DOS facilities, or information systems. The Contractor shall insert this clause in all subcontracts when the subcontractor's employees will require frequent and continuing access to DOS facilities, or information systems.

(b) The DOS Personal Identification Card Issuance Procedures may be accessed at <http://www.state.gov/m/ds/rls/rpt/c21664.htm> .

(End of clause)

652.228-71 WORKER'S COMPENSATION INSURANCE (DEFENSE BASE ACT) - SERVICES

(a) This clause supplements FAR 52.228-3. For the purposes of this clause, "covered contractor employees" includes the following individuals:

- (1) United States citizens or residents;
- (2) Individuals hired in the United States or its possessions, regardless of citizenship; and
- (3) Local nationals and third country nationals where contract performance takes place in a country where there are no local workers compensation laws.

(b) The Contractor shall procure Defense Base Act (DBA) insurance directly from a Department of Labor (DOL) approved insurance provider. Approved providers can be found at the DOL website at <http://www.dol.gov/owcp/dlhwc/lscarrrier.htm>.

(c)(1) Section 16 of the State Basic Authorities Act (22 U.S.C. 2680a), as amended, provides that the Defense Base Act shall not apply with respect to such contracts as the Secretary of State determines are contracts with persons employed to perform work for the Department of State on an intermittent basis for not more than 90 days in a calendar year. "Persons" includes individuals hired by companies under contract with the Department. The Procurement Executive has the authority to issue the waivers for Contractor employees who work on an intermittent or short-term basis.

(2) The Contractor shall submit waiver requests to the contracting officer. The request shall contain the following information:

(i) Contract number;

(ii) Name of Contractor;

(iii) Brief description of the services to be provided under the contract and country of performance;

(iv) Name and position title of individual(s);

(v) Nationality of individual(s) (must be U.S. citizen or U.S. resident);

(vi) Dates (or timeframe) of performance at the overseas location; and,

(vii) Evidence of alternative worker's compensation coverage for these employees (e.g., evidence that the State worker's compensation program covers workers on short-term foreign assignments).

(3) The contracting officer shall provide to the Contractor the original of the approved or disapproved document and maintain a copy in the contract file.

(End of clause)

652.229-71 PERSONAL PROPERTY DISPOSITION AT POSTS ABROAD (AUG 1999)

Regulations at 22 CFR Part 136 require that U.S. Government employees and their families do not profit personally from sales or other transactions with persons who are not themselves entitled to exemption from import restrictions, duties, or taxes. Should the Contractor experience importation or tax privileges in a foreign country because of its contractual relationship to the United States Government, the Contractor shall observe the requirements of 22 CFR Part 136 and all policies, rules, and procedures issued by the chief of mission in that foreign country.

(End of clause)

CONTRACTOR IDENTIFICATION (JULY 2008)

Contract performance may require contractor personnel to attend meetings with government personnel and the public, work within government offices, and/or utilize government email.

Contractor personnel must take the following actions to identify themselves as non-federal employees:

- 1) Use an e-mail signature block that shows name, the office being supported and company affiliation (e.g. "John Smith, Office of Human Resources, ACME Corporation Support Contractor");
- 2) Clearly identify themselves and their contractor affiliation in meetings;
- 3) Identify their contractor affiliation in Departmental e-mail and phone listings whenever contractor personnel are included in those listings; and
- 4) Contractor personnel may not utilize Department of State logos or indicia on business cards.

(End of clause)

652.236-70 ACCIDENT PREVENTION (APR 2004)

(a) *General.* The Contractor shall provide and maintain work environments and procedures which will safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to contractor operations and activities; avoid interruptions of Government operations and delays in project completion dates; and, control costs in the performance of this contract. For these purposes, the Contractor shall:

- (1) Provide appropriate safety barricades, signs and signal lights;
- (2) Comply with the standards issued by any local government authority having jurisdiction over occupational health and safety issues; and,
- (3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for this purpose are taken.
- (4) For overseas construction projects, the Contracting Officer shall specify in writing additional requirements regarding safety if the work involves:
 - (i) Scaffolding;
 - (ii) Work at heights above two (2) meters;
 - (iii) Trenching or other excavation greater than one (1) meter in depth;
 - (iv) Earth moving equipment;
 - (v) Temporary wiring, use of portable electric tools, or other recognized electrical hazards. Temporary wiring and portable electric tools require the use of a ground fault circuit interrupter (GFCI) in the affected circuits; other electrical hazards may also require the use of a GFCI;
 - (vi) Work in confined spaces (limited exits, potential for oxygen less than 19.5 percent or combustible atmosphere, potential for solid or liquid engulfment, or other hazards considered to be immediately dangerous to life or health such as water tanks, transformer vaults, sewers, cisterns, etc.);
 - (vii) Hazardous materials – a material with a physical or health hazard including but not limited to, flammable, explosive, corrosive, toxic, reactive or unstable, or any

operations which creates any kind of contamination inside an occupied building such as dust from demolition activities, paints, solvents, etc.; or
(viii) Hazardous noise levels.

(b) *Records.* The Contractor shall maintain an accurate record of exposure data on all accidents incident to work performed under this contract resulting in death, traumatic injury, occupational disease, or damage to or theft of property, materials, supplies, or equipment. The Contractor shall report this data in the manner prescribed by the Contracting Officer.

(c) *Subcontracts.* The Contractor shall be responsible for its subcontractors' compliance with this clause.

(d) *Written program.* Before commencing work, the Contractor shall:

(1) Submit a written plan to the Contracting Officer for implementing this clause. The plan shall include specific management or technical procedures for effectively controlling hazards associated with the project; and,

(2) Meet with the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program.

(e) *Notification.* The Contracting Officer shall notify the Contractor of any non-compliance with these requirements and the corrective actions required. This notice, when delivered to the Contractor or the Contractor's representative on site, shall be deemed sufficient notice of the non-compliance and corrective action required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order suspending all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any suspension of work order issued under this clause.

(End of clause)

652.242-73 AUTHORIZATION AND PERFORMANCE (AUG 1999)

(a) The Contractor warrants the following:

(1) That it has obtained authorization to operate and do business in the country or countries in which this contract will be performed;

(2) That it has obtained all necessary licenses and permits required to perform this contract; and,

(3) That it shall comply fully with all laws, decrees, labor standards, and regulations of said country or countries during the performance of this contract.

(b) If the party actually performing the work will be a subcontractor or joint venture partner, then such subcontractor or joint venture partner agrees to the requirements of paragraph (a) of this clause.

(End of clause)

652.243-70 NOTICES (AUG 1999)

Any notice or request relating to this contract given by either party to the other shall be in writing. Said notice or request shall be mailed or delivered by hand to the other party at the address provided in the schedule of the contract. All modifications to the contract must be made in writing by the Contracting Officer.

(End of clause)

I. LIST OF ATTACHMENTS

ATTACHMENT NUMBER	DESCRIPTION OF ATTACHMENT	NUMBER OF PAGES
Attachment 1	Statement of Work (Specification included)	10
Attachment 2	Sample Bank Letter of Guaranty	1
Attachment 3	Breakdown of Price by Divisions of Specifications	1

J. QUOTATION INFORMATION

A. QUALIFICATIONS OF OFFERORS

Offerors/quoters must be technically qualified and financially responsible to perform the work described in this solicitation. At a minimum, each Offeror/Quoter must meet the following requirements:

- (1) Be able to understand written and spoken English;
- (2) Have an established business with a permanent address and telephone listing;
- (3) Be able to demonstrate prior construction experience with suitable references;
- (4) Have the necessary personnel, equipment and financial resources available to perform the work;
- (5) Have all licenses and permits required by local law;
- (6) Meet all local insurance requirements;
- (7) Have the ability to obtain or to post adequate performance security, such as bonds, irrevocable letters of credit or guarantees issued by a reputable financial institution;
- (8) Have no adverse criminal record; and
- (9) Have no political or business affiliation which could be considered contrary to the interests of the United States.

B. SUBMISSION OF QUOTATIONS

This solicitation is for the performance of the construction services described in SCOPE OF WORK, and the Attachments which are a part of this request for quotation.

Each quotation must consist of the following:		
VOLUME	TITLE	NUMBER OF COPIES*
I	Standard Form 1442 including a completed Attachment 2, "BREAKDOWN OF PROPOSAL PRICE BY DIVISIONS OF SPECIFICATIONS	2
II	Performance schedule in the form of a "bar chart" and Business Management/Technical Proposal	2

Submit the complete quotation to the address indicated. If mailed, on Standard Form 18, or if hand-delivered, use the address set forth below:

American Embassy Zagreb
Thomasa Jeffersona 2
10010 Zagreb, Croatia

The Offeror/Quoter shall identify and explain/justify any deviations, exceptions, or conditional assumptions taken with respect to any of the instructions or requirements of this request for quotation in the appropriate volume of the offer.

Volume II: Performance schedule and Business Management/Technical Proposal.

(a) Present the performance schedule in the form of a "bar chart" indicating when the various portions of the work will be commenced and completed within the required schedule. This bar chart shall be in sufficient detail to clearly show each segregable portion of work and its planned commencement and completion date.

(b) The Business Management/Technical Proposal shall be in two parts, including the following information:

Proposed Work Information - Provide the following:

- (1) A list of the names, addresses and telephone numbers of the owners, partners, and principal officers of the Offeror;
- (2) The name and address of the Offeror's field superintendent for this project;
- (3) A list of the names, addresses, and telephone numbers of subcontractors and principal materials suppliers to be used on the project, indicating what portions of the work will be performed by them; and,

Experience and Past Performance - List all contracts and subcontracts your company has held over the past three years for the same or similar work. Provide the following information for each contract and subcontract:

- (1) Customer's name, address, and telephone numbers of customer's lead contract and technical personnel;
- (2) Contract number and type;
- (3) Date of the contract award place(s) of performance, and completion dates; Contract dollar value;
- (4) Brief description of the work, including responsibilities; and
- (5) Any litigation currently in process or occurring within last 5 years.

C. 52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) A site visit has been scheduled for **Friday, July 15th 2016 at 12:30pm**

(c) Participants will meet at US Embassy Zagreb, Thomasa Jeffersona 2, 10010 Zagreb

D. MAGNITUDE OF CONSTRUCTION PROJECT

It is anticipated that the range in price of this contract will be: between \$25,000 and \$100,000.

E. LATE QUOTATIONS. Late quotations shall be handled in accordance with FAR.

F. 52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates the following provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer.

Also, the full text of a solicitation provision may be accessed electronically at: <http://acquisition.gov/far/index.html/> or <http://farsite.hill.af.mil/vffara.htm>. Please note these addresses are subject to change.

If the Federal Acquisition Regulation (FAR) is not available at the locations indicated above, use the Department of State Acquisition website at <http://www.statebuy.state.gov> to access the link to the FAR, or use of an Internet "search engine" (for example, Google, Yahoo or Excite) is suggested to obtain the latest location of the most current FAR.

The following Federal Acquisition Regulation provisions are incorporated by reference (48 CFR CH. 1):

<u>PROVISION</u>	<u>TITLE AND DATE</u>
52.204-6	DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (JULY 2013)
52.204-7	SYSTEM FOR AWARD MANAGEMENT (JULY 2013)
52.204-16	COMMERCIAL AND GOVERNMENT ENTITY CODE REPORTING (JUL 2015)

52.214-34

SUBMISSION OF OFFERS IN THE ENGLISH LANGUAGE (APR
1991)

52.215-1

INSTRUCTIONS TO OFFERORS--COMPETITIVE ACQUISITION
(JAN 2004)

K. EVALUATION CRITERIA

Award will be made to the lowest priced, acceptable, responsible quoter. The Government reserves the right to reject quotations that are unreasonably low or high in price.

The Government will determine acceptability by assessing the offeror's compliance with the terms of the RFQ. The Government will determine responsibility by analyzing whether the apparent successful quoter complies with the requirements of FAR 9.1, including:

- ability to comply with the required performance period, taking into consideration all existing commercial and governmental business commitments;
- satisfactory record of integrity and business ethics;
- necessary organization, experience, and skills or the ability to obtain them;
- necessary equipment and facilities or the ability to obtain them; and
- otherwise, qualified and eligible to receive an award under applicable laws and regulations.

The following DOSAR is provided in full text:

652.209-79 REPRESENTATION BY CORPORATION REGARDING AN UNPAID DELINQUENT TAX LIABILITY OR A FELONY CRIMINAL CONVICTION UNDER ANY FEDERAL LAW (SEPT 2014) (DEVIATION per PIB 2014-21)

(a) In accordance with section 7073 of Division K of the Consolidated Appropriations Act, 2014 (Public Law 113-76) none of the funds made available by that Act may be used to enter into a contract with any corporation that –

(1) Was convicted of a felony criminal violation under any Federal law within the preceding 24 months, where the awarding agency has direct knowledge of the conviction, unless the agency has considered, in accordance with its procedures, that this further action is not necessary to protect the interests of the Government; or

(2) Has any unpaid Federal tax liability that has been assessed for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, where the awarding agency has direct knowledge of the unpaid tax liability, unless the Federal agency has considered, in accordance with its procedures, that this further action is not necessary to protect the interests of the Government.

For the purposes of section 7073, it is the Department of State's policy that no award may be made to any corporation covered by (1) or (2) above, unless the Procurement Executive has made a written determination that suspension or debarment is not necessary to protect the interests of the Government.

(b) Offeror represents that—

(1) It is [] is not [] a corporation that was convicted of a felony criminal violation under a Federal law within the preceding 24 months.

(2) It is [] is not [] a corporation that has any unpaid Federal tax liability that has been assessed for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

(End of provision)

L. SECTION L - REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS OR QUOTERS

L.1 52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

(a) Definitions.

"Common parent", as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Taxpayer Identification Number (TIN)", as used in this provision, means the number required by the IRS to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

- (b) All offerors must submit the information required in paragraphs (d) through (f) of this provision in order to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325 (d), reporting requirements of 26 USC 6041, 6041A, and 6050M and implementing regulations issued by the Internal Revenue Service (IRS). If the resulting contract is subject to the reporting requirements described in FAR 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments
- (c) otherwise due under the contract.

- (d) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 USC 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(e) Taxpayer Identification Number (TIN).

TIN: _____

- TIN has been applied for.
- TIN is not required because:
 - Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the U.S. and does not have an office or place of business or a fiscal paying agent in the U.S.;
 - Offeror is an agency or instrumentality of a foreign government;
 - Offeror is an agency or instrumentality of the Federal Government.

(e) Type of Organization.

- Sole Proprietorship;
- Partnership;
- Corporate Entity (not tax exempt);
- Corporate Entity (tax exempt);
- Government Entity (Federal, State or local);

- Foreign Government;
- International organization per 26 CFR 1.6049-4;
- Other _____.

(f) Common Parent.

- Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this clause.
- Name and TIN of common parent:
Name _____
TIN _____

L.2 Annual Representations and Certifications. (Apr 2016)

(a) (1) The North American Industry classification System (NAICS) code for this acquisition is/are: **236118 - Construction Management, residential remodeling**

236220 - Construction Management, commercial and institutional building or Warehouse construction

237990 - Construction Management, outdoor recreation facility

(2) The small business size standard is **\$36.5 Million USD**.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) (1) If the provision at 52.204-7, System for Award Management, is included in this solicitation, paragraph (d) of this provision applies.

(2) If the provision at 52.204-7 is not included in this solicitation, and the offeror is currently registered in the System for Award Management (SAM), and has completed the Representations and Certifications section of SAM electronically, the offeror may choose to use paragraph (d) of this provision instead of completing the corresponding individual representations and certification in the solicitation. The offeror shall indicate which option applies by checking one of the following boxes:

(i) Paragraph (d) applies.

(ii) Paragraph (d) does not apply and the offeror has completed the individual representations and certifications in the solicitation.

(c) (1) The following representations or certifications in SAM are applicable to this solicitation as indicated:

(i) 52.203-2, Certificate of Independent Price Determination. This provision applies to solicitations when a firm-fixed-price contract or fixed-price contract with economic price adjustment is contemplated, unless—

(A) The acquisition is to be made under the simplified acquisition procedures in Part 13;

(B) The solicitation is a request for technical proposals under two-step sealed bidding procedures; or

- (C) The solicitation is for utility services for which rates are set by law or regulation.
- (ii) 52.203-11, Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions. This provision applies to solicitations expected to exceed \$150,000.
- (iii) 52.204-3, Taxpayer Identification. This provision applies to solicitations that do not include the provision at 52.204-7, System for Award Management.
- (iv) 52.204-5, Women-Owned Business (Other Than Small Business). This provision applies to solicitations that—
 - (A) Are not set aside for small business concerns;
 - (B) Exceed the simplified acquisition threshold; and
 - (C) Are for contracts that will be performed in the United States or its outlying areas.
- (v) 52.209-2, Prohibition on Contracting with Inverted Domestic Corporations—Representation.
- (vi) 52.209-5; Certification Regarding Responsibility Matters. This provision applies to solicitations where the contract value is expected to exceed the simplified acquisition threshold.
- (vii) 52.209-11, Representation by Corporations Regarding Delinquent Tax Liability or a Felony Conviction under any Federal Law. This provision applies to all solicitations.
- (viii) 52.214-14, Place of Performance--Sealed Bidding. This provision applies to invitations for bids except those in which the place of performance is specified by the Government.
- (ix) 52.215-6, Place of Performance. This provision applies to solicitations unless the place of performance is specified by the Government.
- (x) 52.219-1, Small Business Program Representations (Basic & Alternate I). This provision applies to solicitations when the contract will be performed in the United States or its outlying areas.
 - (A) The basic provision applies when the solicitations are issued by other than DoD, NASA, and the Coast Guard.
 - (B) The provision with its Alternate I applies to solicitations issued by DoD, NASA, or the Coast Guard.
- (xi) 52.219-2, Equal Low Bids. This provision applies to solicitations when contracting by sealed bidding and the contract will be performed in the United States or its outlying areas.
- (xii) 52.222-22, Previous Contracts and Compliance Reports. This provision applies to solicitations that include the clause at 52.222-26, Equal Opportunity.

(xiii) 52.222-25, Affirmative Action Compliance. This provision applies to solicitations, other than those for construction, when the solicitation includes the clause at 52.222-26, Equal Opportunity.

(xiv) 52.222-38, Compliance with Veterans' Employment Reporting Requirements. This provision applies to solicitations when it is anticipated the contract award will exceed the simplified acquisition threshold and the contract is not for acquisition of commercial items.

(xv) 52.223-1, Biobased Product Certification. This provision applies to solicitations that require the delivery or specify the use of USDA-designated items; or include the clause at 52.223-2, Affirmative Procurement of Biobased Products Under Service and Construction Contracts.

(xvi) 52.223-4, Recovered Material Certification. This provision applies to solicitations that are for, or specify the use of, EPA- designated items.

(xvii) 52.225-2, Buy American Certificate. This provision applies to solicitations containing the clause at 52.225-1.

(xviii) 52.225-4, Buy American--Free Trade Agreements--Israeli Trade Act Certificate. (Basic, Alternates I, II, and III.) This provision applies to solicitations containing the clause at 52.225- 3.

(A) If the acquisition value is less than \$25,000, the basic provision applies.

(B) If the acquisition value is \$25,000 or more but is less than \$50,000, the provision with its Alternate I applies.

(C) If the acquisition value is \$50,000 or more but is less than \$77,533, the provision with its Alternate II applies.

(D) If the acquisition value is \$79,507 or more but is less than \$100,000, the provision with its Alternate III applies.

(xix) 52.225-6, Trade Agreements Certificate. This provision applies to solicitations containing the clause at 52.225-5.

(xx) 52.225-20, Prohibition on Conducting Restricted Business Operations in Sudan-- Certification. This provision applies to all solicitations.

(xxi) 52.225-25, Prohibition on Contracting with Entities Engaging in Certain Activities or Transactions Relating to Iran—Representation and Certification. This provision applies to all solicitations.

(xxii) 52.226-2, Historically Black College or University and Minority Institution Representation. This provision applies to solicitations for research, studies, supplies, or services of the type normally acquired from higher educational institutions.

FAR Clause	Title	Date	Change

(2) The following representations or certifications are applicable as indicated by the Contracting Officer:

N/A (i) 52.204-17, Ownership or Control of Offeror.

N/A (ii) 52.204-20, Predecessor of Offeror.

N/A (iii) 52.222-18, Certification Regarding Knowledge of Child Labor for Listed End Products.

N/A (iv) 52.222-48, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment--Certification.

N/A (v) 52.222-52 Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services--Certification.

N/A (vi) 52.223-9, with its Alternate I, Estimate of Percentage of Recovered Material Content for EPA-Designated Products (Alternate I only).

N/A (vii) 52.227-6, Royalty Information.

(A) Basic.

(B) Alternate I.

N/A (viii) 52.227-15, Representation of Limited Rights Data and Restricted Computer Software.

- (c) The offeror has completed the annual representations and certifications electronically via the SAM Web site accessed through <https://www.acquisition.gov> . After reviewing the SAM database information, the offeror verifies by submission of the offer that the representations and certifications currently posted electronically that apply to this solicitation as indicated in paragraph (c) of this provision have been entered or updated within the last 12 months, are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the NAICS code referenced for this solicitation), as of the date of this offer and are incorporated in this offer by reference (see FAR 4.1201); except for the changes identified below [offeror to insert changes, identifying change by clause number, title, date]. These amended representation(s) and/or certification(s) are also incorporated in this offer and are current, accurate, and complete as of the date of this offer.

Any changes provided by the offeror are applicable to this solicitation only, and do not result in an update to the representations and certifications posted on SAM.

L.3. 52.225-18 PLACE OF MANUFACTURE (SEPT 2006)

(a) *Definitions.* As used in this clause—

“Manufactured end product” means any end product in Federal Supply Classes (FSC) 1000-9999, except—

- (1) FSC 5510, Lumber and Related Basic Wood Materials;
- (2) Federal Supply Group (FSG) 87, Agricultural Supplies;
- (3) FSG 88, Live Animals;
- (4) FSG 89, Food and Related Consumables;
- (5) FSC 9410, Crude Grades of Plant Materials;
- (6) FSC 9430, Miscellaneous Crude Animal Products, Inedible;
- (7) FSC 9440, Miscellaneous Crude Agricultural and Forestry Products;
- (8) FSC 9610, Ores;
- (9) FSC 9620, Minerals, Natural and Synthetic; and
- (10) FSC 9630, Additive Metal Materials.

“Place of manufacture” means the place where an end product is assembled out of components, or otherwise made or processed from raw materials into the finished product that is to be provided to the Government. If a product is disassembled and reassembled, the place of reassembly is not the place of manufacture.

(b) For statistical purposes only, the offeror shall indicate whether the place of manufacture of the end products it expects to provide in response to this solicitation is predominantly—

- (1) In the United States (Check this box if the total anticipated price of offered end products manufactured in the United States exceeds the total anticipated price of offered end products manufactured outside the United States); or
- (2) Outside the United States.

(End of provision)

L.4 AUTHORIZED CONTRACTOR ADMINISTRATOR

If the offeror does not fill-in the blanks below, the official who signed the offer will be deemed to be the offeror's representative for Contract Administration, which includes all matters pertaining to payments.

Name:
Telephone Number:
Address:

[Proposal Note: If the bidder/offeror has indicated “yes” in blocks (a)(1), (2), or (3) of the following provision, the bidder/offeror shall include Defense Base Act insurance costs

covering those employees in their proposed prices. The bidder/offeror may obtain DBA insurance directly from any Department of Labor approved providers at the DOL website at <http://www.dol.gov/owcp/dlhwc/lscarrier.htm>.]

**L.5 652.228-70 DEFENSE BASE ACT – COVERED CONTRACTOR EMPLOYEES
(JUN 2006)**

(a) Bidders/offerors shall indicate below whether or not any of the following categories of employees will be employed on the resultant contract, and, if so, the number of such employees:

<u>Category</u>	<u>Yes/No</u>	<u>Number</u>	
(1) United States citizens or residents			
(2) Individuals hired in the United States, regardless of citizenship			
(3) Local nationals or third country nationals where contract performance takes place in a country where there are no local workers' compensation laws		local nationals:	
		third-country nationals:	
(4) Local nationals or third country nationals where contract performance takes place in a country where there are local workers' compensation laws		local nationals:	
		third-country nationals:	

(b) The Contracting Officer has determined that for performance in the country of [*Note to Contracting Officer: insert country of performance and check the appropriate block below.*] –

- Workers' compensation laws exist that will cover local nationals and third country nationals.
- Workers' compensation laws do not exist that will cover local nationals and third country nationals.

(c) If the bidder/offeror has indicated "yes" in block (a)(4) of this provision, the bidder/offeror shall not purchase Defense Base Act insurance for those employees. However, the bidder/offeror shall assume liability toward the employees and their beneficiaries for war-hazard injury, death, capture, or detention, in accordance with the clause at FAR 52.228-4.

(d) RESERVED

(End of provision)

ATTACHMENT #2 - UNITED STATES DEPARTMENT OF STATE
BREAKDOWN OF PRICE BY DIVISIONS OF SPECIFICATIONS

(1) DIVISION/DESCRIPTION (2) LABOR (3) MATERIALS (4) OVERHEAD
(5) PROFIT (6) TOTAL

1. General Requirements
2. Site Work

3. Concrete
4. Masonry

5. Metals
6. Wood and Plastic

7. Thermal and Moisture
8. Doors and Windows

9. Finishes
10. Specialties

11. Equipment
12. Furnishings

13. Special Construction
14. Conveying Systems

15. Mechanical
16. Electrical

TOTAL: _____

[*Note to Contracting Officer: identify currency*]

Allowance Items:

PROPOSAL PRICE: _____

TOTAL: [*Note to Contracting Officer: identify currency*]

Alternates (list separately; do not total):

Offeror: _____ *Date* _____

PRICE BREAKDOWN BY DIVISION OF SPECIFICATION ITEMS

DUNS instructions

In order to register at SAM, you will need a DUNS number and a CAGE code:

How to obtain a DUNS Number

1. Click on the following link <http://ccr.dnb.com/ccr/pages/CCRSearch.jsp> or <http://fedgov.dnb.com/webform>
2. Click to request a D-U-N-S Number via the Web
3. Select your country: Croatia
4. Fill out the form. Provide: Business Name, Enter the verification code you see. Click: SUBMIT
If a D-U-N-S Number has already been assigned to the vendor – you should be able to request it by clicking on the “Request your existing D-U-N-S Number” button.
If NO D-U-N-S Number was already assigned to your business follow steps number 5 and 6 below...
5. Click “Request a New D-U-N-S Number” Button;
6. Fill out the “Request for New D-U-N-S Number” Form. Provide the name of your Company as it is written into the Central Registry of Republic of Croatia (do NOT translate your company name into English). Under the “Notes” tab please provide your Company’s Unique Identification Number (Maticni Broj) and Tax Number (Porezni Broj). When done click “Submit Your Request” Button. You should receive the DUNS number within 1-2 business days.

Should you need a SIC Code please look for it at <http://www.sec.gov/info/edgar/siccodes.htm>.

How to obtain a CAGE Code

Go to: <https://eportal.nspa.nato.int/ac135public/>

1. Click on the "CAGE Code Request" tab and follow the instructions.
The first screen will allow you to check to see if an NCAGE is already assigned to the company that you require an NCAGE for. If your search does not find an existing NCAGE, click on the tab called "Request New CAGE" at the bottom of the search results screen. Follow the instructions provided on the Web site. Make sure you request for "S-CAGE" and not "I-CAGE".
To do that,
 - Choose "private company" under "Type of Entity";
 - Emergency under Emergency Level;
 - Respond "no" to the question: "Is the entity to be registered";
 - Country: Croatia. Then click Ok
2. On the next screen, you fill out all fields marked with * (First Name, Last Name, email). Then, click on Step 2
3. Fill in the fields and then click on Step 3
4. On the Organization Data - Generals screen, choose all applicable responses. Under Questionnaire - future business, select "No" for the question related to "invitation to Tender" and "yes" to question saying "CAGE Code requested by the US CCR". Choose "No" as well to the Questionnaire - former CAGE Code. Then, click on Step 4.
5. You will be prompted to a screen asking you to verify the information you have provided. If ok, click on "Create".
6. After you submit your request, you will automatically receive:
 - 1) a request confirmation/validation e-mail message. You will have to reply to this message and;
 - 2) a second e-mail message once the CAGE request is processed (assignment of the code or reject of the request).

ATTACHMENT #3 – STATEMENT OF WORK



**U.S. Department of State
Bureau of Overseas Buildings Operations**

**STATEMENT OF WORK
FOR**

Zagreb CAC's – HVAC Equipment Replacement

**United States Embassy
Zagreb, Croatia**

May 26, 2016

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Exhibit B – Existing York RTU Literature

Exhibit C – Mechanical/Electrical Project Scope Sketches

Exhibit D – Project Specifications

U.S. DEPARTMENT OF STATE
United States Embassy
Zagreb, Croatia

1.0 INTRODUCTION

- 1.1 The United States Department of State (DOS) requires construction services to remove and replace three (3) curb mounted roof top units (RTU's) installed on the Compound Access Control (CAC) buildings at the U.S Embassy Compound in Zagreb, Croatia. The project also requires the installation of two (2) new heat pump systems for CAC's 1 and 3. The CAC buildings are one (1) story buildings located around the perimeter of the compound. The work will consist of replacing one (1) RTU at each of the three (3) CAC buildings. The intent is for the new RTU's to fit on the existing to remain RTU curbs. The two (2) new heat pump systems shall be installed to condition the guard booth areas of CAC's 1 and 3. The indoor heat pump unit shall be a ducted system that is installed in the plenum ceiling above the guard rooms. The new outdoor unit will be installed on the roof of the CACs adjacent to the RTUs. The contractor shall remove and properly dispose of demolished equipment and materials. This work will also include any necessary modifications to the CAC building's roofing/flashing, electrical, and HVAC systems and their associated components. The anticipated project schedule will be provided during the pre-bid walk-thru. The project must be complete prior to the beginning of the heating season in Zagreb.
- 1.2 The Project Director / Contracting Officer's Representative (PD/COR) Point of Contact for matters related to this SOW is as follows:
- U.S. Embassy Zagreb, Croatia
Alen Nemeček
Assistant Facility Manager
Thomasa Jeffersona 2
(e) nemeceka@state.gov
- 1.3 A pre-bid walk-thru will be coordinated with invited bidders by the PD/COR and the Zagreb Post Facility Manager (FM). The project schedule, along with other miscellaneous project specifics will be reviewed during the walk-thru.

2.0 GENERAL REQUIREMENTS

- 2.1 *Basic Work Summary.* The Contractor shall provide workers, equipment, and materials necessary to:
- a. Remove and properly dispose of the three (3) existing RTU's and associated materials. Unless otherwise dictated by the PD/COR, the contractor should expect to only be able to work on one (1) CAC at a time to minimize the impact to normal operations.
 - b. Provide and Install three (3) new RTU's and associated devices, such as new electrical disconnects, thermostats, canvas/flex connections, natural gas regulators, p-trap and local condensate piping, etc.
 - c. Provide and Install two (2) new heat pump systems with emergency/back-up

electric resistance heat and associated devices, such as electrical conductors/conduits, electrical breakers/disconnects, equipment pads, ductwork, canvas/flex connections, thermostats, vibration isolation, secondary drain pans, condensate pumps, condensate piping, etc. Contractor shall make new roof penetrations for new outdoor air (OA) intakes and refrigerant piping /controls wiring.

In addition to the new equipment: rigging, ductwork, duct connections, duct accessories, piping, piping accessories disconnect switches, electrical whip connectors, thermostats, controllers, and controls wiring are also included. Mechanical, electrical, light carpentry, roofing/flushing, and painting are involved. Test, Adjust, and Balance (TAB), Factory Representative Start-up, and basic adjustments of the new equipment are part of the Work.

- 2.2 *Building Codes.* Work is governed by the latest version of the International Building Code (IBC) and the OBO Supplements, which includes the International Mechanical Code, International Plumbing Code, and National Electric Code. Work shall comply with OBO standards and local jurisdictional requirements. Work not in compliance with the IBC and NEC shall be deemed not in compliance with the Contract.
- 2.3 *Additional Info.* Included with this Statement of Work narrative are attached exhibits including (Exhibit A) photos of existing conditions/equipment, (Exhibit B) existing York RTU literature, (Exhibit C) sketches of demolition and new work requirements, (Exhibit D) construction specifications.
 - 2.3.1 *Project Orientation Photos.* See Exhibit A for orientation photos of existing equipment/systems.
 - 2.3.2 *Specifications and Drawings.* This Statement of Work document and attached Mechanical/Electrical Project Orientation Sketches (Exhibit C) describe the general project requirements. The Exhibit C sketches outline the project intent and shall be understood as a diagrammatic tool to orient the contractor with the general requirements. Where more detailed information is required, the attached Specifications (Exhibit D) shall be referenced. The contractor shall comply with the requirements of the construction specifications (as applicable to this project and as modified by this Statement of Work documentation). Any conflicts between documentation should immediately be brought to the attention of the PD/COR.
- 2.4 *Seismic.* Seismic restraints shall be applied to new mechanical equipment, piping, and ductwork. Seismic restraints shall be designed to meet zone 3 classification design to restrict horizontal seismic forces in two directions, transverse and longitudinal directions.
- 2.5 *Location.* The Project takes place at the Embassy of the United States of America, Ulica Thomasa Jeffersona 2, 10010 Zagreb Croatia.
- 2.6 *Shipping.* The Contractor is responsible for shipping, delivery, and storage of all tools, materials, and equipment to the Work site.
- 2.7 *Safety.* The Contractor is responsible for the safety of for his/her employees, and for conduct of the work in a manner that prioritizes the safety of Post residents, employees, and visitors.

- 2.8 *Damage.* Protect parking lots, sidewalks, landscaping, furniture, furnishings, carpets, and interior finishes from damage. Damage caused by the Contractor will be returned to original condition at the expense of the Contractor.
- 2.9 *Interruptions of Service.* The Contractor shall maintain existing systems in service to the maximum extent possible and coordinate interruptions of any utility services in advance with the Facility Manager.
- 2.10 *Refrigerant Handling.* Handling / charging of refrigerants for use in air conditioning systems shall comply with U.S. and Zagreb, Croatia laws and regulations.
- 2.11 *Drawing/AutoCAD Files.* If needed for reference, available existing design/construction documentation, including AutoCAD files of the CACs may be provided by the PD/COR if requested by the contractor. Availability and accuracy of existing files cannot be guaranteed.
- 2.12 *Submittals.* The contractor shall provide submittals for all new equipment, materials, and chemicals. See included specifications exhibit for additional information.
- 2.13 *Warranty.* The contractor shall provide warranties on all equipment, materials, and workmanship. See included specifications exhibit for additional information.

3.0 SCOPE OF WORK

- 3.1 Provide workers, equipment, and materials necessary to replace three (3) existing Roof Top Units (RTU's) with three (3) new RTU's and install two (2) new heat pump systems. Trades shall include, but may not be limited to mechanical, electrical, roofing/flashing, carpentry, and painting.
- 3.2 In addition to the providing the new mechanical and electrical equipment; duct work, duct connections, miscellaneous duct accessories, piping, piping connections, valves, gages, thermostats, miscellaneous piping accessories, disconnect switches, circuit breakers, electrical conductors, thermostats, controls wiring, and other miscellaneous materials are part of the Work.
- 3.3 All used equipment, debris, trash and hazardous materials will be removed from the property and disposed of properly by the contractor. At a minimum, materials shall be removed weekly. Locations for dumpsters are not guaranteed. Access for trucks/dumpsters shall be coordinated with the PD/COR and FM. The Contractor is responsible for ensuring that disposal of equipment, debris, and hazardous material complies with the laws and regulations of Zagreb, Croatia.
- 3.4 Start-up and commissioning of the new units is part of the Work. All mechanical and electrical functions at the mechanical equipment and at the thermostat(s)/controllers will be verified in all modes, which shall include, but are not limited to heating and cooling modes. Start-up and commissioning shall be completed with the FM or designated technical staff in attendance. Coordinate with PD/COR and FM.
- 3.5 Training: The contractor shall provide training for all new equipment/systems to the facility maintenance staff. Coordinate with PD/COR and FM.

3.6 **Existing Equipment Modification / Removal / Demolition Requirements:**

(See attached Exhibit C - Sketches and Exhibit D - Specifications for additional information)

- 3.6.1 **General:** The contractor shall provide all means to shut-down equipment, isolate equipment, drain down, flush and refill the systems, and lock-out/tag-out systems as required to safely complete the specified tasks.
- 3.6.2 **Remove the three (3) existing York RTUs and Accessories:** Expect work to take place on one CAC at a time, unless otherwise noted. The contractor shall remove the existing York RTUs. Removal shall include any misc. ductwork/duct connections, electrical circuiting/breakers, controls wiring/devices, and piping that will not be used as part of the new work. The contractor shall make an effort to keep infrastructure in place that can be reused as part of the new work tasks; however, devices associated with the RTU's shall be replaced with new, such as condensate p-traps, natural gas pressure regulators, natural gas manual shut-off valves, natural gas dirt-legs, programmable thermostats, etc. See Exhibit C for equipment locations and additional information.

3.7 **New Equipment and New Work Requirements – General Descriptions**

(See attached Exhibit C - Sketches and Exhibit D - Specifications for additional information)

3.7.1 **New RTUs:**

i. Requirement Summary:

- 1. The contractor shall install three (3) new RTU's and all necessary mechanical and electrical accessories to provide a fully functioning system that meets the project requirements. Contractor shall modify and install flashing on existing roof curbs as necessary to accommodate new RTU's.
- 2. The contractor shall provide new controllers/programmable thermostats, sensors, wiring, and necessary devices.
- 3. Perform air-side test, adjust, and balance (TAB) procedure on all three (3) new RTU's

ii. New Equipment Summary:

(Manufacturer/Model substitutions shall meet or exceed the York Sunline Series Equipment. Substitutions are subject to approval by the PD/COR, FM, and FAC/PS Mechanical Engineer. If a substitution is accepted, the contractor is responsible for any curb/roof/flashing modifications. If curb adapters are to be provided, the contractor shall provide detailed/dimensioned drawings for review by FM and PD/COR.)

1. Three (3) New Constant Volume Roof Top Units

- a. Basis of Design: York Sunline 2000
- b. CAC-1, 2, and 3 RTUs shall have 3 Ton (10.5 kW) cooling capacity
- c. Electrical System: 400Y/230V, 3PH, 4 Wire, 50 Hz
- d. Return air filters shall be MERV 8 minimum.
- e. RTUs shall be Constant Volume

- f. RTUs shall have adjustable barometric relief for space pressurization control
 - g. RTUs shall be furnished with motor operated outdoor air (OA) dampers and associated controls. Outdoor air dampers shall open to the balanced set point during occupied hours, but remain closed during unoccupied hours.
 - h. Down-blast. Ductwork shall match existing configuration. New RTU shall sit directly on existing to remain RTU roof curb
 - i. Natural gas heat. Stainless Steel natural gas indirect fired burners
 - j. New RTUs shall be furnished with 7-Day programmable thermostats
 - k. New equipment shall use: R-410a, R-407c, or R-134a refrigerant.
 - l. New RTUs shall provide full cooling capacity with ambient conditions at 35 Deg. C. dry bulb. At 41 Deg. C. ambient the equipment capacity shall not be reduced further than 15%.
2. Electrical: Circuit Breaker and Conductors
- a. Contractor shall provide new fused disconnects for all CACs. Disconnects shall be sized per manufacturer's recommendations. Enclosures and conduit shall be rated for outdoor applications.
3. Test, Adjust, and Balance (TAB):
- a. Initial air flow rates have been provided on the Exhibit C sketches. See heat pump TAB notes in the section below for pressurization requirements between CAC guard booth and intake/processing rooms.

3.7.2 Paint New and Existing to Remain Natural Gas Piping

i. Requirement Summary:

- 1. The contractor shall scrape and paint all new and existing to remain Natural Gas piping on the roofs of the CACs.
- 2. Contractor shall install two (2) coats of paint on Natural Gas piping on the roofs of the CACs. Paint type shall be reviewed and approved by the FM and PD/COR.

3.7.3 New Heat Pump Systems:

i. Requirement Summary:

- 1. The contractor shall install two (2) new Dx split heat pump systems and all necessary mechanical and electrical accessories to provide a fully functioning system that meets the project requirements. Contractor shall make new roof penetrations required for outdoor air (OA) intake ductwork and transfer path of refrigerant piping, electrical power conductors, and controls wiring. See provided drawings in exhibit C for existing roof

construction and roof penetration requirements.

2. The contractor shall provide new controllers/programmable thermostats, sensors, wiring, and necessary devices.
3. Perform air-side test, adjust, and balance (TAB) procedure on all new heat pump systems.

ii. New Equipment Summary:

(Manufacturer/Model substitutions shall meet or exceed the York R Series Equipment. Substitutions are subject to approval by the PD/COR, FM, and FAC/PS Mechanical Engineer

1. Two (2) new single zone heat pump systems
 - a. Basis of Design: York R Series 20 SEER Single-Zone System
 - i. Outdoor unit: DHR18CSB21S
 - ii. Ducted Indoor unit: DHR18NDB21S
 - b. Cooling Capacity: 5,400-18,700 Btu/h
 - c. Heating Capacity: 4,700-23,200 Btu/h
 - d. The refrigerant COOLING cycle operating shall be -18 Deg C to 46 Deg C. The refrigerant HEATING cycle operating shall be -18 Deg C to 24 Deg C.
 - e. The systems shall be provided with emergency/back-up electric resistance heat.
 - f. Electrical System: 400Y/230V, 3PH, 4 Wire, 50 Hz
 - g. Indoor units shall have a minimum of three (3) fan speeds.
 - h. Return air filters shall be MERV 8 minimum.
 - i. New heat pump systems shall be provided with associated outdoor air (OA) inline intake fans. Basis of design: Greenheck CSP-B110 Deluxe Inline Fan, 50 L/S (adjustable), with variable speed motor and controls for balancing. Motor operated inlet isolation damper shall be installed upstream of fan. Fan controls shall be integrated with heat pump system controls.
 - j. New heat pump systems shall be provided with new secondary drain pan /systems below the indoor units. Auxiliary and Secondary Drain Systems: The indoor unit shall be equipped with an auxiliary protection system in compliance with the International Mechanical Code (IMC) section 307.2.3. Options include:
 - i. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1 1/2 inches (38 mm), shall not be less than 3 inches (76 mm) larger than the unit or the coil dimensions in width and length

and shall be constructed of corrosion-resistant material. Galvanized sheet steel pans shall have a minimum thickness of not less than 0.0236 inch (0.6010 mm) (No. 24 gage). Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).

- ii. A separate overflow drain line shall be connected to the drain pan provided with the equipment. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.
 - iii. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water-level detection device conforming to UL 508 that will shut off the equipment served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.
 - iv. A water-level detection device conforming to UL 508 shall be provided that will shut off the equipment served in the event that the primary drain is blocked. The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.
- k. New heat pump system indoor unit shall be ducted with supply and return ductwork with a minimum of 1" (25mm) sound lining insulation inside the duct work. The return duct connection shall be a 90 Degree Fitting to reduce acoustical impact of fan noise to the space. See Exhibit C sketches for heat pumps system and duct work intended configuration.
 - l. New heat pump system outdoor units shall be installed on the CAC roofs with new equipment pad. See provided sketches for mounting details.
 - m. New heat pump systems shall be furnished with 7-Day programmable thermostats. Thermostats shall be capable of controlling all heat pumps modes, including the emergency electric resistance heat coil. The outdoor air fan shall only run during occupied hours. During unoccupied hours, the outdoor air fan shall be off and the upstream motor operated isolation damper shall be closed.
 - n. New equipment shall use: R-410a, R-407c, or R-134a refrigerant.

2. Electrical: Circuit Breaker and Conductors

- a. Contractor shall provide new conductors, conduits, breakers and fused disconnects as required for new heat pumps (indoor and

outdoor units), new OA fans, new electric resistance heat coils, etc. Electrical devices shall be sized per manufacturer's recommendations and shall meet OBO standards. Enclosures and conduit shall be rated for outdoor applications where outdoors.

3. Test, Adjust, and Balance (TAB):

- a. For CAC's 1 and 3, the new heat pump system and RTU system shall be balanced to ensure that the guard booth area positive 2.5 Pascals (minimum) relative to the intake/processing side of the CAC. Measurements shall be taken at the document transfer tray with all doors of the CAC closed. Balancing shall be witnessed by the PD/COR and FM or designated staff. Initial flowrates have been provided on the exhibit C sketches.

4.0 ATTACHMENTS

Exhibit A – Project Orientation Photos – Existing Equipment/Systems

Exhibit B – Existing York RTU Literature

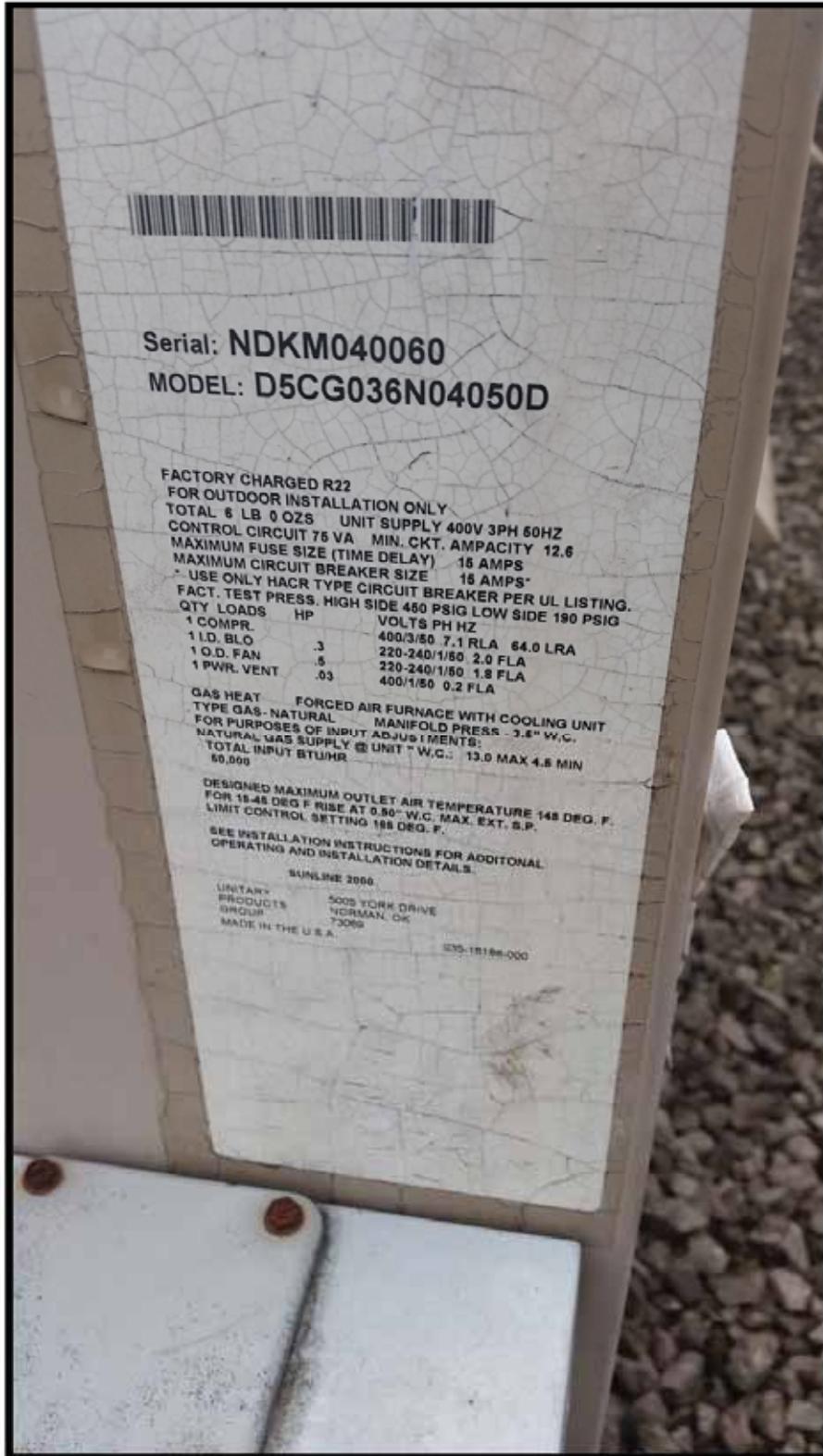
Exhibit C – Mechanical/Electrical Project Scope Sketches

Exhibit D – Project Specifications

Exhibit A

Project Orientation Photos





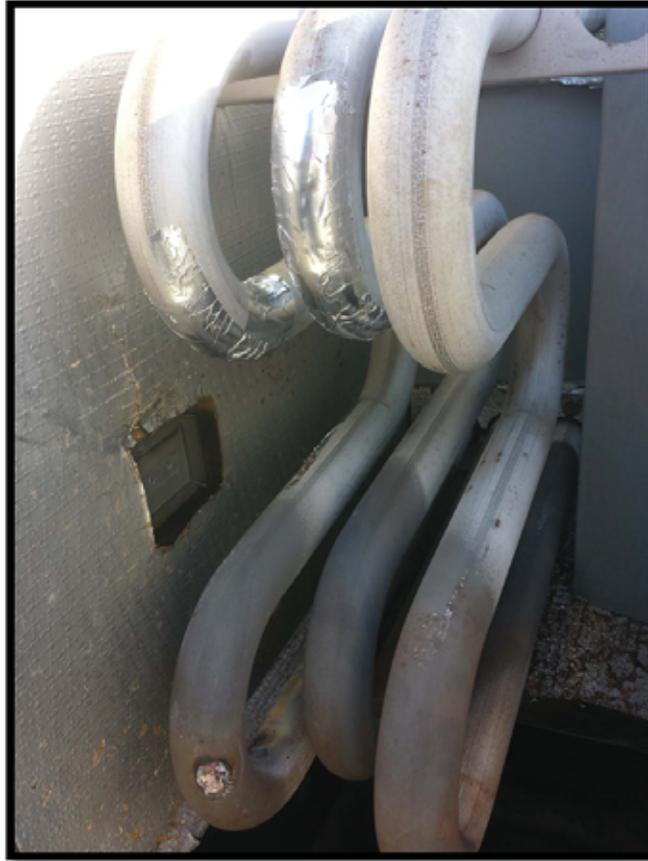
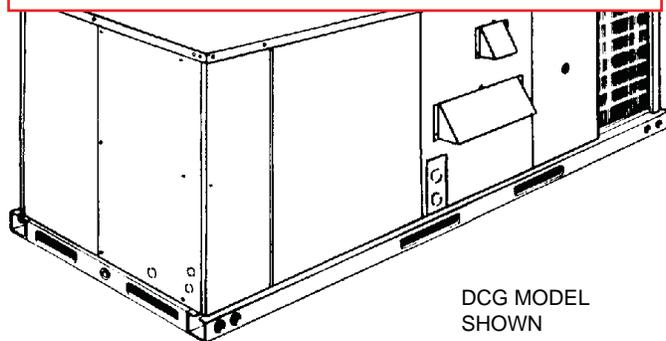


EXHIBIT B

Existing York RTU Literature

Existing RTUs To Be Replaced

MODEL #	SERIAL #
CAC 1 - D5CG048N0605D	NAKM018030
CAC 2 - D5CG036N04050D	NNKM133128
CAC 3 - D5CG036N04050D	NDKM040060

DCG MODEL
SHOWN

SINGLE PACKAGE AIR-COOLED AIR CONDITIONERS

D3CE 036, 048, 060 & 076
D5CG 036, 048, 060 & 076
3, 4, 5 AND 6 NOMINAL TONS

SUNLINE 2000™ (WORLD 50 HZ)



DESCRIPTION

YORK Sunline 2000 units are convertible single package air conditioners with a common cabinet and a common roof curb for the 3, 4, 5 and 6 ton sizes. The units were designed for residential and light commercial applications. They can easily be installed on a roof curb, slab, roof jack or frame.

All units are self-contained and assembled on rigid full perimeter base rails with fork lift slots on three sides and holes for overhead rigging. Every unit is completely piped, wired, charged and tested at the factory to provide for a quick and easy field installation.

The units are available in cooling only, and cooling with gas heat. Electric heaters are available as field-installed accessories.

Both bottom and side duct connections are available without having to swap panels. The installer removes the duct covers for the desired configuration. Economizers may be used on either bottom and side duct applications with no modifications required.

These units are designed and manufactured under ISO 9002 Quality System Certification.

FEATURES

COMMON FOOTPRINT/COMMON CABINET -- All model sizes and configurations share a common cabinet and a common roof curb. The installer has the flexibility of setting one curb and placing the proper tonnage unit on that curb after the internal load has been determined. Selection of gas or electric heat can be made after the curb has been set.

HIGH EFFICIENCY -- All units have a high cooling efficiency, and gas / electric models have a minimum AFUE of 79%.

CONVERTIBLE AIRFLOW DESIGN -- Both the side and bottom duct openings are covered when they leave the factory. If a side supply / side return is desired, remove the two side duct covers from the outside of the unit and discard them. If a bottom supply / bottom return is desired, remove the two knockout panels from the base of the unit and discard them. No panel

cutting or swapping is required. Convertible airflow design allows maximum field flexibility and minimum inventory.

FIELD--INSTALLED ACCESSORIES -- Accessories were designed for quick and easy installation. The motorized damper and economizers slide in, and electrical connections are made by modular plugs. Electric heaters mount easily, and knockouts are provided in the internal partitions to connect the elements to the control box single point kit.

The 356mm (14in.) high roof curb is shipped knocked down. An insulated deck is not required because the bottom of the unit is insulated.

WIDE RANGE OF INDOOR AIRFLOWS -- All 3, and 4--ton models operate over a wide range of design conditions with a 3--speed direct--drive fan motor. Belt--drive blowers are standard on all 5 and 6 ton models.

FULL PERIMETER BASE RAILS -- The permanently attached base rails provide a solid foundation for the entire unit and protect the unit during shipment. The rails provide fork lift access from three sides, and rigging holes are also provided so that an overhead crane can be used to place the units on a roof.

SYSTEM PROTECTION -- Crankcase heat and internal overload protection are standard on all compressors. Every unit has a liquid line filter--drier, high and low pressure switches and a suction line freezestat to protect all system components. All units provide cooling at ambient temperatures down to 7°C (45°F).

UTILITY CONNECTIONS MADE EASY -- Gas and electric utility knockouts are provided in the unit base as well as the side of the unit. A clearly identified location is provided to mount a field supplied electrical disconnect switch. Utility connections can be made quickly and with a minimum amount of field labor.

SIMPLE CONTROL CIRCUIT -- A low voltage printed circuit board contains a compressor lockout indicator light and a low voltage terminal strip. An additional set of pin connectors is also provided to simplify the field interface of external controls.

Cont'd.

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FEATURES - cont'd.

Mate--n--lock plug connectors are used where line and low voltage wires pass thru internal bulkheads. This allows for easier troubleshooting and component replacement. The electrical control box is not located in the compressor compartment so the access cover can be removed for

troubleshooting without affecting the normal system operating pressures.

AIR FILTERS -- Units are shipped with 25mm (1in.) throwaway filters. The unit filter racks can accommodate 25mm (1in.) or 50mm (2in.) filters without modification.

SUNLINE 2000™

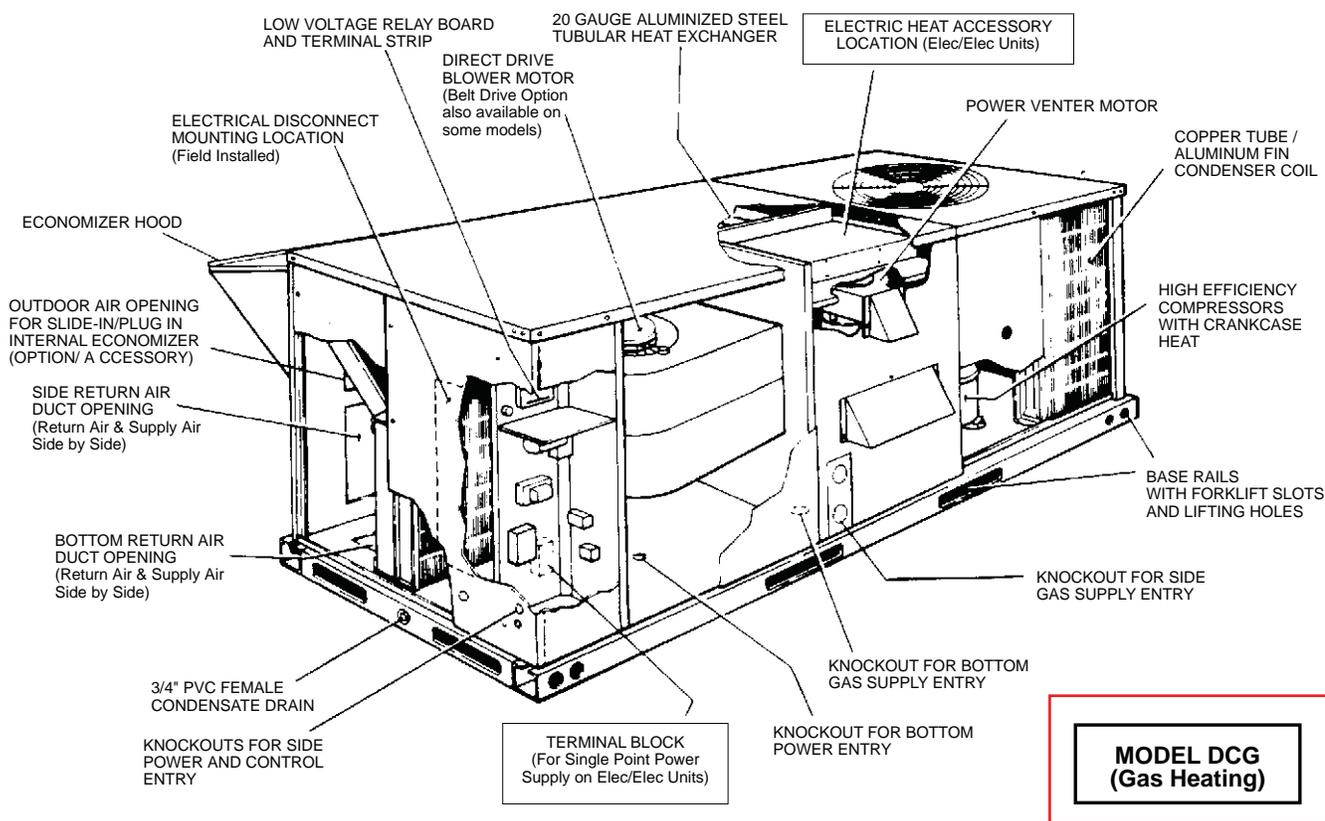


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RATINGS

CAPACITY RATINGS - Cooling / Electric Heating

Model	Rating Point ¹	Indoor DB/WB	Outdoor DB/WB	Total Output kW/MBH	Total Input kW	COP ²	Electric Heat Nominal Capacity kW
D3CE036	T1	27 / 19	35 / 24	10.6 / 36.1	3.8	2.80	5.1, 7.5
	T2	29 / 19	46 / 24	8.9 / 30.3	4.2	2.10	10.2, 14.6
	T3	21 / 15	27 / 19	9.9 / 33.7	3.4	2.90	
D3CE048	T1	27 / 19	35 / 24	13.5 / 46.0	4.9	2.70	5.1, 7.5
	T2	29 / 19	46 / 24	11.0 / 37.5	4.0	2.70	10.2, 14.6
	T3	21 / 15	27 / 19	12.2 / 41.6	4.4	2.80	
D3CE060	T1	27 / 19	35 / 24	17.3 / 59.0	6.2	2.80	5.1, 7.5
	T2	29 / 19	46 / 24	14.6 / 49.8	6.8	2.10	10.2, 14.6
	T3	21 / 15	27 / 19	16.5 / 56.3	5.4	3.10	21.5
D3CE076	T1	27 / 19	35 / 24	20.5 / 69.9	8.6	2.40	5.1, 7.5
	T2	29 / 19	46 / 24	16.2 / 55.3	9.4	1.70	10.2, 14.6
	T3	21 / 15	27 / 19	19.6 / 66.9	7.8	2.50	21.5

¹ T1 = Moderate Climates, T2 = Hot Climates, T3 = Cool Climates.

² COP = Coefficient of Performance - total output kW divided by the total input kW.

CAPACITY RATINGS - Cooling / Gas Heating

Model	Rating Point ¹	Indoor DB/WB	Outdoor DB/WB	Total Output kW/MBH	Total Input kW	COP ²	Gas Heating			
							Input (Net) kW	Output kW/MBH	Temperature Rise (min-max)	
									°C	°F
D5CG036	T1	27 / 19	35 / 24	10.6 / 36.1	3.8	2.80	14.6	11.7 / 39.9	8-25	15-45
	T2	29 / 19	46 / 24	8.9 / 30.3	4.2	2.10				
	T3	21 / 15	27 / 19	9.9 / 33.7	3.4	2.90				
D5CG048	T1	27 / 19	35 / 24	13.5 / 46.0	4.9	2.70	22.0	17.6 / 60.0	14-31	25-55
	T2	29 / 19	46 / 24	11.0 / 37.5	4.0	2.70				
	T3	21 / 15	27 / 19	12.2 / 41.6	4.4	2.80				
D5CG060	T1	27 / 19	35 / 24	17.3 / 59.0	6.2	2.80	29.3	23.1 / 78.8	14-31	25-55
	T2	29 / 19	46 / 24	14.6 / 49.8	6.8	2.10				
	T3	21 / 15	27 / 19	16.5 / 56.3	5.4	3.10				
D5CG076	T1	27 / 19	35 / 24	20.5 / 69.9	8.6	2.40	29.3	23.1 / 78.8	14-31	25-55
	T2	29 / 19	46 / 24	16.2 / 55.3	9.4	1.70				
	T3	21 / 15	27 / 19	19.6 / 66.9	7.8	2.50				

¹ T1 = Moderate Climates, T2 = Hot Climates, T3 = Cool Climates.

² COP = Coefficient of Performance - total output kW divided by the total input kW.

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PHYSICAL DATA - BASIC UNITS

Model (DCE/DCG)		036	048	060	076
Evaporator blower	Centrifugal Blower (Dia. x Wd. mm (in.))	12 x 10 (305 x 254)	12 x 10 (305 x 254)	12 x 10 (305 x 254)	12 x 11 (305 x 279)
	Fan Motor Hp (direct-drive)	1/3	1/4	-	-
	Fan Motor Hp (belt-drive)	-	-	1.5	1.5
Evaporator coil	Rows Deep	3	3	3	3
	Fins Per 25mm (1 in.)	13	13	13	13
	Face Area (m ² /ft ² .)	0.33 / 3.6	0.40 / 4.3	0.57 / 5.1	0.57 / 5.1
Condenser fan	Propeller Dia. (mm/in.)	610 / 24	610 / 24	610 / 24	610 / 24
	Fan Motor HP	1/2	1/2	1/2	1/2
	Nom. CFM Total	4,500	4,500	4,500	4,500
Condenser coil	Rows Deep	1	1	1	2
	Fins Per 25mm (1 in.)	16	19	22	16
	Face Area (m ² /ft ² .)	1.60 / 17.1	1.60 / 17.1	1.60 / 17.1	1.55 / 16.7
Air filters (see Note)	Quantity Per Unit (14" X 20" X 1")	2	2	2	2
	quantity Per Unit (14" X 25" X 1")	1	1	1	1
	total Face Area (m ² /ft ² .)	0.59 / 6.3	0.59 / 6.3	0.59 / 6.3	0.59 / 6.3
Charge	Refrigerant-22 (kg/lbs./oz.)	2.72 (6/0)	3.0 (6/10)	2.8 (6/12)	4.5 (10)

NOTE: Filter racks are adapted for 25mm (1") or 50mm (2") thick filters.

COMPONENT WEIGHTS (kg/lbs)

COMPONENT			MODELS DCE & DCG			
			036	048	060	076
Basic Unit	DCE (Cooling only)		250 / 550	268 / 590	286 / 630	313 / 690
	DCG (Gas / Electric)	41 Mbh	277 / 610	-	-	-
		62 Mbh	-	295 / 650	-	-
		82 Mbh	-	-	313 / 690	338 / 745
	103 Mbh	-	-	-	-	
Options and Accessories	Economizer			23 / 50		
	Motorized Outdoor Air Damper			22 / 48		
	Electric Heat (Nominal KW) (DCE only)	5 - 7 KW		8 / 18		
		10 - 15 KW		10 / 23		
		20 - 30 KW		13 / 28		
	Roof Mounting Curb			42 / 92		
Relief / Fixed Air Damper			5 / 10			

COOLING CAPACITIES - DCE / DCG036

M³/S

Air On Cooling Coil		Temperature of Air on Condensing Coil																	
		27°C							35°C							46°C			
		Total Cap., ¹ kW	Power Input ² kW	Sensible Capacity ¹ , kW				Total Cap., kW	Power Input kW	Sensible Capacity ¹ , kW				Total Cap., kW	Power Input kW	Sensible Capacity ¹ , kW			
Entering Dry Bulb, °C				Entering Dry Bulb, °C						Entering Dry Bulb, °C									
M ³ /S	WB °C			31	28	25	22			31	28	25	22			31	28	25	22
0.70	23	13.6	3.2	9.4	6.9	4.4	-	12.7	3.6	9.3	6.7	4.2	-	11.4	4.1	9.0	6.4	3.9	-
	20	12.7	3.2	12.4	9.8	7.1	4.6	12.0	3.5	12.0	9.6	6.9	4.4	10.9	4.0	10.9	9.2	6.6	4.1
	17	12.6	3.2	12.6	11.9	10.1	7.4	11.9	3.5	11.9	11.2	9.8	7.1	10.9	4.0	10.9	10.2	9.4	6.8
	14	12.6	3.2	12.6	11.9	11.2	10.2	11.9	3.5	11.9	11.2	10.5	9.8	10.9	4.0	10.9	10.2	9.5	8.8
0.55	23	13.2	3.2	8.1	6.0	4.1	-	12.3	3.5	7.9	5.8	3.8	-	11.1	4.0	7.7	5.5	3.5	-
	20	12.2	3.1	10.6	8.4	6.3	4.3	11.4	3.5	10.4	8.2	6.1	4.1	10.3	3.9	10.0	7.9	5.8	3.7
	17	11.8	3.1	11.8	10.8	8.7	6.5	11.1	3.4	11.1	10.5	8.4	6.3	10.2	3.9	10.2	9.5	8.1	6.0
	14	11.7	3.1	11.7	11.1	10.4	8.9	11.1	3.4	11.1	10.5	9.8	8.6	10.2	3.9	10.2	9.5	8.9	8.2
0.45	23	12.8	3.2	7.1	5.4	3.8	-	12.0	3.5	6.9	5.2	3.6	-	10.8	4.0	6.6	4.9	3.3	-
	20	11.7	3.1	9.2	7.4	5.7	4.1	11.0	3.4	9.0	7.2	5.5	3.8	9.9	3.9	8.7	6.9	5.1	3.5
	17	11.0	3.0	11.0	9.5	7.7	5.9	10.4	3.4	10.4	9.3	7.4	5.7	9.5	3.8	9.5	8.9	7.1	5.3
	14	10.9	3.0	10.9	10.3	9.7	7.9	10.4	3.4	10.4	9.8	9.2	7.6	9.5	3.8	9.5	8.9	8.3	7.3

CFM

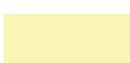
Air On Cooling Coil		Temperature of Air on Condensing Coil																	
		95°F						105°F						115°F					
		Total Cap., MBH	Power Input kW	Sensible Capacity, MBH				Total Cap., MBH	Power Input kW	Sensible Capacity, MBH				Total Cap., MBH	Power Input kW	Sensible Capacity, MBH			
Entering Dry Bulb, °F				Entering Dry Bulb, °F						Entering Dry Bulb, °F									
CFM	WB °F			86	80	74	68			86	80	74	68			86	80	74	68
1500	72	42.4	3.6	31.6	21.6	12.0	-	40.3	3.8	31.1	21.1	11.5	-	38.1	4.1	30.6	20.5	11.0	-
	67	40.1	3.5	40.1	30.7	20.6	11.1	38.4	3.7	38.4	30.1	20.0	10.6	36.6	4.0	36.6	29.6	19.4	10.0
	62	40.1	3.5	40.1	37.3	29.7	19.6	38.3	3.7	38.3	35.6	29.0	18.9	36.5	4.0	36.5	33.8	28.4	18.3
	57	40.0	3.5	40.0	37.3	34.6	28.6	38.3	3.7	38.3	35.6	33.0	27.9	36.5	4.0	36.5	33.8	31.2	27.3
1200	72	41.3	3.5	27.3	19.1	11.5	-	39.2	3.8	26.8	18.6	10.9	-	37.0	4.0	26.3	18.1	10.4	-
	67	38.4	3.4	35.2	26.6	18.5	10.8	36.4	3.7	34.5	26.1	18.0	10.3	34.5	3.9	33.8	25.6	17.4	9.7
	62	37.6	3.4	37.6	34.3	26.0	17.9	36.0	3.7	36.0	33.5	25.4	17.2	34.3	3.9	34.3	31.9	24.8	16.7
	57	37.5	3.4	37.5	35.0	32.6	25.2	35.9	3.7	35.9	33.5	31.0	24.6	34.2	3.9	34.2	31.8	29.4	23.9
900	72	39.5	3.5	22.6	16.5	10.9	-	37.5	3.7	22.1	16.0	10.4	-	35.5	4.0	21.6	15.5	9.8	-
	67	36.3	3.4	28.8	22.4	16.3	10.5	34.5	3.6	28.3	21.8	15.7	9.9	32.7	3.8	27.9	21.3	15.1	9.3
	62	34.0	3.3	34.0	28.5	22.0	15.8	32.6	3.5	32.6	28.1	21.4	15.2	31.1	3.8	31.1	27.5	20.8	14.6
	57	34.0	3.3	34.0	31.8	28.1	21.5	32.5	3.5	32.5	30.4	27.5	20.9	31.1	3.8	31.1	28.9	26.7	20.3

¹These capacities are gross ratings. For net capacity, determine the kW of the supply air blower motor from the Blower Performance Table, multiply this value by 3.415 MBH / kW to determine the motor heat, and deduct this heat from the gross capacity of the unit.

²These ratings include the compressor and the condenser fan motors but not the supply air blower motor. The total condenser fan motor power input is 0.46 kW. Refer to the Blower Performance Table for the kW of the supply air blower motor.



NOMINAL RATING



ALL SENSIBLE

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COOLING CAPACITIES - DCE / DCG048

M³/S

Air On Cooling Coil		Temperature of Air on Condensing Coil																	
		27°C						35°C				46°C							
		Total Cap., kW	Power Input kW	Sensible Capacity, kW				Total Cap., kW	Power Input kW	Sensible Capacity, kW				Total Cap., kW	Power Input kW	Sensible Capacity, kW			
Entering Dry Bulb, °C				Entering Dry Bulb, °C						Entering Dry Bulb, °C									
M ³ /S	WB °C			31	28	25	22			31	28	25	22			31	28	25	22
0.95	23	17.4	4.1	12.2	8.6	5.2	-	16.2	4.5	12.2	8.3	5.0	-	14.6	5.2	11.9	8.0	4.7	-
	20	16.6	4.0	16.6	12.8	9.0	5.6	15.7	4.4	15.7	12.6	8.7	5.3	14.3	5.1	14.3	12.3	8.4	4.9
	17	16.6	4.0	16.6	15.6	13.3	9.4	15.6	4.4	15.6	14.7	13.0	9.2	14.3	5.1	14.3	13.3	12.4	8.8
	14	16.6	4.0	16.6	15.6	14.6	13.7	15.6	4.4	15.6	14.7	13.7	12.8	14.2	5.1	14.2	13.3	12.4	11.5
0.75	23	17.0	4.0	10.5	7.6	4.8	-	15.8	4.5	10.3	7.3	4.6	-	14.2	5.1	10.0	7.0	4.2	-
	20	15.7	3.9	14.1	10.9	7.9	5.1	14.6	4.3	13.9	10.7	7.7	4.9	13.4	5.0	13.4	10.5	7.3	4.5
	17	15.5	3.9	15.5	14.6	11.5	8.3	14.7	4.3	14.7	13.8	11.2	8.1	13.4	5.0	13.4	12.5	10.8	7.7
	14	15.5	3.9	15.5	14.6	13.7	11.9	14.6	4.3	14.6	13.8	12.9	11.6	13.4	5.0	13.4	12.5	11.7	10.9
0.55	23	16.2	4.0	8.5	6.4	4.4	-	15.1	4.4	8.3	6.1	4.1	-	13.6	5.0	8.0	5.8	3.8	-
	20	14.7	3.9	11.3	9.0	6.8	4.7	13.8	4.2	11.1	8.8	6.5	4.4	12.5	4.8	10.8	8.4	6.1	4.0
	17	17.0	3.8	14.0	11.8	9.4	7.1	13.2	4.2	13.2	11.5	9.2	6.8	12.1	4.8	12.1	11.2	8.8	6.4
	14	13.9	3.8	13.9	13.2	12.2	9.8	13.2	4.2	13.2	12.4	11.7	9.5	12.1	4.8	12.1	11.4	10.6	9.1

CFM

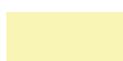
Air On Cooling Coil		Temperature of Air on Condensing Coil																	
		95°F						105°F				115°F							
		Total Cap., MBH	Power Input kW	Sensible Capacity, MBH				Total Cap., MBH	Power Input kW	Sensible Capacity, MBH				Total Cap., MBH	Power Input kW	Sensible Capacity, MBH			
Entering Dry Bulb, °F				Entering Dry Bulb, °F						Entering Dry Bulb, °F									
CFM	WB °F			86	80	74	68			86	80	74	68			86	80	74	68
2000	72	54.1	4.5	40.6	26.5	14.0	-	51.4	4.8	40.3	26.0	13.4	-	48.6	5.1	39.7	25.3	12.8	-
	67	52.3	4.4	52.3	39.9	25.5	12.8	50.0	4.7	50.0	39.3	24.9	12.1	47.6	5.0	47.6	38.7	24.0	11.5
	62	52.2	4.4	52.2	48.7	38.8	24.4	49.9	4.7	49.9	46.4	38.1	23.7	47.5	5.0	47.5	44.1	37.5	22.9
	57	52.2	4.4	52.2	48.6	45.1	37.5	49.9	4.7	49.9	46.4	42.9	36.7	47.4	5.0	47.4	44.0	40.7	35.7
1600	72	52.8	4.4	34.9	23.7	13.2	-	50.1	4.7	34.6	22.9	12.6	-	47.3	5.1	33.8	22.3	12.0	-
	67	49.0	4.3	46.4	34.3	23.0	12.4	46.6	4.6	45.6	33.9	22.0	11.8	44.9	4.9	44.9	33.3	21.7	11.1
	62	49.2	4.3	49.2	45.9	33.7	22.1	47.0	4.6	47.0	43.8	33.1	21.4	44.8	4.9	44.8	41.7	32.5	20.7
	57	49.1	4.3	49.1	45.8	42.6	32.9	47.0	4.6	47.0	43.7	40.5	32.2	44.7	4.9	44.7	41.6	38.5	31.1
1200	72	50.7	4.3	28.8	20.3	12.5	-	48.2	4.6	28.3	19.7	11.9	-	45.5	5.0	27.8	19.1	11.3	-
	67	46.6	4.2	37.8	28.7	19.9	12.1	44.3	4.5	37.3	28.1	19.3	11.4	41.9	4.8	36.7	27.4	18.6	10.7
	62	44.7	4.2	44.7	37.7	28.4	19.5	42.8	4.5	42.8	36.9	27.7	18.8	40.9	4.8	40.9	36.1	26.9	18.1
	57	44.7	4.2	44.7	41.8	37.2	27.8	42.8	4.4	42.8	39.9	36.5	27.1	40.8	4.7	40.8	38.0	35.3	26.1

¹These capacities are gross ratings. For net capacity, determine the kW of the supply air blower motor from the Blower Performance Table, multiply this value by 3.415 MBH / kW to determine the motor heat, and deduct this heat from the gross capacity of the unit.

²These ratings include the compressor and the condenser fan motors but not the supply air blower motor. The total condenser fan motor power input is 0.46 kW. Refer to the Blower Performance Table for the kW of the supply air blower motor.



NOMINAL RATING



ALL SENSIBLE

COOLING CAPACITIES - DCE / DCG060

M³/S

Air On Cooling Coil		Temperature of Air on Condensing Coil																	
		27°C						35°C				46°C							
		M ³ /S	WB °C	Total Cap., kW	Power Input kW	Sensible Capacity, kW				Total Cap., kW	Power Input kW	Sensible Capacity, kW				Total Cap., kW	Power Input kW	Sensible Capacity, kW	
Entering Dry Bulb, °C						Entering Dry Bulb, °C						Entering Dry Bulb, °C							
1.15	23	22.1	5.5	15.4	11.1	7.1	-	20.7	6.1	15.1	10.7	6.8	-	18.9	6.9	14.8	10.4	6.4	-
	20	20.9	5.4	20.9	15.9	11.5	7.5	19.9	6.0	19.9	15.6	11.2	7.2	18.3	6.8	18.3	15.2	10.8	6.6
	17	20.9	5.4	20.9	19.7	16.5	12.0	19.8	6.0	19.8	18.6	16.0	11.5	18.3	6.8	18.3	17.1	15.6	11.0
	14	20.9	5.4	20.9	19.7	18.5	17.3	19.8	6.0	19.8	18.6	17.4	16.3	18.3	6.8	18.3	17.1	15.9	14.8
0.95	23	21.6	5.5	13.7	10.1	6.6	-	20.3	6.1	13.4	9.8	6.3	-	18.5	6.8	13.1	9.4	5.9	-
	20	20.0	5.3	18.1	14.2	10.5	7.0	18.8	5.9	17.8	13.9	10.2	6.7	17.4	6.6	17.4	13.6	9.8	6.2
	17	19.9	5.3	19.9	18.7	14.8	11.0	18.8	5.9	18.8	17.7	14.4	10.6	17.4	6.6	17.4	16.3	13.8	10.1
	14	19.8	5.3	19.8	18.7	17.6	15.1	18.8	5.9	18.8	17.7	16.6	14.7	17.4	6.6	17.4	16.3	15.2	14.1
0.75	23	20.9	5.4	12.0	9.1	6.2	-	19.7	6.0	11.7	8.8	5.9	-	17.9	6.7	11.3	8.3	5.5	-
	20	19.2	5.3	15.6	12.5	9.5	6.6	18.0	5.8	15.3	12.2	9.2	6.2	16.4	6.4	14.8	11.7	8.7	5.8
	17	18.5	5.2	18.5	16.0	12.9	9.9	17.5	5.7	17.5	15.7	12.5	9.5	16.2	6.4	16.2	15.2	12.1	9.0
	14	18.5	5.2	18.5	17.4	16.4	13.3	17.5	5.7	17.5	16.5	15.5	13.0	16.2	6.4	16.2	15.2	14.2	12.4

CFM

Air On Cooling Coil		Temperature of Air on Condensing Coil																	
		95°F						105°F				115°F							
		CFM	WB °F	Total Cap., MBH	Power Input kW	Sensible Capacity, MBH				Total Cap., MBH	Power Input kW	Sensible Capacity, MBH				Total Cap., MBH	Power Input kW	Sensible Capacity, MBH	
Entering Dry Bulb, °F						Entering Dry Bulb, °F						Entering Dry Bulb, °F							
2400	72	69.2	6.0	51.0	34.5	19.3	-	66.0	6.4	50.5	33.9	18.6	-	63.0	6.8	50.1	33.1	17.9	-
	67	66.4	5.9	66.4	49.7	33.1	17.8	63.9	6.3	63.9	48.9	32.4	17.0	61.1	6.7	61.1	48.1	31.5	16.1
	62	66.3	5.9	66.3	61.8	48.3	31.7	63.7	6.3	63.7	56.2	47.3	30.7	61.0	6.7	61.0	56.6	46.6	29.8
	57	66.2	5.9	66.2	61.8	57.4	46.5	63.6	6.3	63.6	56.2	54.8	45.5	60.9	6.7	60.9	56.5	52.2	44.8
2000	72	67.6	6.0	45.2	31.7	18.5	-	64.5	6.4	44.6	31.0	17.8	-	61.5	6.7	44.2	30.2	17.0	-
	67	62.9	5.8	58.8	44.3	30.7	17.4	60.0	6.2	58.5	43.5	29.9	16.5	58.2	6.6	58.2	43.1	29.0	15.7
	62	63.1	5.8	63.1	58.9	43.2	29.5	60.7	6.2	60.7	56.5	42.7	28.5	58.1	6.6	58.1	53.9	41.8	27.6
	57	63.0	5.8	63.0	58.8	54.7	42.0	60.6	6.2	60.6	56.3	52.3	41.3	58.0	6.6	58.0	53.8	49.7	40.4
1600	72	65.6	5.9	39.8	28.4	17.7	-	62.6	6.3	38.9	27.7	16.9	-	59.6	6.6	38.2	26.9	16.2	-
	67	60.5	5.7	50.9	38.9	27.8	17.0	57.8	6.1	50.2	38.4	26.9	16.1	54.9	6.4	49.3	37.4	26.1	15.2
	62	58.8	5.7	58.8	50.3	38.4	27.0	56.5	6.0	56.5	49.3	37.5	26.0	54.1	6.3	54.1	48.7	36.7	25.1
	57	58.7	5.6	58.7	54.9	49.5	37.3	56.4	6.0	56.4	52.6	48.9	36.5	54.0	6.3	54.0	50.2	46.6	35.6

¹These capacities are gross ratings. For net capacity, determine the kW of the supply air blower motor from the Blower Performance Table, multiply this value by 3.415 MBH / kW to determine the motor heat, and deduct this heat from the gross capacity of the unit.

²These ratings include the compressor and the condenser fan motors but not the supply air blower motor. The total condenser fan motor power input is 0.46 kW. Refer to the Blower Performance Table for the kW of the supply air blower motor.



NOMINAL RATING



ALL SENSIBLE

036-21563-001-A-0204

COOLING CAPACITIES - DCE / DCG076

M³/S

Air On Cooling Coil		Temperature of Air on Condensing Coil																	
		27°C						35°C						46°C					
		Total Cap., kW	Power Input kW	Sensible Capacity, kW				Total Cap., kW	Power Input kW	Sensible Capacity, kW				Total Cap., kW	Power Input kW	Sensible Capacity, kW			
Entering Dry Bulb, °C				Entering Dry Bulb, °C						Entering Dry Bulb, °C									
M ³ /S	WB °C																		
		31				28				25				22					
1.40	23	26.8	7.1	19.8	15.3	11.0	-	25.1	7.8	19.4	14.7	10.5	-	22.6	8.9	18.9	14.0	9.7	-
	20	25.8	6.9	25.8	20.0	15.6	11.2	24.4	7.7	24.4	19.6	14.9	10.6	22.3	8.8	2.3	18.7	14.2	9.8
	17	25.8	6.9	25.8	24.3	20.2	15.7	24.3	7.7	24.3	22.9	19.6	15.0	22.2	8.8	22.2	20.8	19.5	14.3
	14	25.7	6.9	25.7	24.2	22.8	21.4	24.3	7.7	24.3	22.8	21.4	20.1	22.2	8.8	22.2	20.8	19.5	1832
1.15	23	26.2	7.0	18.1	14.3	10.5	-	24.5	7.7	17.6	13.8	10.0	-	22.1	8.8	16.8	13.0	9.2	-
	20	24.2	6.8	22.1	18.3	14.5	10.8	22.7	7.5	21.5	17.7	13.9	10.2	21.2	8.6	21.2	16.9	13.0	9.3
	17	24.4	6.8	24.4	23.0	18.4	14.6	23.1	7.5	23.1	21.7	17.8	14.1	21.1	8.6	21.1	19.9	17.0	13.2
	14	24.4	6.8	24.4	23.0	21.6	18.5	23.0	7.5	23.0	21.7	20.4	17.8	21.1	8.6	21.1	19.8	18.5	17.3
0.85	23	25.0	6.9	15.8	12.9	9.7	-	23.5	7.6	15.2	12.3	9.2	-	21.2	8.6	14.4	11.5	8.4	-
	20	22.9	6.6	18.9	16.0	13.0	9.9	21.5	7.3	18.3	15.3	12.5	9.4	19.5	8.2	17.4	14.6	11.6	8.6
	17	22.1	6.5	22.1	19.0	16.0	13.1	21.0	7.2	21.0	18.3	15.5	12.5	19.3	8.2	19.3	17.6	14.6	11.7
	14	22.1	6.5	22.1	20.9	19.7	16.0	20.9	7.2	20.9	19.8	18.9	15.5	19.3	8.2	19.3	18.1	17.0	14.6

CFM

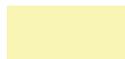
Air On Cooling Coil		Temperature of Air on Condensing Coil																	
		95°F						105°F						115°F					
		Total Cap., MBH	Power Input kW	Sensible Capacity, MBH				Total Cap., MBH	Power Input kW	Sensible Capacity, MBH				Total Cap., MBH	Power Input kW	Sensible Capacity, MBH			
Entering Dry Bulb, °F				Entering Dry Bulb, °F						Entering Dry Bulb, °F									
CFM	WB °F																		
		86				80				74				68					
3000	72	83.9	7.7	65.6	47.9	31.2	-	79.6	8.2	64.0	46.9	29.9	-	75.4	8.8	63.0	45.2	28.5	-
	67	81.7	7.6	81.7	62.8	45.6	28.5	78.3	8.2	78.3	61.5	44.4	27.1	74.6	8.7	74.6	60.4	43.0	25.7
	62	81.6	7.6	81.6	76.2	60.4	43.5	78.1	8.2	78.1	72.8	58.9	41.6	74.4	8.7	74.4	69.2	57.8	40.4
	57	81.5	7.6	81.5	76.1	70.7	58.0	78.0	8.2	78.0	72.6	67.4	56.5	74.3	8.7	74.3	69.1	64.1	54.8
2400	72	81.7	7.6	58.9	44.6	29.7	-	77.7	8.1	57.6	43.2	28.4	-	73.6	8.7	56.3	41.8	27.1	-
	67	76.0	7.4	71.2	56.9	42.7	27.7	72.3	7.9	69.6	55.3	41.0	26.3	70.6	8.5	70.6	54.1	39.5	24.9
	62	77.0	7.4	77.0	71.9	54.7	40.4	73.7	7.9	73.7	68.8	53.4	38.9	70.3	8.5	70.3	65.5	51.8	37.3
	57	76.8	7.4	76.8	71.8	66.9	52.7	73.6	7.9	73.6	68.6	63.8	50.9	70.2	8.5	70.2	65.5	60.6	49.6
1800	72	78.2	7.5	51.3	40.4	28.2	-	74.6	8.0	50.2	39.1	26.9	-	70.6	8.5	48.6	37.7	25.6	-
	67	72.0	7.2	60.9	50.0	38.7	26.8	68.7	7.7	59.9	48.4	37.5	25.4	65.3	8.2	58.4	47.2	35.9	24.0
	62	70.3	7.2	70.3	59.6	48.4	37.1	67.4	7.6	67.4	57.9	46.7	35.6	64.5	8.1	64.5	56.5	45.4	34.2
	57	70.1	7.1	70.1	65.7	57.6	46.6	67.3	7.6	67.3	62.9	56.1	45.1	64.5	8.2	64.5	60.0	55.8	42.9

¹These capacities are gross ratings. For net capacity, determine the kW of the supply air blower motor from the Blower Performance Table, multiply this value by 3.415 MBH / kW to determine the motor heat, and deduct this heat from the gross capacity of the unit.

²These ratings include the compressor and the condenser fan motors but not the supply air blower motor. The total condenser fan motor power input is 0.46 kW. Refer to the Blower Performance Table for the kW of the supply air blower motor.



NOMINAL RATING



ALL SENSIBLE

SUPPLY AIR BLOWER PERFORMANCE - DCG036 & 048 with Direct Drive Blower

M³/S

MODEL DCG	MOTOR SPEED	Available External Static Pressure -Pa *									
		50		74		99		124		149	
		m ³ /s	Watts	m ³ /s	Watts	m ³ /s	Watts	m ³ /s	Watts	m ³ /s	Watts
036	HI	-	-	-	-	0.80	825	0.78	785	0.74	755
	MED	0.79	800	0.77	780	0.75	750	0.72	720	0.67	690
	LOW	0.70	710	0.69	690	0.67	670	0.64	650	0.62	620
048	HI	0.94	960	0.91	936	0.88	910	0.85	880	0.81	845
	MED	0.85	838	0.83	810	0.80	785	0.78	765	0.75	735
	LOW	0.79	760	0.77	738	0.76	715	0.73	695	0.70	670

MODEL DCG	MOTOR SPEED	Available External Static Pressure - Pa *							
		174		198		223		248	
		m ³ /s	Watts	m ³ /s	Watts	m ³ /s	Watts	m ³ /s	Watts
036	HI	0.67	725	0.64	700	0.60	680	0.56	655
	MED	0.62	650	0.59	630	0.59	610	0.52	590
	LOW	0.59	605	0.56	590	0.55	570	0.48	545
048	HI	0.77	820	0.73	790	0.67	765	0.61	740
	MED	0.71	705	0.66	675	0.61	645	0.56	625
	LOW	0.67	645	0.63	620	0.58	595	0.53	575

CFM

MODEL DCG	MOTOR SPEED	Available External Static Pressure - IWG *									
		0.20		0.30		0.40		0.50		0.60	
		CFM	Watts	CFM	Watts	CFM	Watts	CFM	Watts	CFM	Watts
036	HI	-	-	-	-	1699	825	1650	785	1570	755
	MED	1684	800	1631	780	1582	750	1524	720	1410	690
	LOW	1487	710	1464	690	1421	670	1367	650	1315	620
048	HI	1996	960	1933	936	1868	910	1795	880	1722	845
	MED	1804	838	1765	810	1714	785	1650	765	1589	735
	LOW	1681	760	1640	738	1604	715	1541	695	1490	670

MODEL DCG	MOTOR SPEED	Available External Static Pressure - IWG *							
		0.70		0.80		0.90		1.00	
		CFM	Watts	CFM	Watts	CFM	Watts	CFM	Watts
036	HI	1430	725	1360	700	1280	680	1180	655
	MED	1324	650	1260	630	1185	610	1100	590
	LOW	1246	605	1185	590	1110	570	1020	545
048	HI	1635	820	1544	790	1419	765	1300	740
	MED	1508	705	1407	675	1306	645	1195	625
	LOW	1416	645	1337	620	1230	595	1120	575

* Includes allowances for a wet evaporator coil, 25mm (1in.) filters and gas fired heat exchangers. Refer to tables for resistance values on connections other than side duct airflows.

036-21563-001-A-0204

SUPPLY AIR PERFORMANCE - M³/S - DCG060 & 076 w/Belt-Drive Blower

SIDE DUCT CONNECTIONS @ 380/415 Volts

MODEL DCG	AIR FLOW M ³ /S	Available External Static Pressure - Pa*													
		50		74		99		124		149		174		198	
		RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
060	1.18	1059	1560	1077	1590	1095	1630	1114	1650	1134	1660	1158	1685	-	-
	1.13	1032	1405	1054	1470	1074	1525	1094	1560	1116	1595	1140	1620	1167	1640
	1.08	1005	1260	1024	1275	1049	1370	1069	1440	1090	1475	1116	1505	1142	1535
	1.04	980	1160	1002	1170	1022	1190	1044	1250	1066	1350	1090	1410	1117	1440
	0.99	930	1060	957	1070	983	1080	1010	1100	1039	1160	1064	1260	1092	1340
	0.94	877	950	908	975	941	1000	976	1020	1009	1050	1040	1100	1070	1225
	0.90	-	-	-	-	894	885	940	940	980	980	1014	1020	1047	1095
	0.85	-	-	-	-	855	815	903	860	950	905	988	940	1022	970
	0.80	-	-	-	-	-	-	884	815	925	850	964	880	1001	910
	0.75	-	-	-	-	-	-	864	770	908	805	948	835	987	870
0.71	-	-	-	-	-	-	-	-	882	740	926	780	965	830	

MODEL DCG	AIR FLOW M ³ /S	Available External Static Pressure - Pa*													
		223		248		273		298		322		347		372	
		RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
060	1.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.08	1170	1580	-	-	-	-	-	-	-	-	-	-	-	-
	1.04	1148	1480	1180	1530	-	-	-	-	-	-	-	-	-	-
	0.99	1121	1385	1155	1425	-	-	-	-	-	-	-	-	-	-
	0.94	1100	1285	1133	1340	1169	1385	-	-	-	-	-	-	-	-
	0.90	1079	1180	1110	1240	1143	1280	1178	1330	-	-	-	-	-	-
	0.85	1058	1060	1090	1135	1122	1190	1158	1240	-	-	-	-	-	-
	0.80	1035	960	1071	1030	1103	1100	1134	1140	1164	1175	-	-	-	-
	0.75	1020	900	1056	965	1088	1035	1118	1065	1145	1105	1170	1130	-	-
0.71	1004	860	1038	880	1070	925	1101	980	1130	1045	1158	1075	-	-	

*INCLUDES ALLOWANCES FOR A WET EVAPORATOR COIL, 25mm (1in.) FILTERS, AND GAS-FIRED HEAT EXCHANGERS.

SIDE DUCT CONNECTIONS @ 380/415 Volts

MODEL DCG	AIR FLOW M ³ /S	Available External Static Pressure - Pa*													
		50		74		99		124		149		174		198	
		RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
076	1.50	1150	2325	1182	2425	-	-	-	-	-	-	-	-	-	-
	1.42	1100	2010	1129	2090	1157	2150	1185	2225	-	-	-	-	-	-
	1.32	1045	1700	1074	1780	1102	1850	1131	1940	1160	2025	1190	2075	-	-
	1.23	985	1425	1015	1475	1045	1540	1075	1630	1103	1715	1135	1760	1163	1825
	1.13	930	1240	958	1300	990	1350	1020	1400	1051	1430	1081	1490	1111	1600
	1.04	-	-	905	1070	933	1160	965	1210	997	1250	1028	1285	1060	1325
	0.94	-	-	-	-	-	-	919	1025	950	1100	982	1130	1014	1160
	0.85	-	-	-	-	-	-	-	-	909	925	939	1005	968	1030

MODEL DCG	AIR FLOW M ³ /S	Available External Static Pressure - Pa*													
		223		248		273		298		322		347		372	
		RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
076	1.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.23	1193	1920	-	-	-	-	-	-	-	-	-	-	-	-
	1.13	1142	1675	1173	1730	-	-	-	-	-	-	-	-	-	-
	1.04	1090	1380	1124	1450	1155	1550	1186	1640	-	-	-	-	-	-
	0.94	1045	1175	1077	1200	1109	1275	1140	1360	1170	1460	-	-	-	-
	0.85	998	1050	1028	1060	1058	1060	1087	1075	1118	1150	1148	1250	1176	1360

*INCLUDES ALLOWANCES FOR A WET EVAPORATOR COIL, 25mm (1") FILTERS, AND GAS-FIRED HEAT EXCHANGERS.

SUPPLY AIR BLOWER PERFORMANCE - CFM - DCG060 & 076 with Belt-Drive

SIDE DUCT CONNECTIONS @ 380/415 Volts

MODEL DCG	AIR FLOW CFM	Available External Static Pressure - IWG*													
		0.20		0.30		0.40		0.50		0.60		0.70		0.80	
		RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
060	2500	1059	1560	1077	1590	1095	1630	1114	1650	1134	1660	1158	1685	-	-
	2400	1032	1405	1054	1470	1074	1525	1094	1560	1116	1595	1140	1620	1167	1640
	2300	1005	1260	1024	1275	1049	1370	1069	1440	1090	1475	1116	1505	1142	1535
	2200	980	1160	1002	1170	1022	1190	1044	1250	1066	1350	1090	1410	1117	1440
	2100	930	1060	957	1070	983	1080	1010	1100	1039	1160	1064	1260	1092	1340
	2000	877	950	908	975	941	1000	976	1020	1009	1050	1040	1100	1070	1225
	1900	-	-	-	-	894	885	940	940	980	980	1014	1020	1047	1095
	1800	-	-	-	-	855	815	903	860	950	905	988	940	1022	970
	1700	-	-	-	-	-	-	884	815	925	850	964	880	1001	910
	1600	-	-	-	-	-	-	864	770	908	805	948	835	987	870
1500	-	-	-	-	-	-	-	-	882	740	926	780	965	830	

MODEL DCG	AIR FLOW CFM	Available External Static Pressure - IWG*													
		0.90		1.00		1.10		1.20		1.30		1.40		1.50	
		RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
060	2500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2400	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2300	1170	1580	-	-	-	-	-	-	-	-	-	-	-	-
	2200	1148	1480	1180	1530	-	-	-	-	-	-	-	-	-	-
	2100	1121	1385	1155	1425	-	-	-	-	-	-	-	-	-	-
	2000	1100	1285	1133	1340	1169	1385	-	-	-	-	-	-	-	-
	1900	1079	1180	1110	1240	1143	1280	1178	1330	-	-	-	-	-	-
	1800	1058	1060	1090	1135	1122	1190	1158	1240	-	-	-	-	-	-
	1700	1035	960	1071	1030	1103	1100	1134	1140	1164	1175	-	-	-	-
	1600	1020	900	1056	965	1088	1035	1118	1065	1145	1105	1170	1130	-	-
1500	1004	860	1038	880	1070	925	1101	980	1130	1045	1158	1075	-	-	

*INCLUDES ALLOWANCES FOR A WET EVAPORATOR COIL, 25mm (1") FILTERS, AND GAS-FIRED HEAT EXCHANGERS.

SIDE DUCT CONNECTIONS @ 380/415 Volts

MODEL DCG	AIR FLOW CFM	Available External Static Pressure - IWG*													
		0.20		0.30		0.40		0.50		0.60		0.70		0.80	
		RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
076	3200	1150	2325	1182	2425	-	-	-	-	-	-	-	-	-	-
	3000	1100	2010	1129	2090	1157	2150	1185	2225	-	-	-	-	-	-
	2800	1045	1700	1074	1780	1102	1850	1131	1940	1160	2025	1190	2075	-	-
	2600	985	1425	1015	1475	1045	1540	1075	1630	1103	1715	1135	1760	1163	1825
	2400	930	1240	958	1300	990	1350	1020	1400	1051	1430	1081	1490	1111	1600
	2200	-	-	905	1070	933	1160	965	1210	997	1250	1028	1285	1060	1325
	2000	-	-	-	-	-	-	919	1025	950	1100	982	1130	1014	1160
	1800	-	-	-	-	-	-	-	-	909	925	939	1005	968	1030

MODEL DCG	AIR FLOW CFM	Available External Static Pressure - IWG*													
		0.90		1.00		1.10		1.20		1.30		1.40		1.50	
		RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts	RPM	Watts
076	3200	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2800	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2600	1193	1920	-	-	-	-	-	-	-	-	-	-	-	-
	2400	1142	1675	1173	1730	-	-	-	-	-	-	-	-	-	-
	2200	1090	1380	1124	1450	1155	1550	1186	1640	-	-	-	-	-	-
	2000	1045	1175	1077	1200	1109	1275	1140	1360	1170	1460	-	-	-	-
	1800	998	1050	1028	1060	1058	1060	1087	1075	1118	1150	1148	1250	1176	1360

*INCLUDES ALLOWANCES FOR A WET EVAPORATOR COIL, 25mm (1") FILTERS, AND GAS-FIRED HEAT EXCHANGERS.

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FIELD-INSTALLED ACCESSORIES

SINGLE INPUT ELECTRONIC ENTHALPY ECONOMIZER -

Includes a slide-in / plug-in damper assembly with fully modulating spring return motor actuator capable of introducing up to 100% outdoor air, one outdoor air electronic enthalpy sensor and a rain hood with filters. The rain hood is painted to match the basic unit and must be field-assembled before installation. Economizer dampers are 2% low leakage type.

DUAL INPUT ELECTRONIC ENTHALPY ECONOMIZER -

Includes the same damper system and rain hood with filters as described for a single enthalpy economizer except this accessory contains two enthalpy sensors. It uses a differential enthalpy control that compares the outdoor air versus the return air. The logic module then optimizes the economizer operation for additional savings over the single input economizer.

MOTORIZED AIR DAMPER - Includes slide-in / plug-in damper assembly with 2-position spring-return motor actuator and a rain hood with permanent-type filters. The outdoor air dampers open when the indoor fan motor is energized. The rain hood is shipped knocked down and must be field assembled.

BAROMETRIC RELIEF / FIXED OUTDOOR AIR INTAKE AIR DAMPER - A dual function device that consists of a rain hood with a bird screen and a flexible damper. It provides either of the following: 1) a fixed outdoor air intake on units less economizer or 2) barometric relief or units with economizer. The rain hood is fully assembled, painted to match the basic unit and ready for installation.

ELECTRIC HEATERS - Include nickel chromium elements, a terminal block, fuses (where required by UL), all the necessary connectors and hardware. All heaters utilize single point power supply hookup. Capacities from 5 KW thru 30 KW heating are available.

OUTDOOR THERMOSTAT - A 24-volt thermostat providing two stages of control for units equipped with electric heat accessories.

ROOF CURB - This 356mm (14") high full perimeter roof curb is shipped knocked down for field assembly and contains duct supports that can easily be shifted for the desired unit duct arrangement. No insulated deck is required because the unit underside is insulated.

ANTI-RECYCLE TIMER - A timer to prevent the unit compressor from short cycling. It assures a 5-minute off-time between compressor cycles.

GAS PIPING - This kit contains 13mm (1/2") pipe nipples, fittings and gas cock (including panel access gaskets) required for bottom gas supply connection with external shut-off.

OUTDOOR COIL GUARD - Consists of grille-type sections for installation over the outdoor coil to protect it from damage.

WALL THERMOSTAT - The units are designed to operate with 24-volt electronic and electro-mechanical thermostats. All units can operate with single stage heat / single stage cool thermostats - with or without the economizer.

STATIC RESISTANCES

EXTERNAL STATIC PRESSURE DROP												
DESCRIPTION		RESISTANCE, Pa										
		M ³ /s										
		0.47	0.57	0.66	0.75	0.85	0.94	1.03	1.13	1.23	1.32	1.42
Economizer/Motorized Damper ^{1, 3}		17.4	19.8	22.3	27.3	32.2	37.2	42.2	49.6	57.0	64.5	74.4
Electric Heaters ¹	5 - 15kW	10.0	12.4	14.9	17.4	19.8	24.8	29.8	34.7	39.7	47.1	54.6
	20 - 30 kW	14.9	17.4	19.8	22.3	27.3	32.2	37.2	42.2	49.6	57.0	64.5
Bottom Duct Connections ¹		14.9	17.4	19.8	22.3	24.8	27.3	29.8	34.7	39.7	47.1	54.6
Cooling Only ²		19.8	25.0	29.8	34.7	39.7	44.6	49.6	57.0	64.5	71.9	79.4

RESISTANCE, IWG												
DESCRIPTION		CFM										
		1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000
		Economizer/Motorized Damper ^{1, 3}		0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.23
Electric Heaters ¹	5 - 15kW	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.09	0.22
	20 - 30 kW	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.23	0.26
Bottom Duct Connections ¹		0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.16	0.19	0.22
Cooling Only ²		0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.23	0.26	0.29	0.32

¹Deduct these resistance values from the available external static pressure shown in the respective Blower Performance Table.

²Add these resistance values to the available static resistance in the respective Blower Performance Table.

³The pressure thru the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct system is less than 0.25 IWG, the unit will deliver less CFM during full economizer operation.

MOTOR AND DRIVE DATA - Belt-drive Blower

MODEL	BLOWER RANGE (RPM)	MOTOR*				ADJUSTABLE MOTOR PULLEY				FIXED BLOWER PULLEY				BELT		
		HP	RPM	FRAME SIZE	SERVICE FACTOR	PITCH DIA.		BORE		PITCH DIA.		BORE		PITCH LENGTH		DESIGNATION
						in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	
DCG 060	815 - 1105	1½	1450	56	1.0	2.8 - 3.8	69 - 97	¾	22	5.0	127	1	25	37.3	947	A36
DCG 076	950 - 1225	1½	1450	56	1.0	3.4 - 4.4	86 - 112	¾	22	5.2	132	1	25	38.3	973	A37

*All motors have solid bases and are inherently protected. These motors can be selected to operate into their service factor because they are located in the moving air, upstream of any heating device.

ELECTRICAL DATA - Basic Unit

MODEL DCG	POWER SUPPLY	VOLTAGE LIMITATIONS ¹		COMPRESSOR		COND. FAN MOTOR FLA	SUPPLY AIR BLOWER MOTOR FLA	TOTAL UNIT AMPACITY AMPS	MAX. FUSE SIZE AMPS ²	MAX. HACR BREAKER SIZE AMPS
		MIN.	MAX.	FLA	LRA					
036	380/415-3+N-50	342	457	5.8	64	1.8	2.0	11.3	15	15
048	380/415-3+N-50	342	457	9.6	73	1.8	4.0	18.0	25	25
060	380/415-3+N-50	342	457	9.6	74	1.8	2.6	16.6	25	25
076	380/415-3+N-50	342	457	14.1	128	1.8	2.6	22.0	35	35

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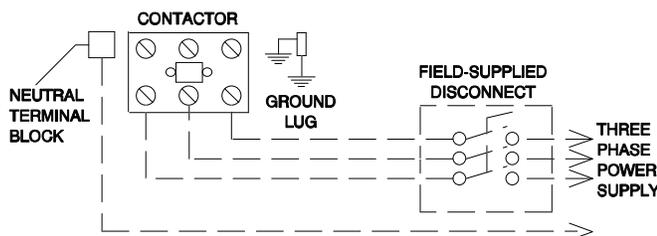
ELECTRICAL DATA - Cooling / Electric Heating (DCE036, 048, 060 & 076)

Model DCE	Power Supply	Heater Accessory Model Number	Supply Air Blower Motor FLA	Electric Heaters			Total Unit Ampacity Amps	Max Fuse Size Amps	Max Size HACR Breaker Amps
				kW	Stages	Total Amps			
036	380-3+N-50	2CE04510746	2.0	4.3	1	6.5	12.6	15	15
		2CE04511046		6.3	1	9.6	14.5	15	15
		2CE04511546		8.5	1	13.0	18.7	20	20
		2CE04512046		12.2	2	18.6	25.7	30	30
	415-3+N-50	2CE04510746		5.1	1	7.1	12.6	15	15
		2CE04511046		7.5	1	10.5	15.6	20	20
		2CE04511546		10.2	1	14.1	20.2	25	25
		2CE04512046		14.6	2	20.3	27.8	30	30
048	380-3+N-50	2CE04510746	4.0	4.3	1	6.5	17.8	25	25
		2CE04511046		6.3	1	9.6	17.8	25	25
		2CE04511546		8.5	1	13.0	21.2	25	25
		2CE04512046		12.2	2	18.6	28.2	30	30
	415-3+N-50	2CE04510746		5.1	1	7.1	17.8	25	25
		2CE04511046		7.5	1	10.5	18.1	25	25
		2CE04511546		10.2	1	14.1	22.7	25	25
		2CE04512046		14.6	2	20.3	30.3	35	35
060	380-3+N-50	2CE04510746	2.6	4.3	1	6.5	17.2	25	25
		2CE04511046		6.3	1	9.6	17.2	25	25
		2CE04511546		8.5	1	13.0	19.4	25	25
		2CE04512046		12.2	2	18.6	26.5	30	30
		2CE04513046		18.1	2	27.4	37.5	40	40
	415-3+N-50	2CE04510746		5.1	1	7.1	17.2	25	25
		2CE04511046		7.5	1	10.5	17.2	25	25
		2CE04511546		10.2	1	14.1	20.9	25	25
		2CE04512046		14.6	2	20.3	28.6	30	30
		2CE04513046		21.5	2	30.0	40.7	45	45
076	380-3+N-50	2CE04510746	2.6	4.3	1	6.5	22.0	35	35
		2CE04511046		6.3	1	9.6	22.0	35	35
		2CE04511546		8.5	1	13.0	22.0	35	35
		2CE04512046		12.2	2	18.6	26.5	35	35
		2CE04513046		18.1	2	27.4	37.5	40	40
	415-3+N-50	2CE04510746		5.1	1	7.1	22.0	35	35
		2CE04511046		7.5	1	10.5	22.0	35	35
		2CE04511546		10.2	1	14.1	22.0	35	35
		2CE04512046		14.6	2	20.3	28.6	35	35
		2CE04513046		21.5	2	30.0	40.7	45	45

FIELD WIRING

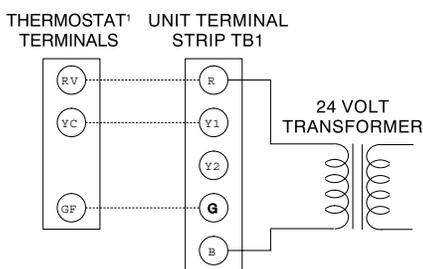
POWER WIRING

REFER TO ELECTRICAL DATA TABLES TO SIZE THE DISCONNECT SWITCH, OVERCURRENT PROTECTION AND WIRING.



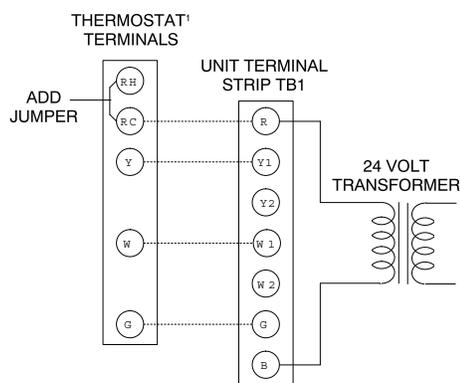
CONTROL WIRING

COOLING ONLY (24 VOLT THERMOSTAT)



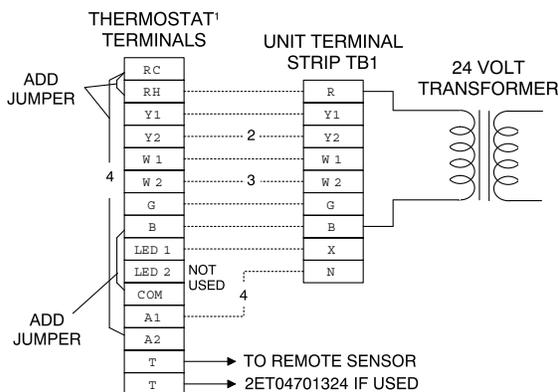
¹ TYPICAL 24 VOLT THERMOSTAT 2ET03700324 IF THE UNIT HAS AN ECONOMIZER, REMOVE JUMPER J1 FROM TERMINALS 8 AND 10 ON THE RELAY BOARD TO PREVENT SIMULTANEOUS OPERATION OF THE COMPRESSOR AND THE ECONOMIZER. IF YOU WANT TO CONTROL THE ECONOMIZER ON A SECOND STAGE OF COOLING, USE THE THERMOSTAT 2ET0770010124.

COOLING/HEATING (24 VOLT THERMOSTAT)



¹ TYPICAL 24 VOLT THERMOSTAT 2ET03700324 IF THE UNIT HAS AN ECONOMIZER, REMOVE JUMPER J1 FROM TERMINALS 8 AND 10 ON THE RELAY BOARD TO PREVENT SIMULTANEOUS OPERATION OF THE COMPRESSOR AND THE ECONOMIZER. IF YOU WANT TO CONTROL THE ECONOMIZER ON A SECOND STAGE OF COOLING, USE THE THERMOSTAT 2ET0770010124.

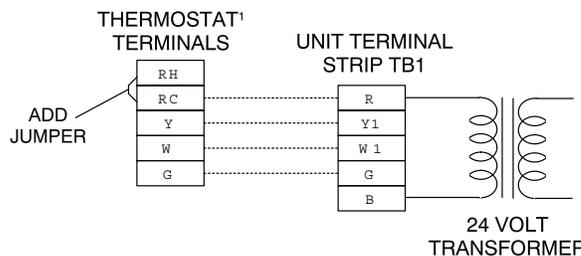
COOLING / HEATING (ELECTRONIC THERMOSTAT) MULTI-STAGE



- ¹ ELECTRONIC PROGRAMMABLE THERMOSTAT 2ET0770010024 (INCLUDES SUBBASE)
- ² SECOND STAGE COOLING IS NOT REQUIRED ON UNITS LESS ECONOMIZER.
- ³ SECOND STAGE HEATING IS ONLY REQUIRED ON UNITS WITH A TWO STAGE ELECTRIC HEATER.
- ⁴ REMOVE JUMPER J2 FROM TERMINALS 4 AND 9 ON JUMPER PLUG CONNECTOR P6 ON UNITS WITH ECONOMIZER. TERMINALS A1 AND A2 PROVIDE A RELAY OUT PUT TO CLOSE THE OUTDOOR ECONOMIZER DAMPERS WHEN THE THERMOSTAT SWITCHES TO THE SET BACK POSITION.

COOLING / HEATING (ELECTRONIC THERMOSTAT) SINGLE STAGE

COOLING / HEATING (ELECTRONIC THERMOSTAT) SINGLE STAGE



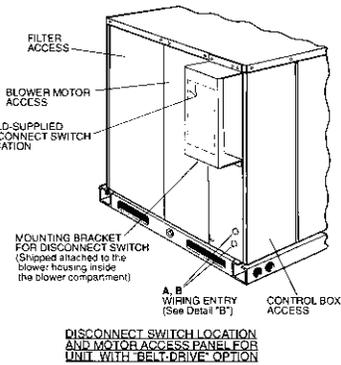
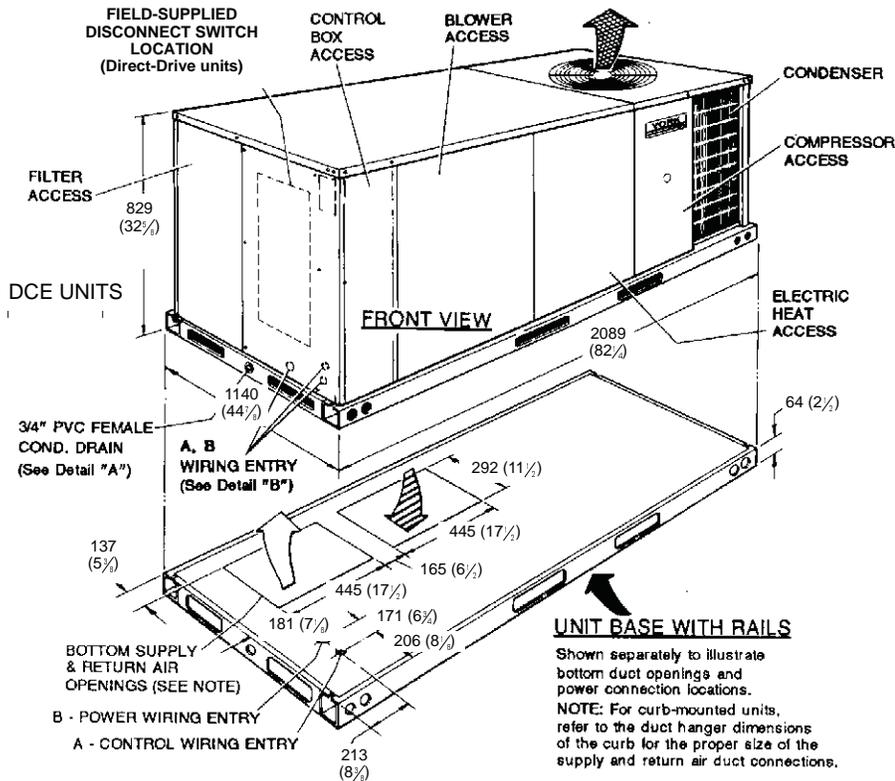
¹ ELECTRONIC THERMOSTAT 2ET0770010124 (INCLUDES SUBBASE). IF THIS UNIT HAS AN ECONOMIZER, REMOVE JUMPER J1 FROM TERMINALS 8 AND 10 ON THE RELAY BOARD TO PREVENT SIMULTANEOUS OPERATION OF THE COMPRESSOR AND THE ECONOMIZER. IF YOU WANT TO CONTROL THE ECONOMIZER ON A SECOND STAGE OF COOLING, USE THERMOSTAT 2ET0770010024

NOTE: The thermostat terminals shown above are typical. Check thermostat and unit wiring diagrams for correct wiring connections.

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UNIT DIMENSIONS (DCE/DCG036, 048, 060 &076)

All dimensions are in millimeters (inches). They are subject to change without notice. Certified dimensions will be provided upon request.



UTILITIES ENTRY DATA

HOLE	KNOCKOUT SIZE (DIA., mm/in.)	USED FOR
A	22 / 0.88 *	Control Wiring (Side or Bottom)**
B	51 / 2.0 *	Power Wiring (Side or Bottom)
C	38 / 1.63"	Gas Piping (Front)
D	38 / 1.5	Gas Piping (Bottom)

*Knockouts in the bottom of the unit can be located by the slice in the insulation.
 **Do not remove the 2" knockout ring.

CLEARANCES (mm/in.)

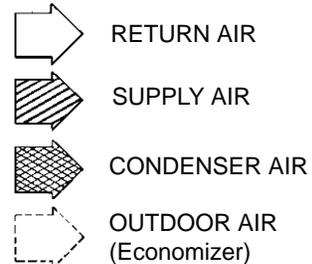
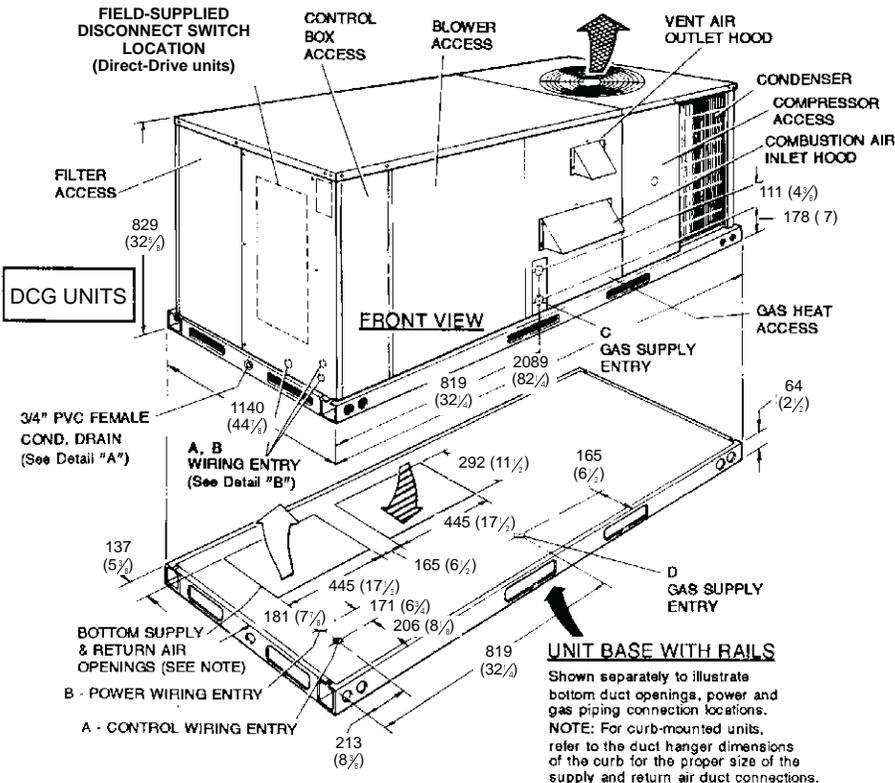
	DCE Units	610 / 24
Front	DCG Units	813 / 32
Back		305 / 12 (Less Economizer) 914 / 36 (With Economizer)
Left Side (Filter Access)		610 / 24 (Less Economizer) 914 / 36 (With Economizer)
Right Side (Cond. Coil)		610 / 24
Below Unit ¹		0 / 0
Above Unit ²		1829 / 72 (For Condenser Air Discharge)

- 1 Units may be installed on combustible floors made from wood or class A, B or C roof covering material.
- 2 Units must be installed outdoors. Overhanging structures or shrubs should not obstruct condenser air discharge outlet.

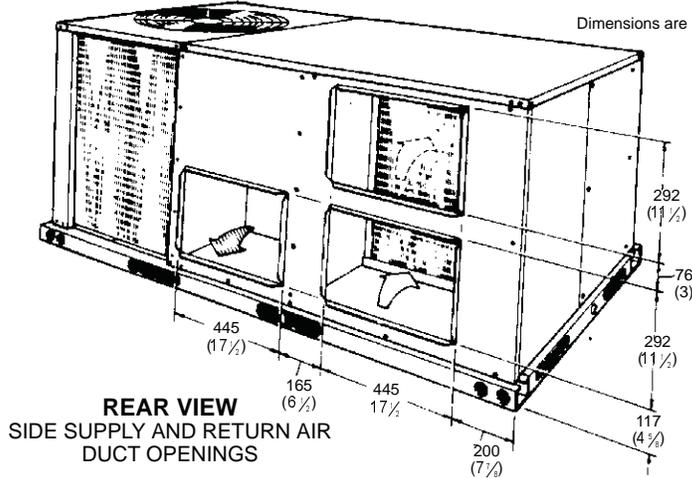
NOTES:
 DCE Models: Units and ductwork are approved for zero clearance to combustible materials when equipped with electric heaters.

DCG Models: A 25mm (1") clearance must be provided between any combustible material and the supply air ductwork for a distance of 914mm (3 ft) from the unit. The products of combustion must not be allowed to accumulate within a confined space and recirculate. Locate unit so that the vent air outlet hood is at least:

- One meter (3ft) above any forced air inlet located within 3 horizontal meters (10ft) (excluding those integral to the unit).
- 1.2 meters (4ft) below, 1.2 horizontal meters (4ft) from, or 305mm (1ft) above any door or gravity air inlet into the building.
- 1.2 meters (4ft) from electric meters, gas meters, regulators and relief equipment.



UNIT DIMENSIONS - CONT'D. (DCE and DCG - 3, 4, 5 & 6 TON)



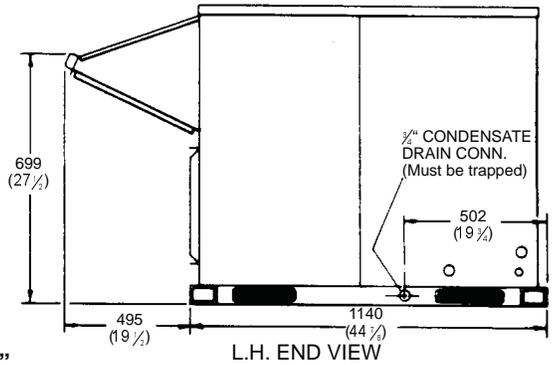
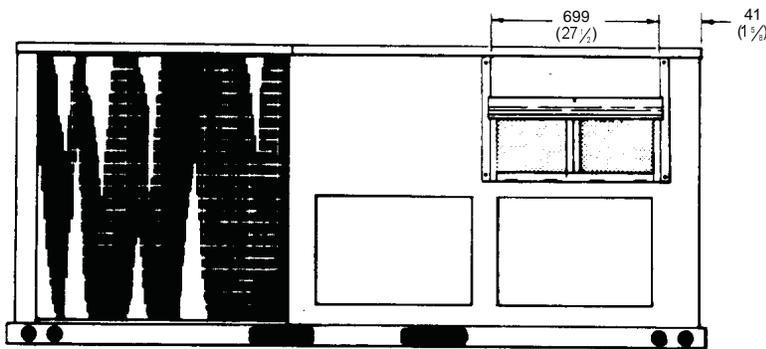
DUCT COVERS - Units are shipped with all air duct openings covered.

For **side duct** applications;

1. Remove and discard the supply and return air duct covers.
2. Connect ductwork to duct flanges on the rear of the unit.

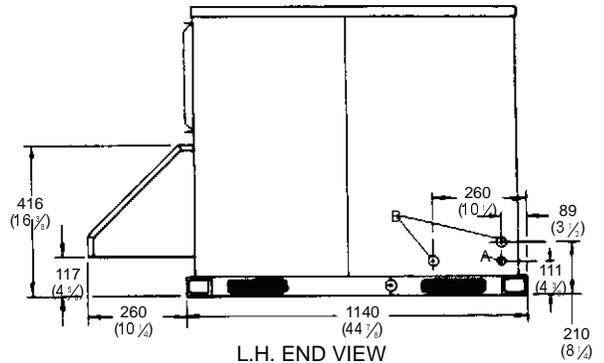
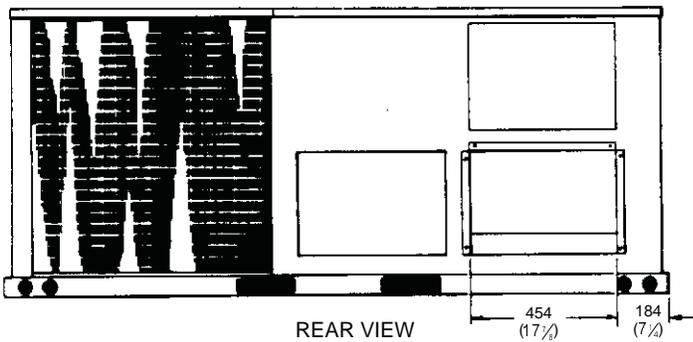
For **bottom duct** applications;

1. Remove the side supply air duct cover to gain access to the bottom supply air knockout panel.
2. Remove and discard the bottom knockout panel.

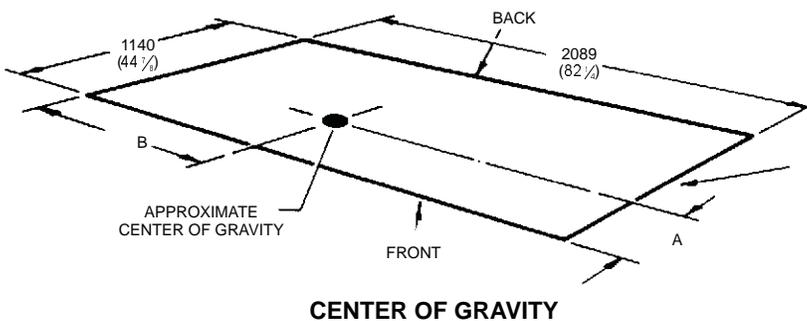


REAR VIEW

DETAIL "A"
UNIT WITH ECONOMIZER RAINHOOD



DETAIL "B"
UNIT WITH FIXED OUTDOOR AIR / BAROMETRIC RELIEF RAINHOOD



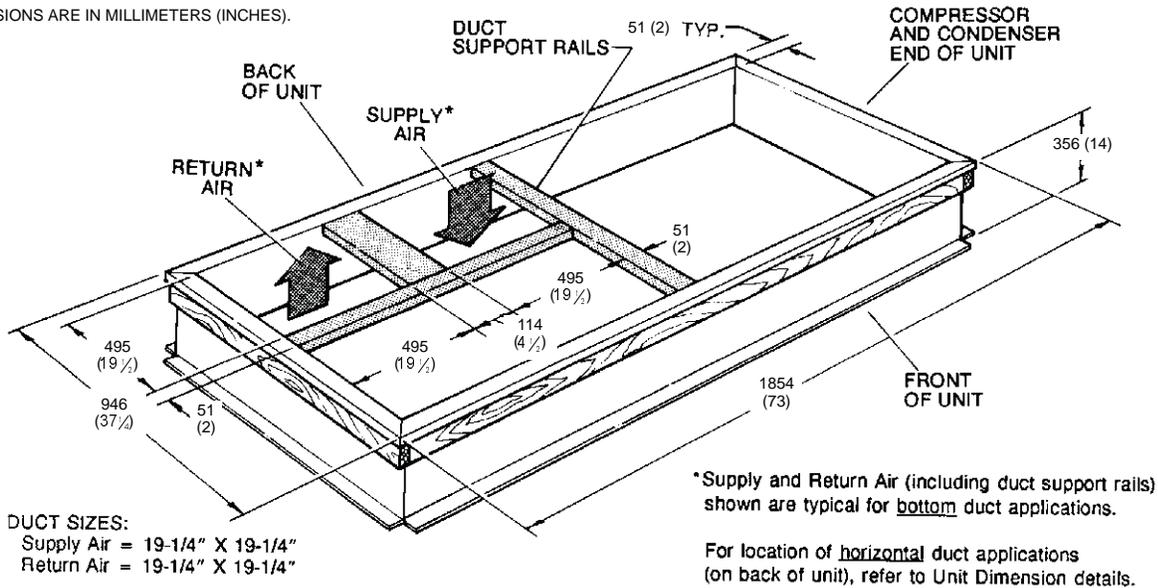
CONDENSER COIL
END OF UNIT

DIM.	036 - 060	076
A	502 (19 3/4)	559 (22)
B	1035 (40 3/4)	1118 (44)

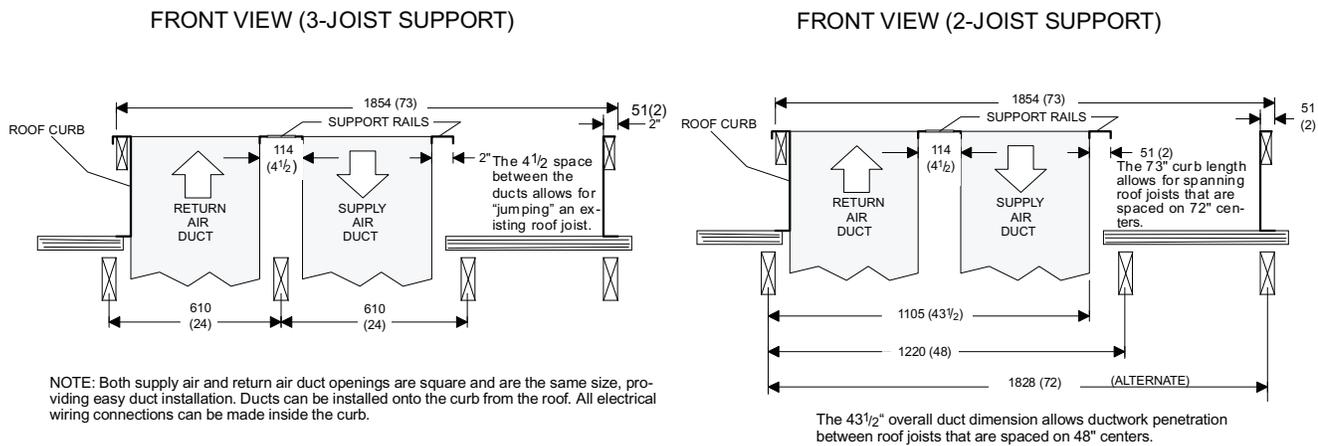
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ROOF CURB DIMENSIONS - (DCE/DCG - 036, 048, 060 & 076)

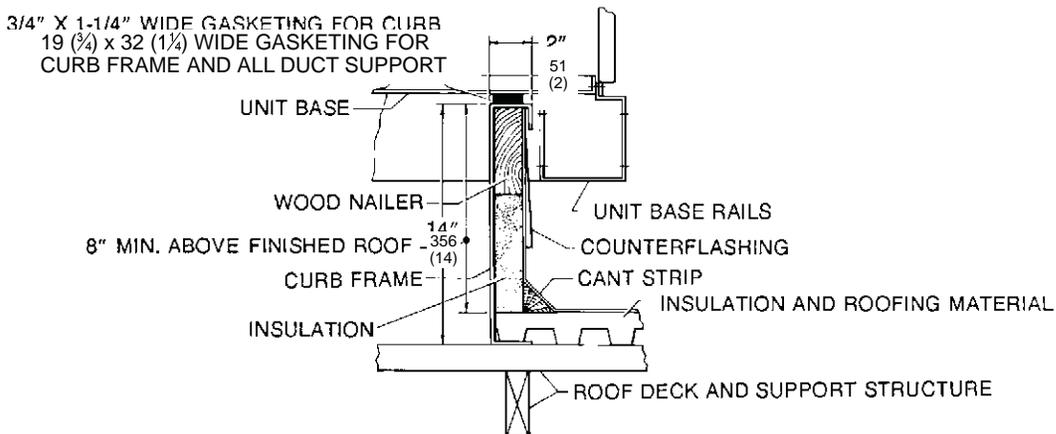
DIMENSIONS ARE IN MILLIMETERS (INCHES).



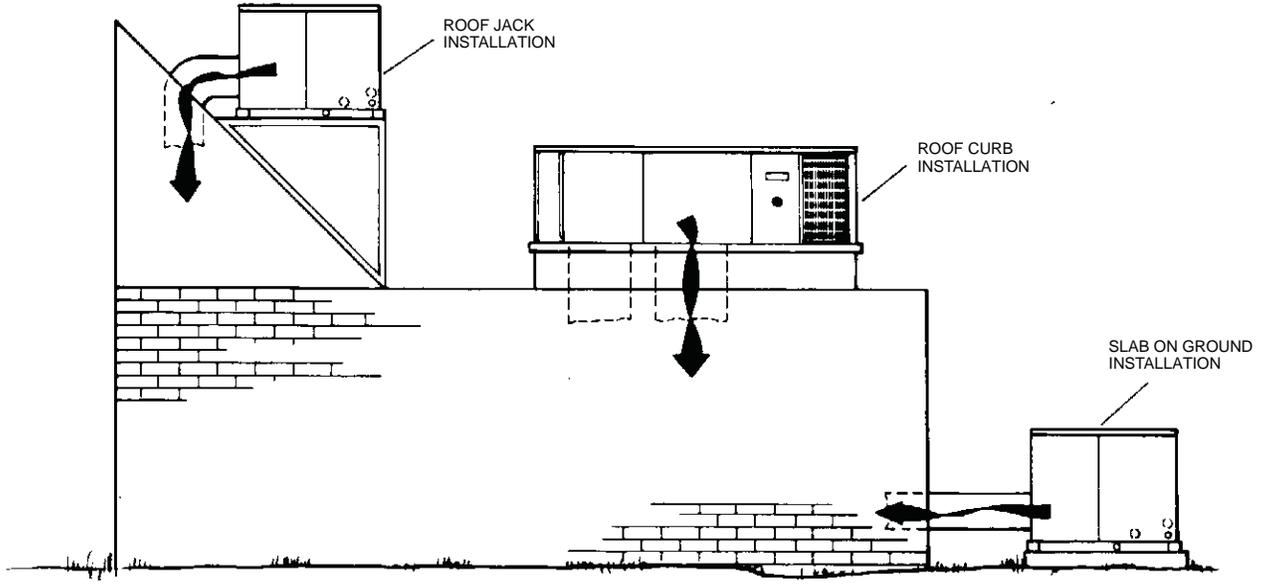
ROOF CURB BENEFITS



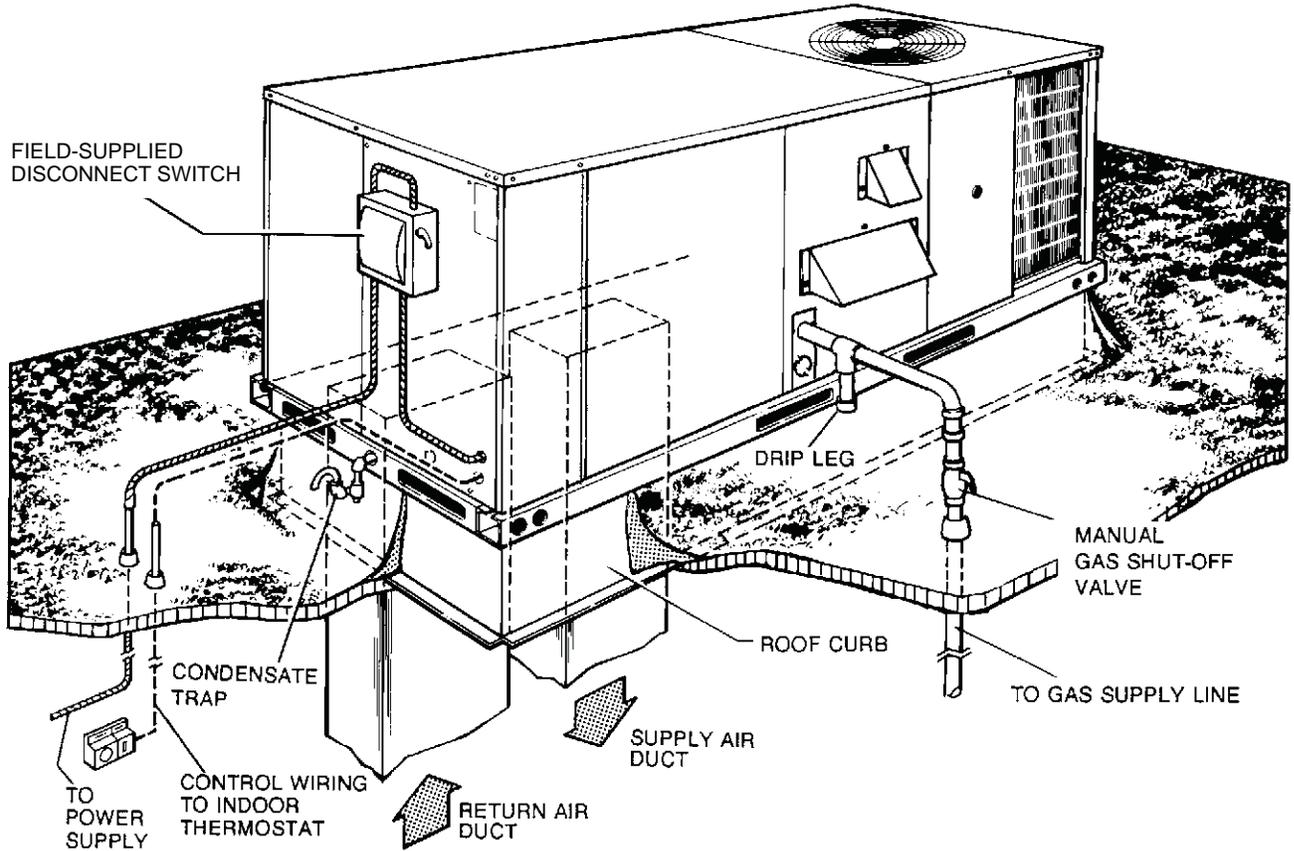
UNIT AND CURB APPLICATION



TYPICAL APPLICATIONS



TYPICAL ROOF-TOP INSTALLATION
(MODEL DCG SHOWN)





Heating and Air Conditioning

EXHIBIT C

PROJECT ORIENTATION SKETCHES

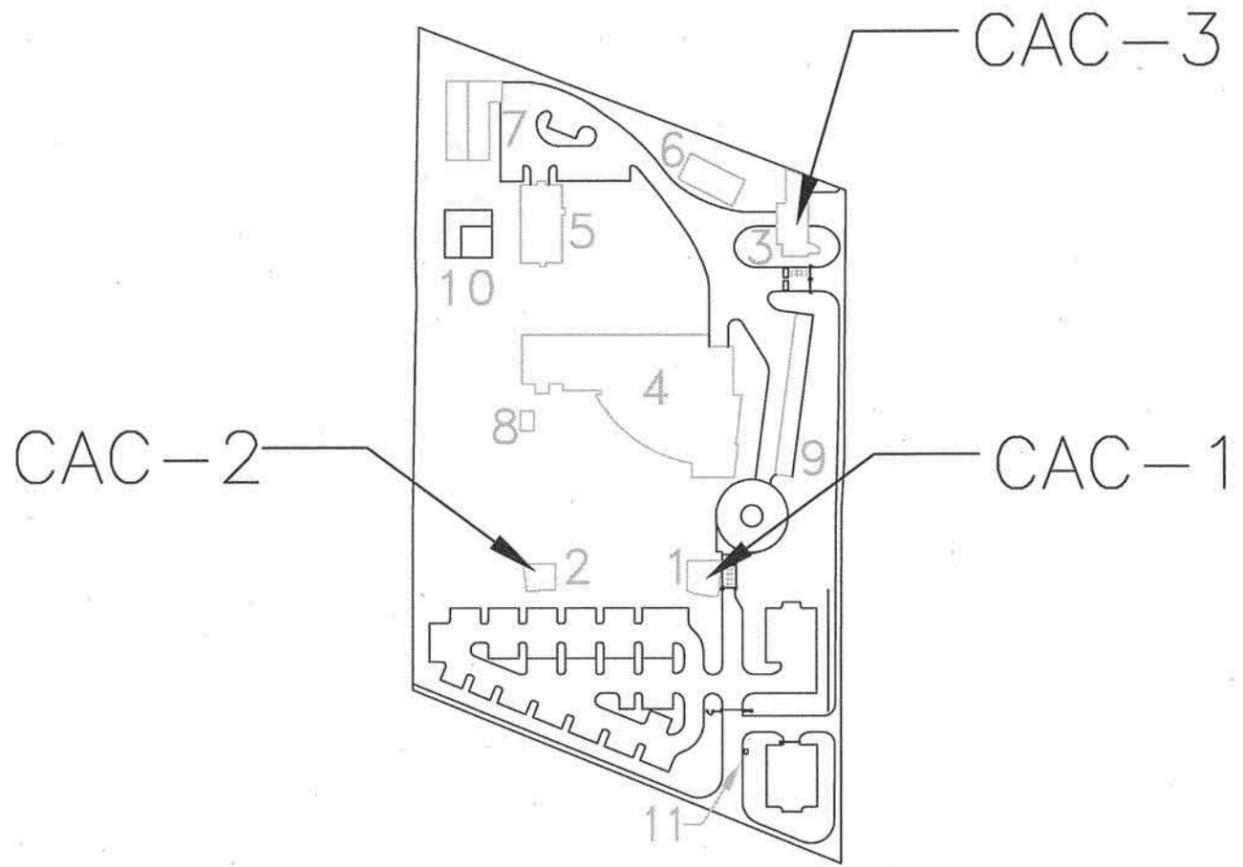
SENSITIVE BUT UNCLASSIFIED

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2016 ZAGREB CAC HVAC UPGRADE

SKETCHES FOR
CONTRACTOR ORIENTATION



COMPOUND ACCESS CONTROL (CAC) LOCATIONS

DRAWING LIST:

- ME0.01 - Cover Sheet - Drawing List / CAC Locations
- ME1.01 - CAC #1 - Existing/Demo
- ME1.02 - CAC #1 - New Work
- ME2.01 - CAC #2 - Existing/Demo
- ME2.02 - CAC #2 - New Work
- ME3.01 - CAC #3 - Existing/Demo
- ME3.02 - CAC #3 - New Work
- ME5.01 - Mechanical Details - Sheet 1 of 2
- ME5.02 - Mechanical Details - Sheet 2 of 2
- ME6.01 - CAC Elec. Schedules for Reference



United States Department of State
OFFICE OF FOREIGN BUILDINGS OPERATIONS
Washington, D.C.

CAC'S-1,2,&3 HVAC UPGRADE 2016

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CONSTRUCTION
SKETCHES
FOR CONTRACTOR ORIENTATION

Rev Number	Description	Date

Release For Construction

ZAGREB CAC UPGRADE COVER SHEET

Rev Number: **NONE**
 REVISION CORRECT NEW CHANGE DELETE

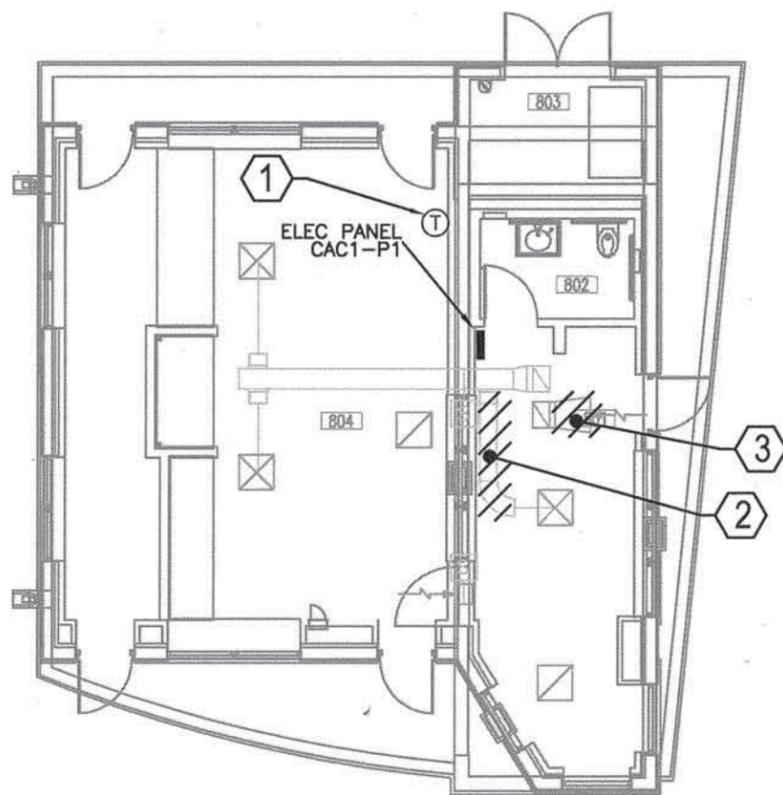
Drawn By: **JWB**
 Checked By: **JWB**
 Project Number: **CAC'S ME0.01**
 Classification: **SBU**

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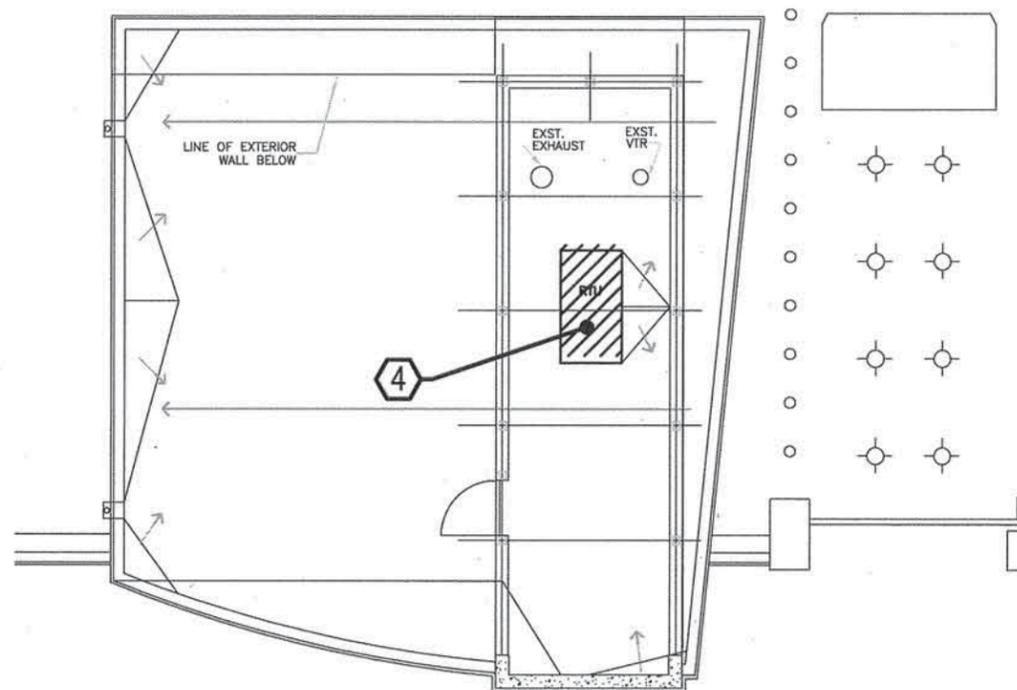
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SENSITIVE BUT UNCLASSIFIED

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CAC #1 - MECH FLOOR PLAN - EXISTING/DEMO:
- NO SCALE



CAC #1 - ROOF PLAN - EXISTING/DEMO:
- NO SCALE

CAC 1 - DEMO SHEET

GENERAL NOTES

1. THESE DRAWINGS DO NOT CONTAIN ALL SPECIFIC PROJECT REQUIREMENTS/DETAILS. THEY ARE SIMPLY A TOOL TO ORIENT THE CONTRACTOR WITH THE PROJECT REQUIREMENTS. THE WORK AND EQUIPMENT SHOWN IS DIAGRAMMATIC AND IN ITS APPROXIMATE LOCATION. THIS SKETCH IS NOT TO SCALE. DETERMINE AND COORDINATE EXACT LOCATIONS OF SYSTEMS, EQUIPMENT AND COMPONENTS IN THE FIELD. THE SKETCHES INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS AND EQUIPMENT. WHERE ADDITIONAL DIRECTION IS REQUIRED, PLEASE REFERENCE ATTACHED SPECIFICATIONS. IF THERE IS A CONTRADICTION B/W ANY OF THE PROJECT DOCUMENTS, COORDINATE WITH THE PD/COR TO OBTAIN CLEAR DIRECTION ON WHICH DOCUMENT TO FOLLOW.
2. SEE STATEMENT OF WORK NARRATIVE AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS PERTAINING TO THESE DOCUMENTS.
3. EXISTING EQUIPMENT, DUCT WORK, CHILLED WATER, HOT WATER, CONDENSATE, AND DOMESTIC WATER PIPING SHALL REMAIN UNTOUCHED UNLESS NOTED OR MODIFICATIONS ARE REQUIRED TO COMPLETE NEW WORK ACTIVITIES.

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SHEET NOTES

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1. EXISTING RTU THERMOSTAT SHALL BE REMOVED AND A NEW 7-DAY PROGRAMMABLE THERMOSTAT INSTALLED AS PART OF NEW WORK. LOCATE NEW THERMOSTAT AWAY FROM DOOR. SEE NEW WORK PLANS.
2. SUPPLY AIR DUCTWORK SECTION ABOVE GUARD BOOTH SHALL REMOVED AND DUCTWORK SECTION SHALL BE CAPPED.
3. REMOVE THE RETURN AIR ELBOW AND TRANSITION DUCTWORK AS NECESSARY TO ACCOMMODATE NEW WORK, WHICH CONNECTS THE RETURN AIR DUCTWORK DIRECTLY TO THE RETURN AIR OPENING IN THE WALL BETWEEN THE GUARD ROOM AND INTAKE/PROCESSING ROOM.
4. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF THE EXISTING ROOF TOP UNIT. ROOF CURB SHALL BE REUSED FOR NEW WORK. RETAIN ELECTRICAL, NATURAL GAS, AND CONDENSATE DRAIN INFRASTRUCTURE FOR NEW WORK. DEVICES SUCH AS THE NATURAL GAS PRESSURE REGULATOR, ELECTRICAL FUSED DISCONNECT SWITCH, AND CONDENSATE P-TRAP SHALL BE REPLACED WITH NEW.



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**CAC'S-1,2,&3
HVAC UPGRADE
2016**

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**CONSTRUCTION
SKETCHES
FOR CONTRACTOR ORIENTATION**

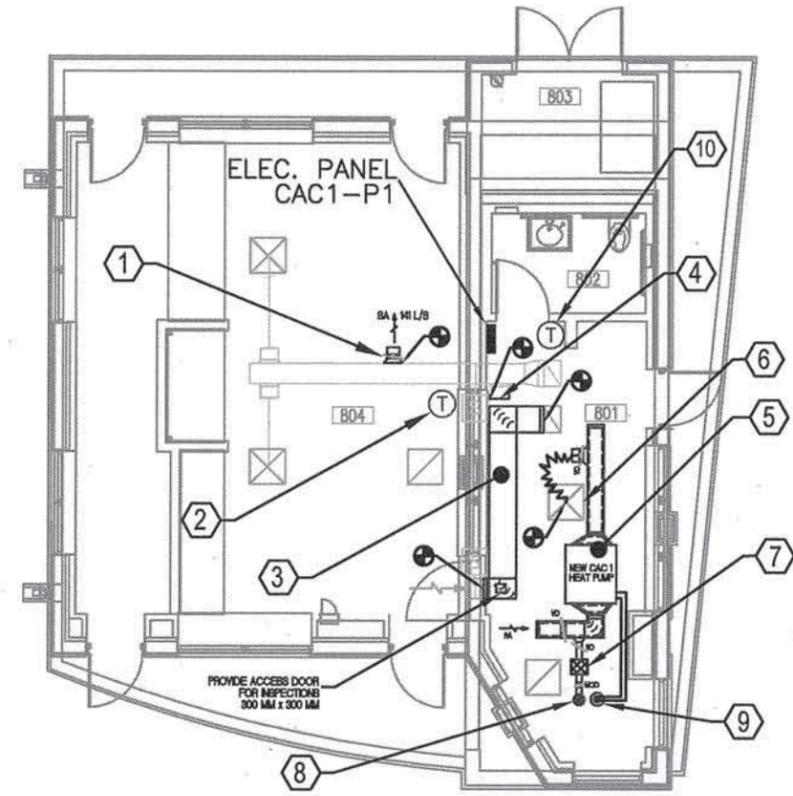
Rev Number	Description	Date

Revision For Construction: Drawing Title: CAC 1 MECH EXST/DEMO	
FBO Project Number (Drawing Title): 201-10-9-2010	Phase: 3:100
GDD File Name: 201-10-9-2010	GDD Plot Scale: 1:0000
Date: Drawn By: Checked By: Project Number: Classification:	Sheet Number: JWB CAC 1 ME1.01 SBU

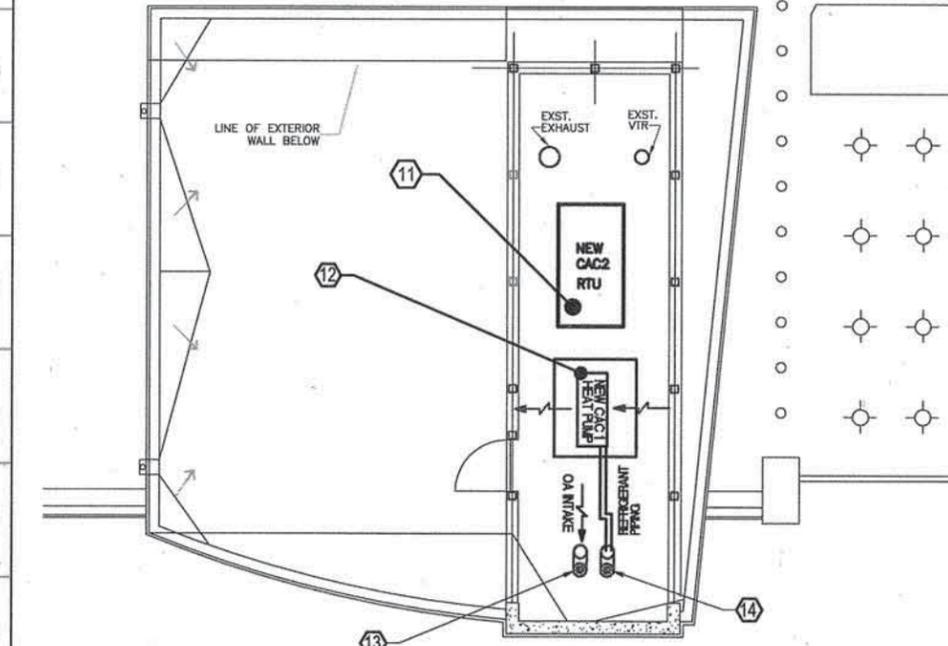
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

SENSITIVE BUT UNCLASSIFIED

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17



CAC #1 - MECH FLOOR PLAN - NEW WORK:
- NO SCALE



CAC #1 - ROOF PLAN - NEW WORK:
- NO SCALE

GENERAL NOTES

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2. SEE STATEMENT OF WORK NARRATIVE AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS PERTAINING TO THESE DOCUMENTS.
3. EXISTING EQUIPMENT, DUCTWORK, CHILLED WATER, HOT WATER, CONDENSATE, AND DOMESTIC WATER PIPING SHALL REMAIN UNTOUCHED UNLESS NOTED OR MODIFICATIONS ARE REQUIRED TO COMPLETE NEW WORK ACTIVITIES.

SHEET NOTES

1. INSTALL NEW 200 MM X 200 MM RELIEF AIR DUCT ON EXISTING DUCT BRANCH WITH VOLUME DAMPER. SET AIR FLOW AT 141 L/S.
2. INSTALL NEW 7-DAY PROGRAMMABLE THERMOSTAT FOR NEW RTU. RTU CONTROLS SHALL BE CAPABLE OF OCCUPIED/UNOCCUPIED MODES, WHERE THE OUTDOOR AIR INTAKE DAMPER IS CLOSED DURING UNOCCUPIED HOURS AND OPEN TO A MINIMUM POSITION DURING OCCUPIED HOURS. LOCATE THERMOSTAT AWAY FROM DOORS. LOCATION SHALL BE APPROVED BY FACILITY MANAGER.
3. INSTALL NEW RETURN AIR DUCTWORK BETWEEN RTU AND EXISTING 350X350 TRANSFER AIR - WALL PENETRATION. ALL RETURN AIR DUCTWORK SHALL BE SOUND LINED WITH A 25 MM MINIMUM ACOUSTICAL LINER. NEW RETURN AIR DUCTWORK SHALL HAVE A FREE AREA OF 350 MM X 350 MM OR EQUIVALENT FREE AREA. INSTALL TURNING VANES AT ALL CHANGES OF DIRECTION. A CANVAS FLEX CONNECTION SHALL BE INSTALLED WHERE THE NEW DUCTWORK CONNECTS TO THE OLD DUCTWORK EXTENDING FROM THE RTU.
4. CAP EXISTING DUCT OPENING AIR TIGHT.
5. INSTALL NEW SPLIT SYSTEM HEAT PUMP (BASIS OF DESIGN: YORK R-SERIES SINGLE ZONE SYSTEM. OUTDOOR UNIT: YORK DHR18CSB21S. CEILING HUNG INDOOR UNIT: YORK DHR18NDB21S)
 - ALL NEW CAC-1 EQUIPMENT SHOULD BE POWERED FROM ELEC. PANEL CAC1-P1. CONTRACTOR IS RESPONSIBLE FOR ALL NEW CONDUCTORS, CONDUITS, BREAKERS, DISCONNECTS, ETC.
 - 25 MM ACOUSTICAL SOUND LINED SUPPLY AIR DUCTWORK
 - 25 MM ACOUSTICAL SOUND LINED RETURN AIR DUCTWORK - 90 DEGREE TRANSITION
 - SUPPLY AND RETURN AIR DUCTWORK SHALL BE 300 MM X 300 MM MINIMUM OR EQUIVALENT FREE AREA.
 - PROVIDE CONDENSATE PUMP IF CONDENSATE CANNOT BE ROUTED VIA GRAVITY TO THE NEAREST DRAIN.
 - PROVIDE CANVAS FLEX CONNECTIONS AT SUPPLY DUCTWORK AND RETURN DUCTWORK CONNECTIONS TO THE HP.
 - THE HP AND DUCTWORK SHALL BE FASTENED TO THE SLAB ABOVE.
 - A SECONDARY DRAIN PAN SYSTEM SHALL BE INSTALLED BELOW THE NEW HP THAT COMPLIES WITH THE INTERNATIONAL MECHANICAL CODE (IMC) 307.2.3 - AUXILIARY AND SECONDARY DRAIN SYSTEMS.
6. SUPPLY AIR DIFFUSER IS EXISTING TO REMAIN. INSTALL NEW FLEXIBLE DUCT CONNECTION. FLEXIBLE DUCT SHALL BE NO GREATER THAN 8'. FLEXIBLE AND HARD DUCTWORK SHALL BE SIZED APPROPRIATELY TO REDUCE PRESSURE LOSSES AND AVOID ACOUSTICAL NUISANCES.
7. INSTALL NEW OUTDOOR AIR SUPPLY FAN AND MOTOR OPERATED SHUT-OFF INLET DAMPER. A MANUAL BALANCING DAMPER SHALL ALSO BE INSTALLED DOWNSTREAM OF THE FAN. SUPPLY FAN SHALL BE DUCTED INTO THE 90 DEGREE RETURN AIR TRANSITION. BALANCING DAMPER SHALL ALSO BE PROVIDED IN THE RETURN AIR DUCTWORK INLET. THE FAN SHALL HAVE AN INTEGRAL BACK-DRAFT DAMPER AND INTERLOCKED MOTOR OPERATED SHUT-OFF DAMPER. THE FAN SHALL BE INTERLOCKED WITH THE HEAT PUMP FAN AND OPERATE ONLY DURING OCCUPIED HOURS. BASIS OF DESIGN GREENHECK CSP-B110 DELUXE INLINE FAN. 50 L/S (ADJUSTABLE). OUTDOOR AIR SUPPLY FAN SHALL HAVE VARIABLE SPEED MOTOR AND CONTROLS.
8. 200 MM ROUND OUTDOOR AIR INTAKE DUCT UP TO ROOF. CONTRACTOR SHALL MAKE ALL NECESSARY ROOF MODIFICATIONS AND PROVIDE 150 MM ROUND GALVANIZED STEEL PIPE GOOSENECK ABOVE ROOF. GOOSENECK SHALL HAVE BIRD/INSECT SCREEN W/ 8.0MM OPENINGS MAXIMUM.
9. 200 MM ROUND GALVANIZED STEEL TRANSITION DUCT UP TO ROOF FOR REFRIGERANT PIPING AND CONTROLS WIRING TO ROOF MOUNTED CONDENSER. CONTRACTOR SHALL MAKE ALL NECESSARY ROOF MODIFICATIONS AND PROVIDE 200 MM ROUND GALVANIZED STEEL PIPE GOOSENECK ABOVE ROOF. GOOSENECK OPENING ABOVE ROOF SHALL BE SEALED WATER TIGHT AROUND PIPING AND CONTROLS WIRING. SEE DETAILS SHEET FOR PENETRATION/GOOSENECK REQUIREMENTS.
10. INSTALL NEW 7-DAY PROGRAMMABLE THERMOSTAT FOR NEW HP. HP CONTROLS SHALL BE CAPABLE OF OCCUPIED/UNOCCUPIED MODES, WHERE THE OUTDOOR AIR FAN DOES NOT OPERATE DURING UNOCCUPIED HOURS AND WHERE THE FAN OPERATES CONTINUOUSLY DURING OCCUPIED HOURS. WHEN THE OUTDOOR AIR FAN IS "OFF", THE INTERLOCKED MOTOR OPERATED DAMPER SHALL ALSO BE CLOSED. SEE DETAILS SHEET FOR PENETRATION/GOOSENECK REQUIREMENTS. LOCATE AWAY FROM DOORS. LOCATION SHALL BE APPROVED BY FACILITY MANAGER.
11. INSTALL NEW RTU AS SPECIFIED. BASIS OF DESIGN YORK DC036 - SUNLINE 200 SERIES. NEW RTU SHALL BE FURNISHED WITH NEW FUSED ELECTRICAL DISCONNECT, NEW NATURAL GAS PRESSURE REGULATOR AND ASSOCIATED SHUTOFF VALVES, NEW CONDENSATE P-TRAP AND NECESSARY CONDENSATE PIPING. RTU SHALL HAVE ADJUSTABLE CONTROL OF THE RELIEF AIR OUTLET TO MAINTAIN SPACE PRESSURIZATION. INITIAL OUT DOOR AIR INTAKE VOLUME SHALL BE SET TO 61 L/S, BUT SHALL BE ADJUSTED IN ACCORDANCE WITH THE NEW HEAT PUMP SYSTEM TO ENSURE THAT THE GUARD BOOTH ROOM IS MAINTAINED AT A POSITIVE PRESSURE (2.5 PA - 5 PA) RELATIVE THE THE INTAKE/PROCESSING SIDE OF THE CAC. CONTRACT SHALL PERFORM ALL NECESSARY ALTERATIONS TO MATE NEW RTU TO EXISTING RTU CURB. CONTRACTOR SHALL PROVIDE NEW FLASHING OR REPAIR FLASHING WHERE DAMAGED.
12. NEW HEAT PUMP CONDENSER MOUNTED TO NEW EQUIPMENT PAD. EQUIPMENT PAD MATERIAL SHALL BE APPROVED BY FACILITY MANAGER. SEE DETAILS SHEET FOR ROOF PREPARATION AND MOUNTING REQUIREMENTS. RECOMMENDED PAD SIZE - 1200 MM X 1200 MM. - ALL NEW CAC-1 EQUIPMENT SHOULD BE POWERED FROM ELEC. PANEL CAC1-P1.
13. NEW ROOF PENETRATION FOR OUTDOOR AIR INTAKE. NEW GALVANIZED STEEL GOOSENECK. 200 MM ROUND MINIMUM. GOOSENECK SHALL HAVE BIRD/INSECT SCREEN W/ 8.0MM OPENINGS MAXIMUM. OUTDOOR AIR INTAKE SHALL BE AT LEAST 10' FROM ANY EXHAUST/VENT OUTLETS.
14. NEW GALVANIZED STEEL GOOSENECK. 200 MM ROUND GALVANIZED STEEL TRANSITION DUCT UP TO ROOF FOR REFRIGERANT PIPING AND POWER/CONTROLS WIRING TO ROOF MOUNTED CONDENSER. CONTRACTOR SHALL MAKE ALL NECESSARY ROOF MODIFICATIONS AND PROVIDE 200 MM ROUND GALVANIZED STEEL PIPE GOOSENECK ABOVE ROOF. GOOSENECK OPENING ABOVE ROOF SHALL BE SEALED WATER TIGHT AROUND PIPING AND CONTROLS WIRING. SEE DETAILS SHEET FOR PENETRATION/GOOSENECK REQUIREMENTS.



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**CAC'S-1,2,&3
HVAC UPGRADE
2016**

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**CONSTRUCTION
SKETCHES
FOR CONTRACTOR ORIENTATION**

Rev. Number	Description	Date

Release For Circulation:

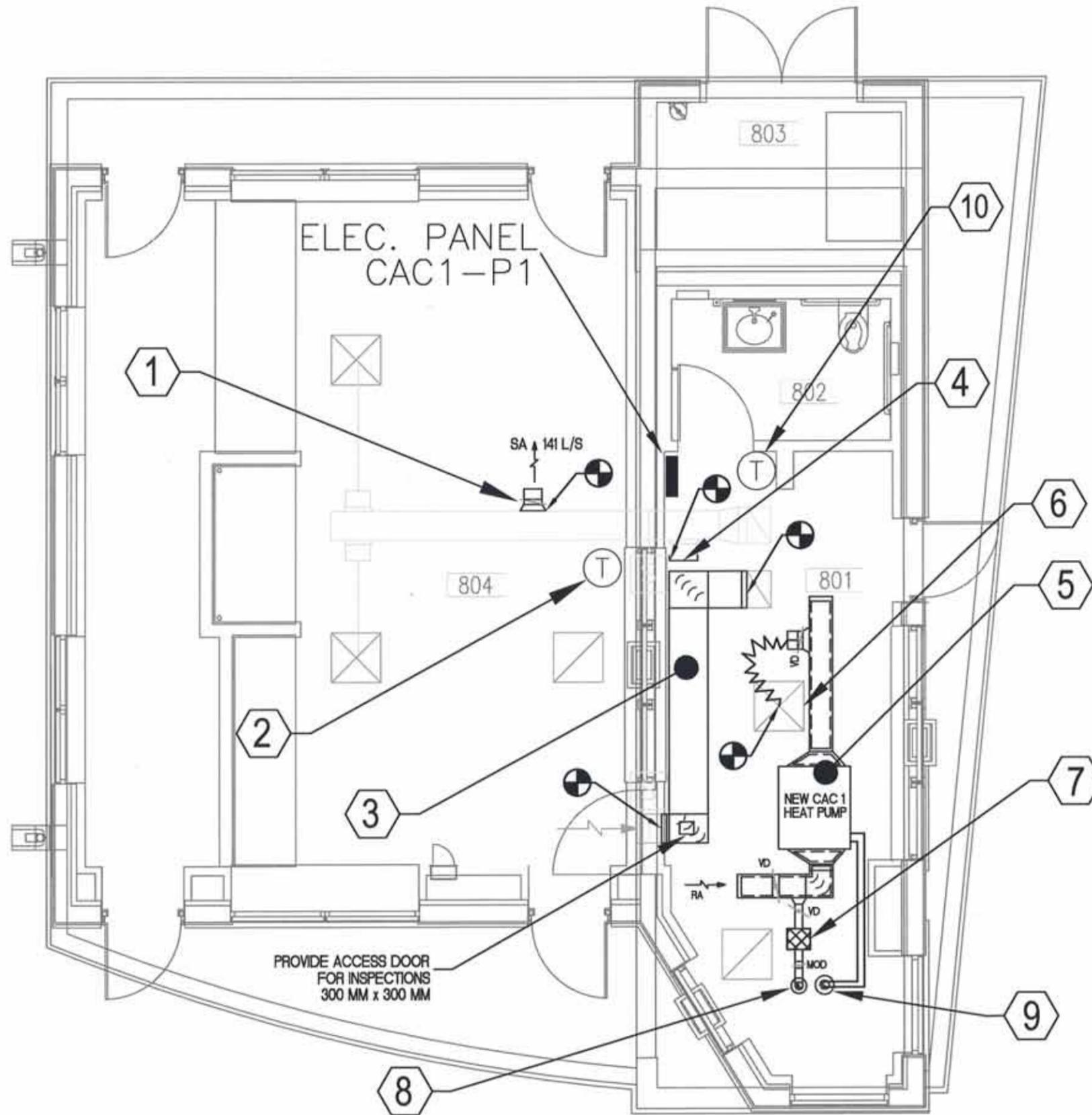
Author: JWB/MS
Drawing Title: **CAC 1 MECH NEW WORK**

FSD Project Number: Drawing Scale: 1:100
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Sheet Number: **CAC 1 ME1.02**

Drawn By: JWB
 Checked By: []
 Project Number: []
 Classification: SBU

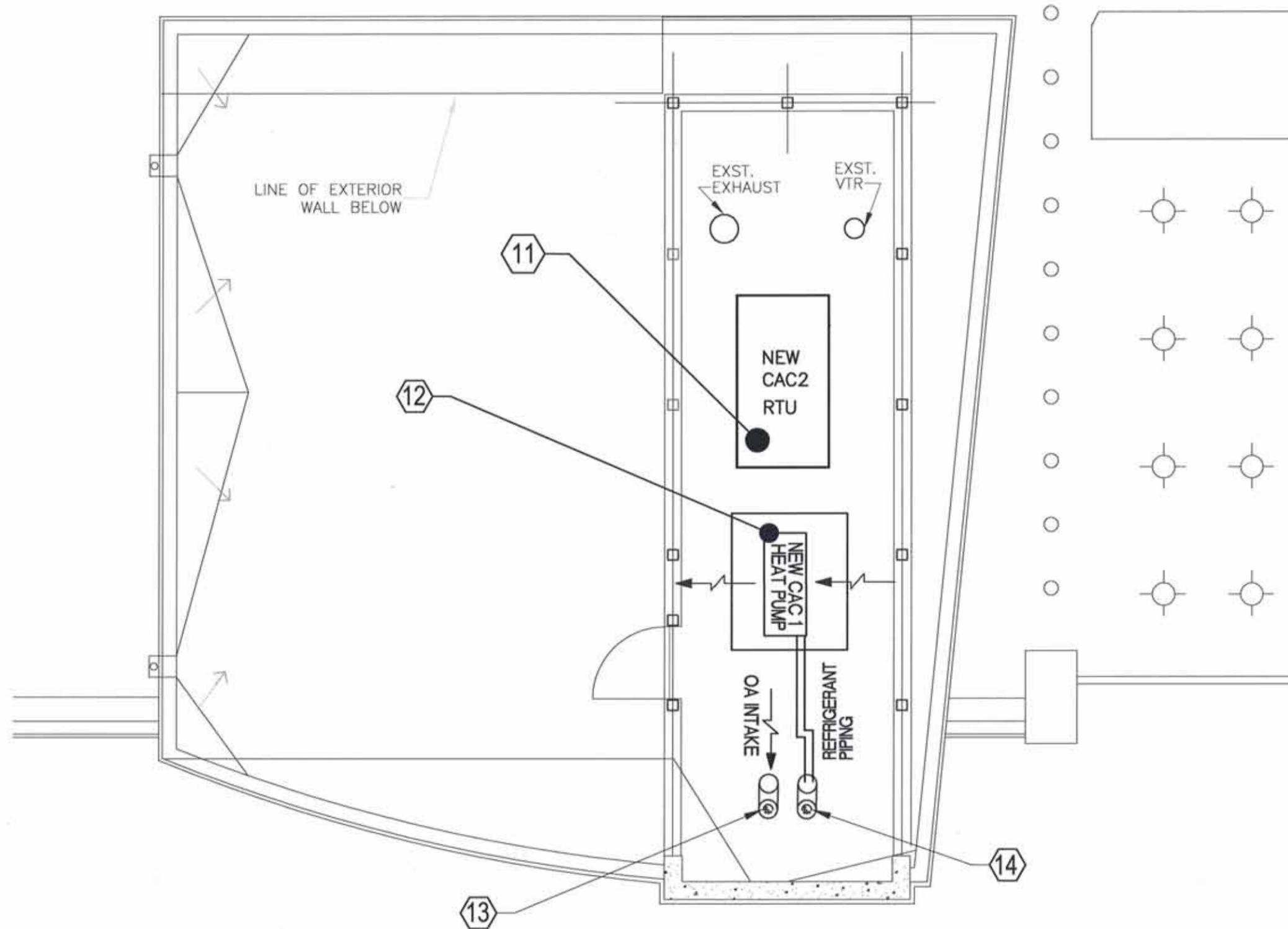
SENSITIVE BUT UNCLASSIFIED



CAC #1 - MECH FLOOR PLAN - NEW WORK:

- NO SCALE

*Larger View From
Sheet ME1.02*



CAC #1 - ROOF PLAN - NEW WORK:
- NO SCALE

*Larger View From
Sheet ME1.02*

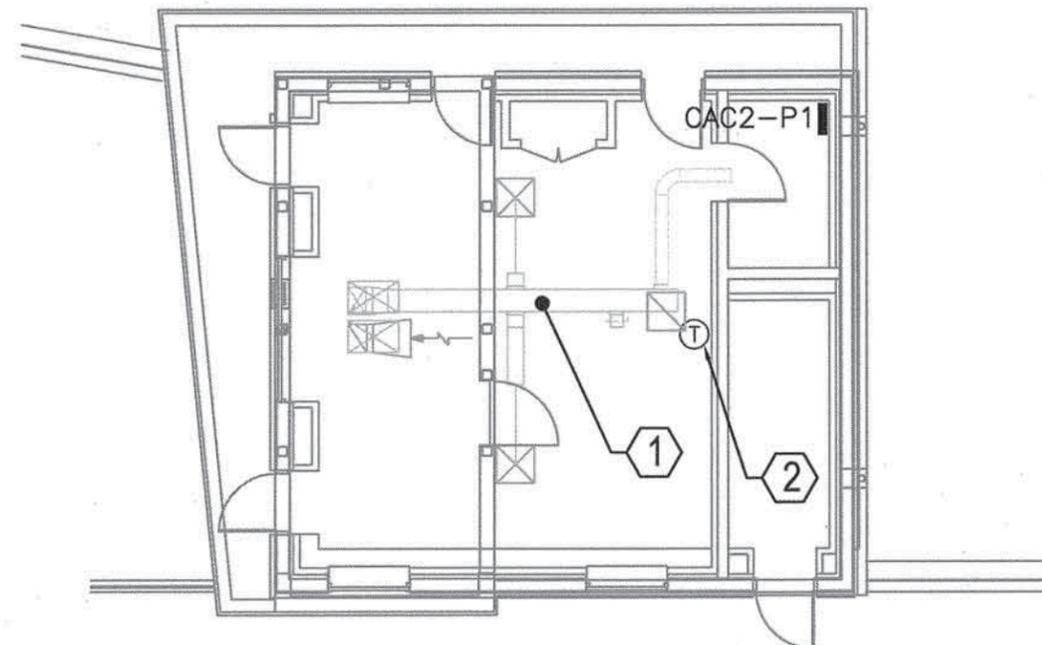
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CAC 2 - DEMO SHEET

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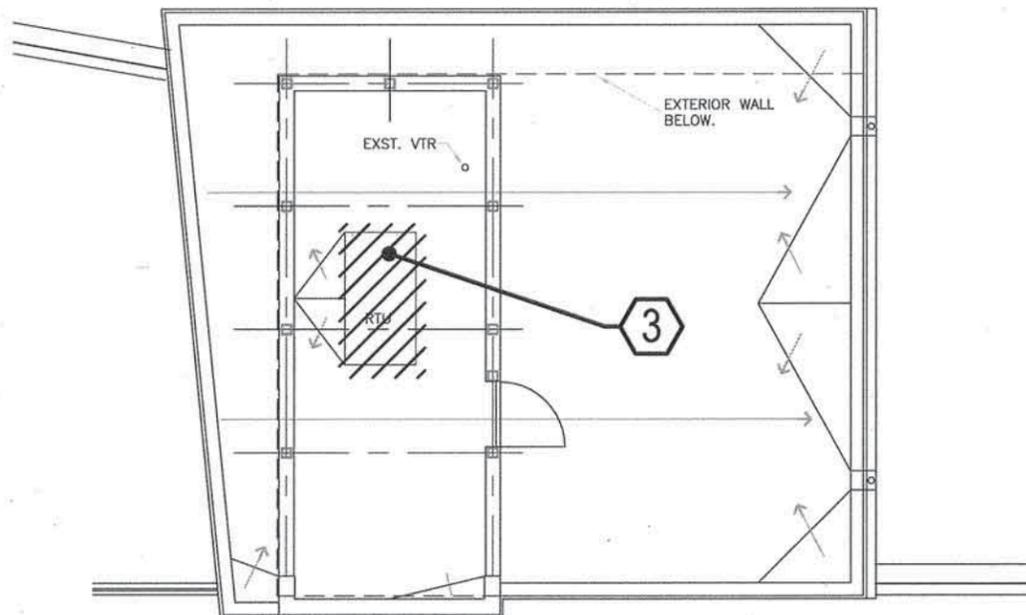
CAC #2 - MECH FLOOR PLAN - EXISTING/DEMO:
- NO SCALE



SHEET NOTES



1. CAC #2 SUPPLY AIR DUCTWORK AND DIFFUSERS SHALL REMAIN UNALTERED.
2. CAC #2 - THERMOSTAT SHALL BE REMOVED AND REPLACED WITH NEW AS PART OF NEW WORK.
3. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF THE EXISTING ROOF TOP UNIT. ROOF CURB SHALL BE REUSED FOR NEW WORK. RETAIN ELECTRICAL, NATURAL GAS, AND CONDENSATE DRAIN INFRASTRUCTURE FOR NEW WORK. DEVICES SUCH AS THE NATURAL GAS PRESSURE REGULATOR, ELECTRICAL FUSED DISCONNECT SWITCH, AND CONDENSATE P-TRAP SHALL BE REPLACED WITH NEW.



CAC #2 - ROOF PLAN - EXISTING/DEMO:
- NO SCALE



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CAC'S-1,2,&3
HVAC UPGRADE
2016

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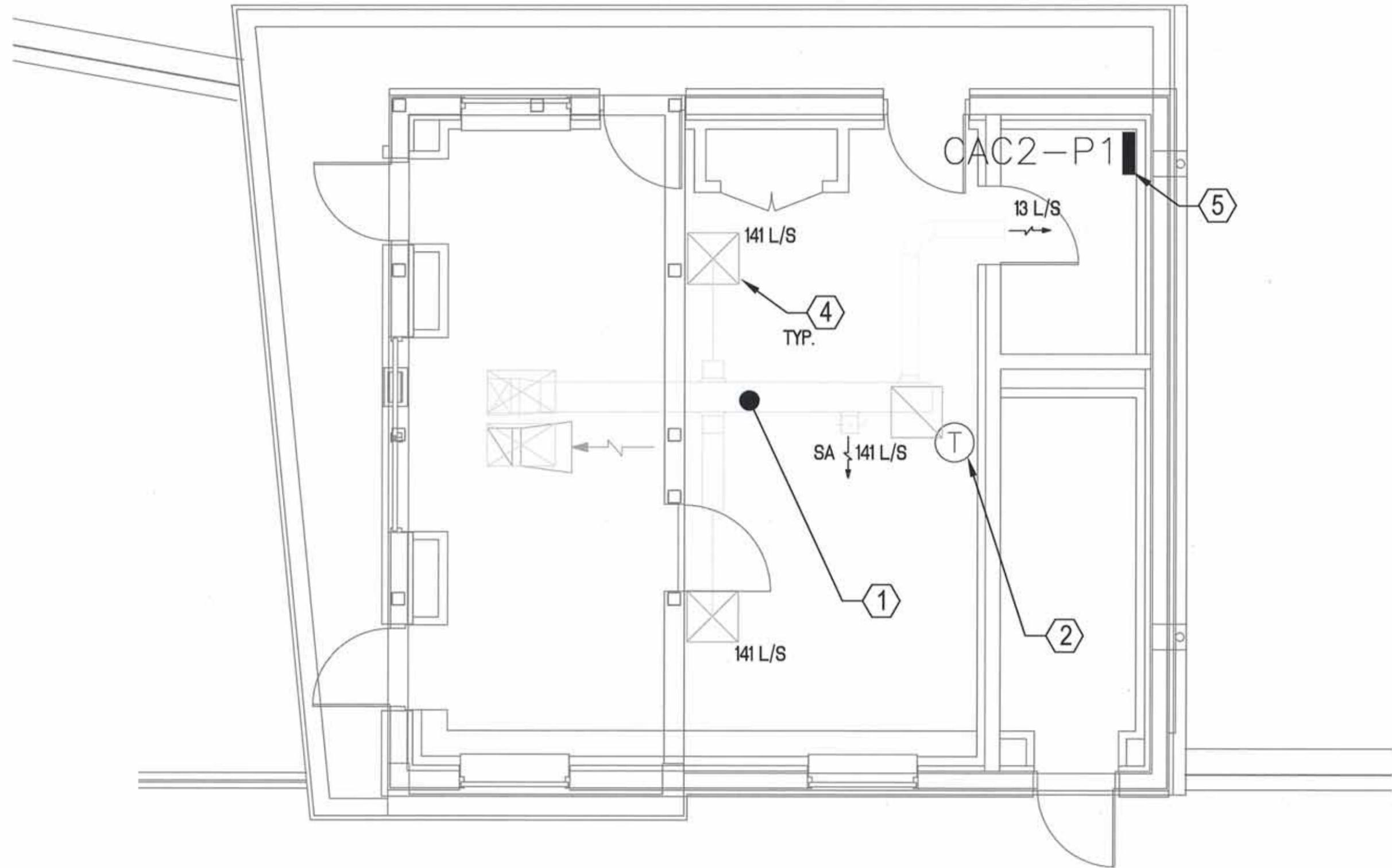
CONSTRUCTION
SKETCHES
FOR CONTRACTOR ORIENTATION

Rev Number	Description	Date

Release For Construction:	
Approved:	Authorizer:
Drawing Title	
CAC 2 MECH EXST/DEMO	
FDU Project Number	Drawing Scale
1-1000	1:1000
CADD File Name	CADD Plot Scale
206_H_B_F_16.10	1:000%
Date	Sheet Number
Drawn By: JWB	CAC 2
Checked By:	ME2.01
Project Number:	
Classification:	SBU

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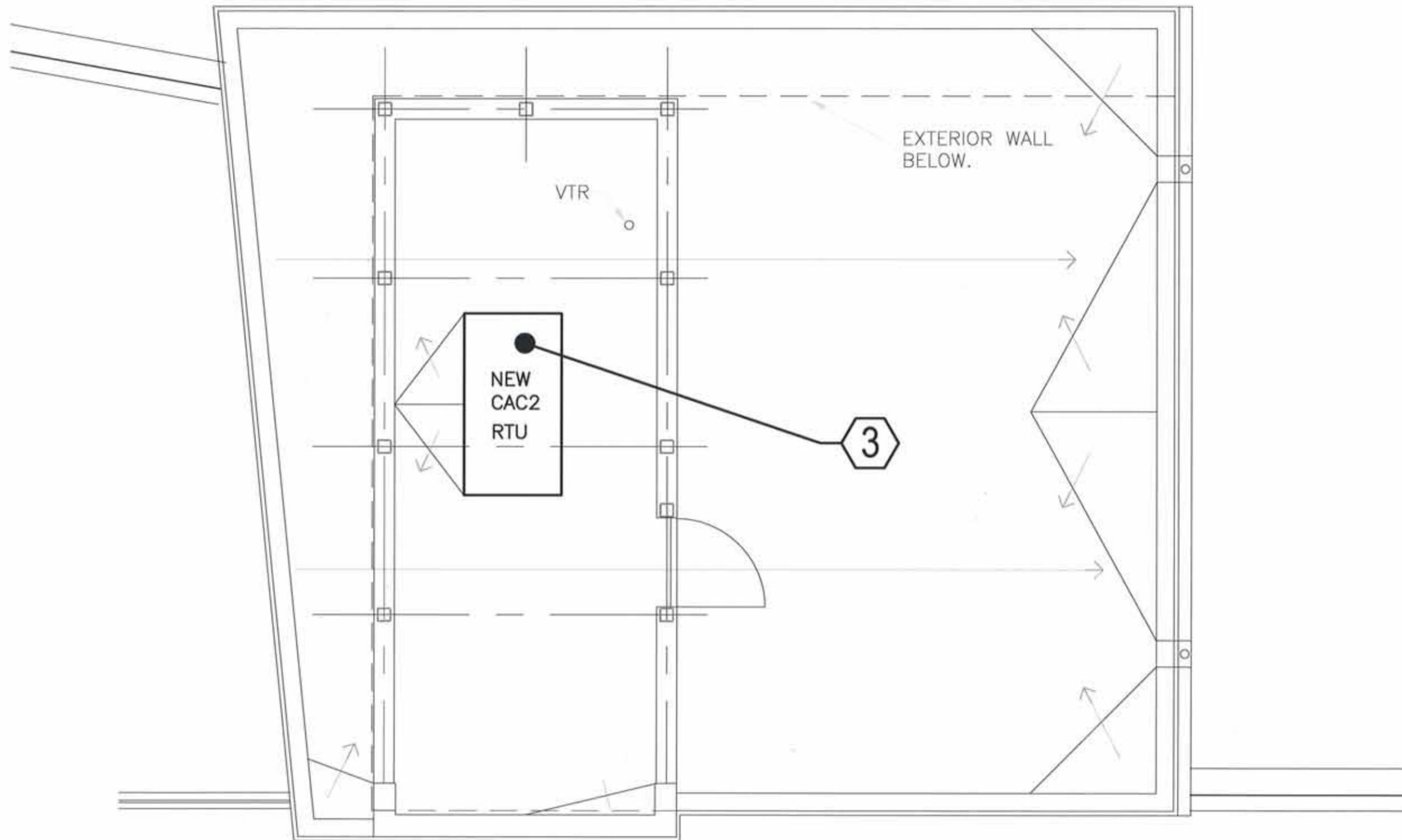
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CAC #2 - MECH FLOOR PLAN - NEW WORK:

- NO SCALE

*Larger View
Front SHEET
ME2.02*



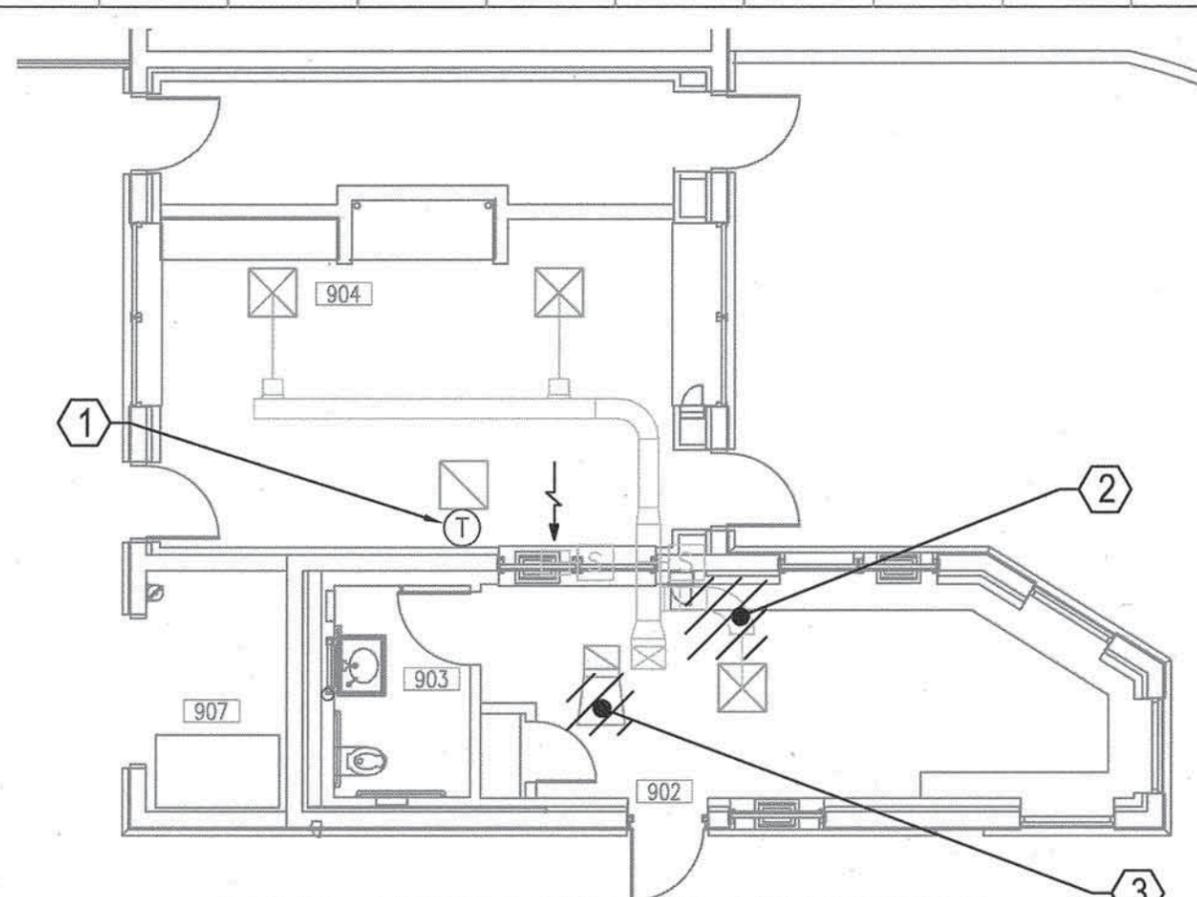
CAC #2 - ROOF PLAN - NEW WORK:
- NO SCALE

*Larger View
From Sheet
ME 2.02*

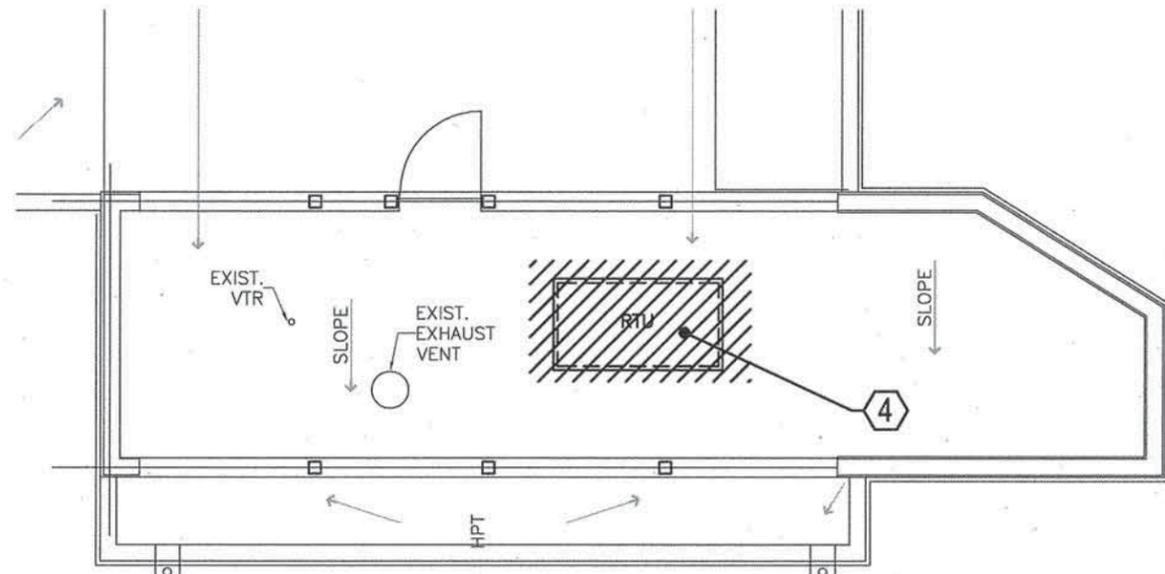
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CAC #3 - MECH FLOOR PLAN - EXISTING/DEMO:
- NO SCALE



CAC #3 - ROOF PLAN - EXISTING/DEMO:
- NO SCALE

CAC 3 - DEMO SHEET

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SHEET NOTES

1. EXISTING RTU THERMOSTAT SHALL BE REMOVED AND A NEW 7-DAY PROGRAMMABLE THERMOSTAT INSTALLED AS PART OF NEW WORK.
2. SUPPLY AIR DUCTWORK SECTION ABOVE GUARD BOOTH SHALL REMOVED AND DUCTWORK SECTION SHALL BE CAPPED.
3. REMOVE THE RETURN AIR ELBOW AND TRANSITION DUCTWORK AS NECESSARY TO ACCOMMODATE NEW WORK, WHICH CONNECTS THE RETURN AIR DUCTWORK DIRECTLY TO THE RETURN AIR OPENING IN THE WALL BETWEEN THE GUARD ROOM AND INTAKE/PROCESSING ROOM.
4. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF THE EXISTING ROOF TOP UNIT. ROOF CURB SHALL BE REUSED FOR NEW WORK. RETAIN ELECTRICAL, NATURAL GAS, AND CONDENSATE DRAIN INFRASTRUCTURE FOR NEW WORK. DEVICES SUCH AS THE NATURAL GAS PRESSURE REGULATOR, ELECTRICAL FUSED DISCONNECT SWITCH, AND CONDENSATE P-TRAP SHALL BE REPLACED WITH NEW.



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**CONSTRUCTION
SKETCHES
FOR CONTRACTOR ORIENTATION**

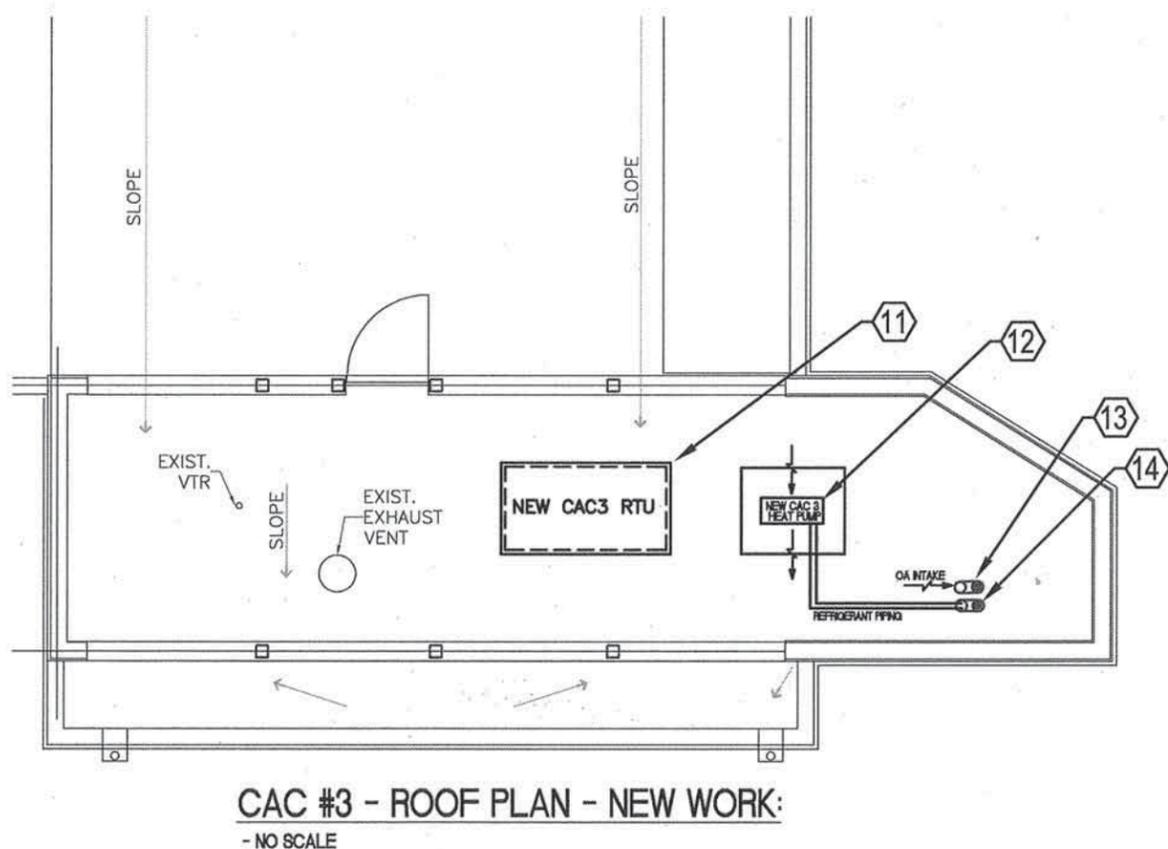
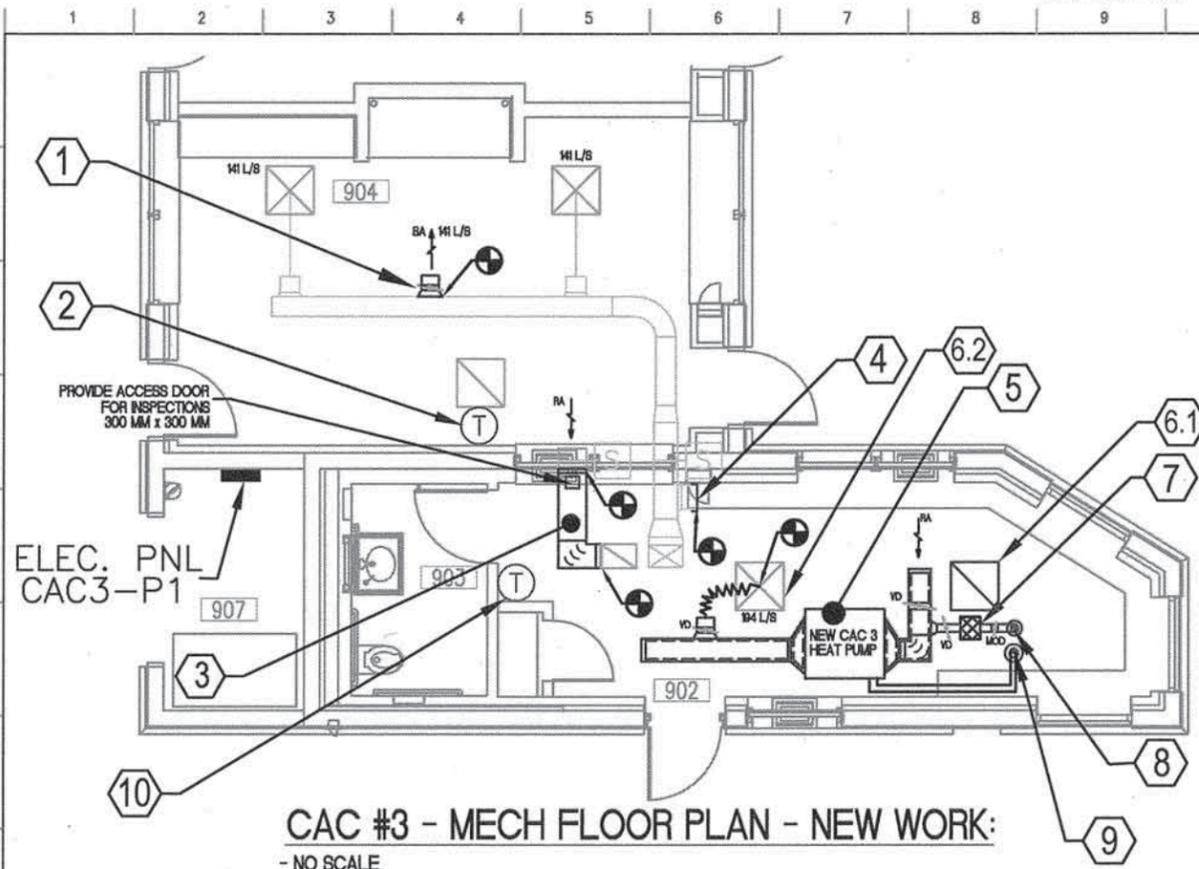
Rev Number	Description	Date

Revision For Construction: Approved: _____ Date: _____	
Drawing Title: CAC 3 MECH EXST/DEMO	
File Project Number: _____ Drawing Scale: 3:1000 Date: 8/6/2016	Plot Date: _____ Plot Scale: 1:1000
Date: Drawn By: JWB Checked By: Project Number:	Sheet Number: CAC 3 ME3.01 Classification: SBU

SENSITIVE BUT UNCLASSIFIED

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

SENSITIVE BUT UNCLASSIFIED



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SHEET NOTES

1. INSTALL NEW 200 MM X 200 MM RELIEF AIR DUCT ON EXISTING DUCT BRANCH WITH VOLUME DAMPER. SET AIR FLOW AT 141 US.
2. INSTALL NEW 7-DAY PROGRAMMABLE THERMOSTAT FOR NEW RTU. RTU CONTROLS SHALL BE CAPABLE OF OCCUPIED/UNOCCUPIED MODES, WHERE THE OUTDOOR AIR DAMPER IS CLOSED DURING UNOCCUPIED HOURS AND OPEN TO A MINIMUM POSITION DURING OCCUPIED HOURS. LOCATE AWAY FROM DOORS.
3. INSTALL NEW RETURN AIR DUCTWORK BETWEEN RTU AND EXISTING 350X350 TRANSFER AIR - WALL PENETRATION. ALL RETURN AIR DUCTWORK SHALL BE SOUND LINED WITH A 25 MM MINIMUM ACOUSTICAL LINER. NEW RETURN AIR DUCTWORK SHALL HAVE A FREE AREA OF 350 MM X 350 MM OR EQUIVALENT FREE AREA. INSTALL TURNING VANES AT ALL CHANGES OF DIRECTION. A CANVAS FLEX CONNECTION SHALL BE INSTALLED WHERE THE NEW DUCTWORK CONNECTS TO THE OLD DUCTWORK EXTENDING FROM THE RTU.
4. CAP EXISTING DUCT OPENING AIR TIGHT.
5. INSTALL NEW SPLIT SYSTEM HEAT PUMP (BASIS OF DESIGN: YORK R-SERIES SINGLE ZONE HEAT PUMP SYSTEM. OUTDOOR UNIT: DHR18CSB215S. CEILING HUNG DUCTED INDOOR UNIT: DHR18NDB21S).
 - 25 MM ACOUSTICAL SOUND LINED SUPPLY AIR DUCTWORK
 - 25 MM ACOUSTICAL SOUND LINED RETURN AIR DUCTWORK - 90 DEGREE TRANSITION
 - SUPPLY AND RETURN AIR DUCTWORK SHALL BE 300 MM X 300 MM MINIMUM OR EQUIVALENT FREE AREA.
 - PROVIDE CONDENSATE PUMP IF CONDENSATE CANNOT BE ROUTED VIA GRAVITY TO THE NEAREST DRAIN.
 - PROVIDE CANVAS FLEX CONNECTIONS AT SUPPLY / RETURN DUCTWORK CONNECTIONS TO THE HP.
 - ALL NEW CAC-3 EQUIPMENT SHOULD BE POWERED FROM ELEC. PANEL CAC3-P1. CONTRACTOR IS RESPONSIBLE FOR ALL NEW CONDUCTORS, CONDUITS, BREAKERS, DISCONNECTS, ETC.
 - THE HP AND DUCTWORK SHALL BE FASTENED TO THE SLAB ABOVE.
 - A SECONDARY DRAIN PAN SYSTEM SHALL BE INSTALLED BELOW THE NEW HP THAT COMPLIES WITH THE INTERNATIONAL MECHANICAL CODE (IMC) 307.2.3 - AUXILIARY AND SECONDARY DRAIN SYSTEMS.
- 6.1 INSTALL NEW RETURN AIR GRILL IN THE CEILING OF THE GUARD BOOTH AREA. RETURN AIR GRILL SHALL BE APPROVED BY THE FACILITY MANAGER.
- 6.2 SUPPLY AIR DIFFUSER IS EXISTING TO REMAIN. INSTALL NEW FLEXIBLE DUCT CONNECTION. FLEXIBLE DUCT SHALL BE NO GREATER THAN 8'. FLEXIBLE AND HARD DUCTWORK SHALL BE SIZED APPROPRIATELY TO REDUCE PRESSURE LOSSES AND AVOID ACOUSTICAL NUISANCES.
7. INSTALL NEW OUTDOOR AIR SUPPLY FAN AND MOTOR OPERATED SHUT-OFF INLET DAMPER. SUPPLY FAN SHALL BE DUCTED INTO THE 90 DEGREE RETURN AIR TRANSITION. BALANCING DAMPER SHALL BE PROVIDED IN THE RETURN AIR DUCTWORK. THE FAN SHALL HAVE AN INTEGRAL BACK-DRAFT DAMPER AND INTERLOCKED MOTOR OPERATED SHUT-OFF DAMPER. THE FAN SHALL BE INTERLOCKED WITH THE HP FAN AND OPERATE ONLY DURING OCCUPIED HOURS. BASIS OF DESIGN GREENHECK CSP-B110 DELUXE INLINE FAN. 50 US (ADJUSTABLE). FAN SHALL HAVE VARIABLE SPEED MOTOR AND CONTROLS FOR BALANCING.
8. 200 MM ROUND OUTDOOR AIR INTAKE DUCT UP TO ROOF. CONTRACTOR SHALL MAKE ALL NECESSARY ROOF MODIFICATIONS AND PROVIDE 150 MM ROUND GALVANIZED STEEL PIPE GOOSENECK ABOVE ROOF. GOOSENECK SHALL HAVE BIRD/INSECT SCREEN W/ 8.0MM OPENINGS MAXIMUM.
9. 200 MM ROUND GALVANIZED STEEL TRANSITION DUCT UP TO ROOF FOR REFRIGERANT PIPING AND CONTROLS WIRING TO ROOF MOUNTED CONDENSER. CONTRACTOR SHALL MAKE ALL NECESSARY ROOF MODIFICATIONS AND PROVIDE 200 MM ROUND GALVANIZED STEEL PIPE GOOSENECK ABOVE ROOF. GOOSENECK OPENING ABOVE ROOF SHALL BE SEALED WATER TIGHT AROUND PIPING AND CONTROLS WIRING. SEE DETAILS SHEET FOR PENETRATION/GOOSENECK REQUIREMENTS.
10. INSTALL NEW 7-DAY PROGRAMMABLE THERMOSTAT FOR NEW HP. HP CONTROLS SHALL BE CAPABLE OF OCCUPIED/UNOCCUPIED MODES, WHERE THE OUTDOOR AIR FAN DOES NOT OPERATE DURING UNOCCUPIED HOURS AND WHERE THE FAN OPERATES CONTINUOUSLY DURING OCCUPIED HOURS. WHEN THE OUTDOOR AIR FAN IS "OFF", THE INTERLOCKED MOTOR OPERATED DAMPER SHALL ALSO BE CLOSED. SEE DETAILS SHEET FOR PENETRATION/GOOSENECK REQUIREMENTS. LOCATE AWAY FROM DOORS.
11. INSTALL NEW RTU AS SPECIFIED. BOD YORK DC036-SUNLINE 200 SERIES. NEW RTU SHALL BE FURNISHED WITH NEW FUSED ELECTRICAL DISCONNECT, NEW NATURAL GAS PRESSURE REGULATOR AND ASSOCIATED SHUTOFF VALVES, NEW CONDENSATE P-TRAP AND NECESSARY CONDENSATE PIPING. RTU SHALL HAVE ADJUSTABLE CONTROL FOR RELIEF AIR TO MAINTAIN SPACE PRESSURIZATION. INITIAL OUTDOOR AIR INTAKE FLOW RATE SHALL BE 54 US, BUT SHALL BE ADJUSTED IN ACCORDANCE WITH THE NEW HEAT PUMP SYSTEM TO ENSURE THAT THE GUARD BOOTH AREA IS POSITIVE 2.5-5.0 PASCALS RELATIVE TO THE INTAKE/PROCESSING SIDE OF THE CAC. CONTRACTOR SHALL PERFORM ALL NECESSARY ALTERATIONS TO MATE NEW RTU TO EXISTING RTU CURB. CONTRACTOR SHALL PROVIDE NEW FLASHING OR REPAIR FLASHING WHERE DAMAGED.
12. NEW HEAT PUMP CONDENSER MOUNTED TO NEW EQUIPMENT PAD. EQUIPMENT PAD MATERIAL SHALL BE APPROVED BY FACILITY MANAGER. SEE DETAILS SHEET FOR ROOF PREPARATION AND MOUNTING REQUIREMENTS. RECOMMENDED PAD SIZE - 1200 MM X 1200 MM. POWER FROM ELEC. PANEL CAC3-P1.
13. NEW ROOF PENETRATION FOR OUTDOOR AIR INTAKE. NEW GALVANIZED STEEL GOOSENECK. 200 MM ROUND MINIMUM. GOOSENECK SHALL HAVE BIRD/INSECT SCREEN W/ 8.0MM OPENINGS MAXIMUM. OUTDOOR AIR INTAKE SHALL BE AT LEAST 10' FROM ANY EXHAUST/VENT OUTLETS.
14. NEW GALVANIZED STEEL GOOSENECK. 200 MM ROUND GALVANIZED STEEL TRANSITION DUCT UP TO ROOF FOR REFRIGERANT PIPING AND POWER/CONTROLS WIRING TO ROOF MOUNTED CONDENSER. CONTRACTOR SHALL MAKE ALL NECESSARY ROOF MODIFICATIONS AND PROVIDE 200 MM ROUND GALVANIZED STEEL PIPE GOOSENECK ABOVE ROOF. GOOSENECK OPENING ABOVE ROOF SHALL BE SEALED WATER TIGHT AROUND PIPING AND CONTROLS WIRING. SEE DETAILS SHEET FOR PENETRATION/GOOSENECK REQUIREMENTS.



**CAC'S-1,2,&3
HVAC UPGRADE
2016**

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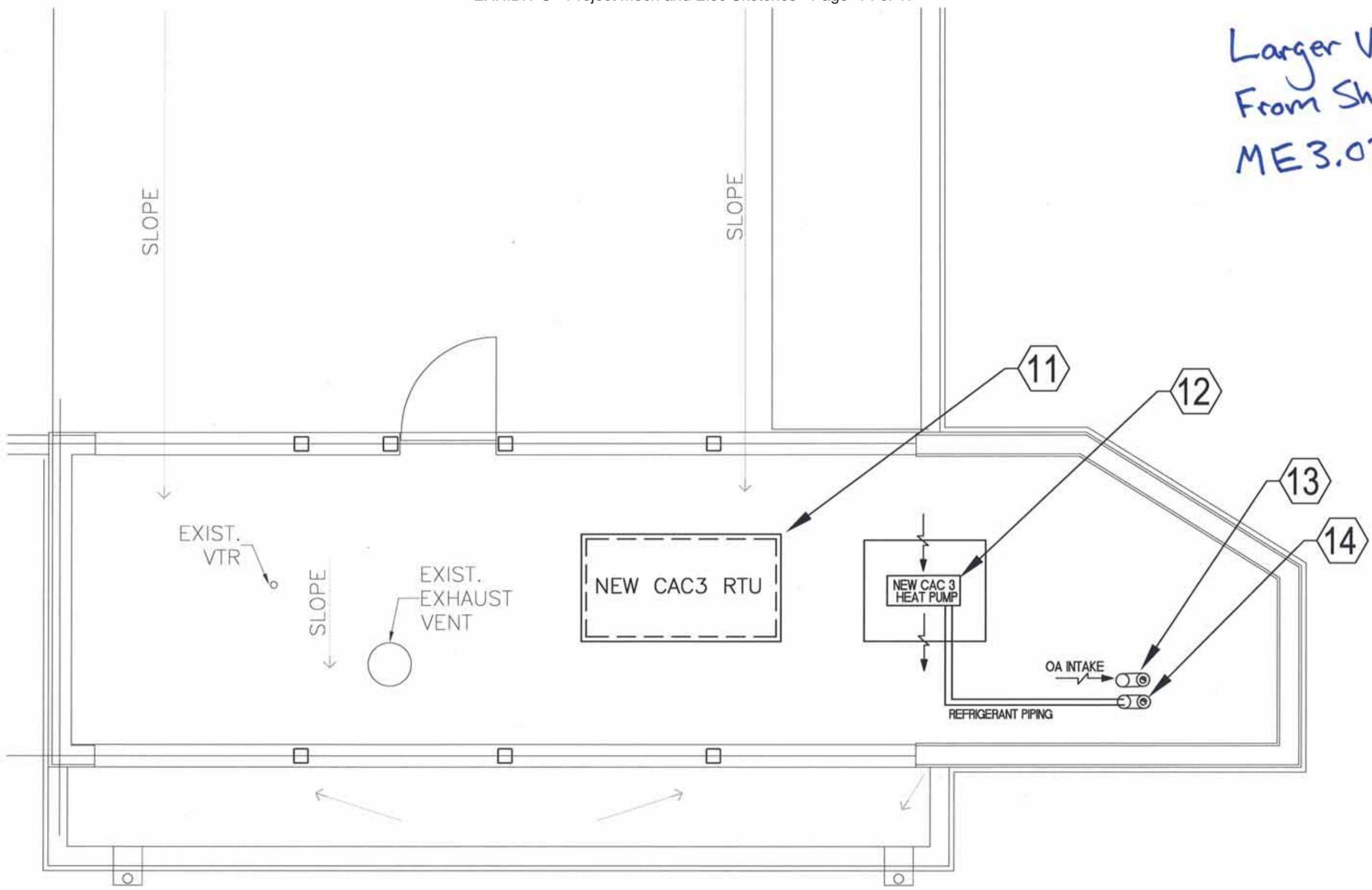
**CONSTRUCTION
SKETCHES
FOR CONTRACTOR ORIENTATION**

Rev Number	Description	Date

Drawing Title: **CAC 3 MECH NEW WORK**
 Date: 11/09/16
 Drawn By: JWB
 Checked By: JWB
 Project Number: CAC 3 ME3.02
 Classification: SBU

SENSITIVE BUT UNCLASSIFIED

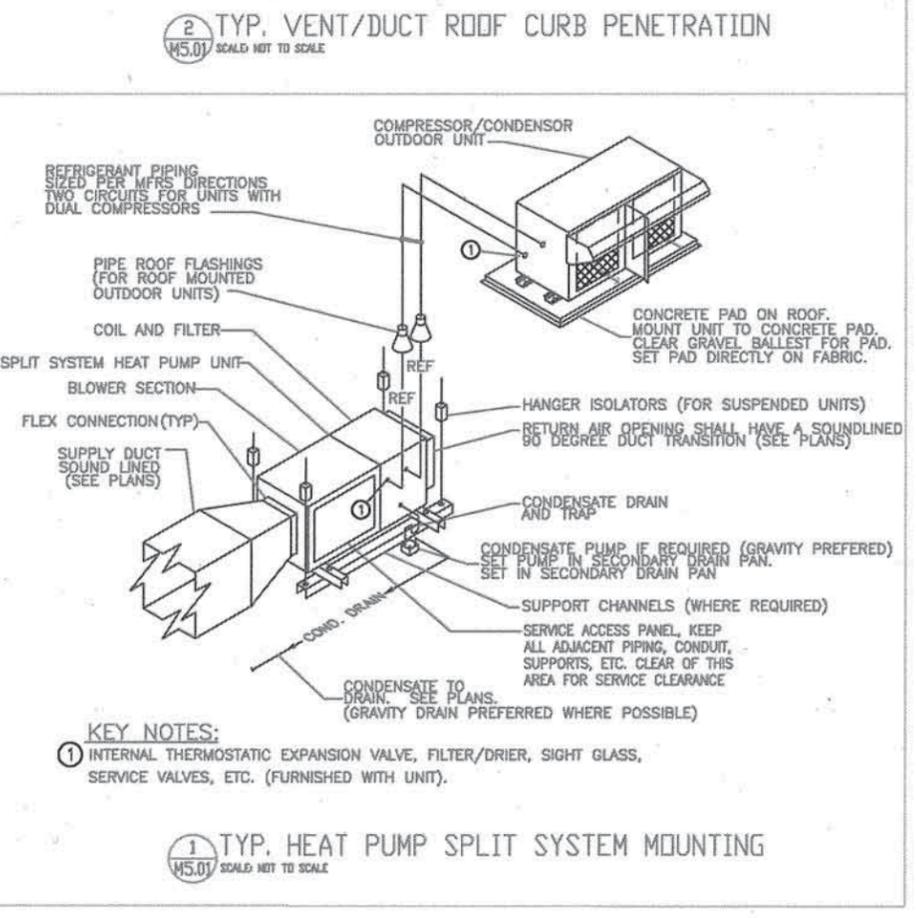
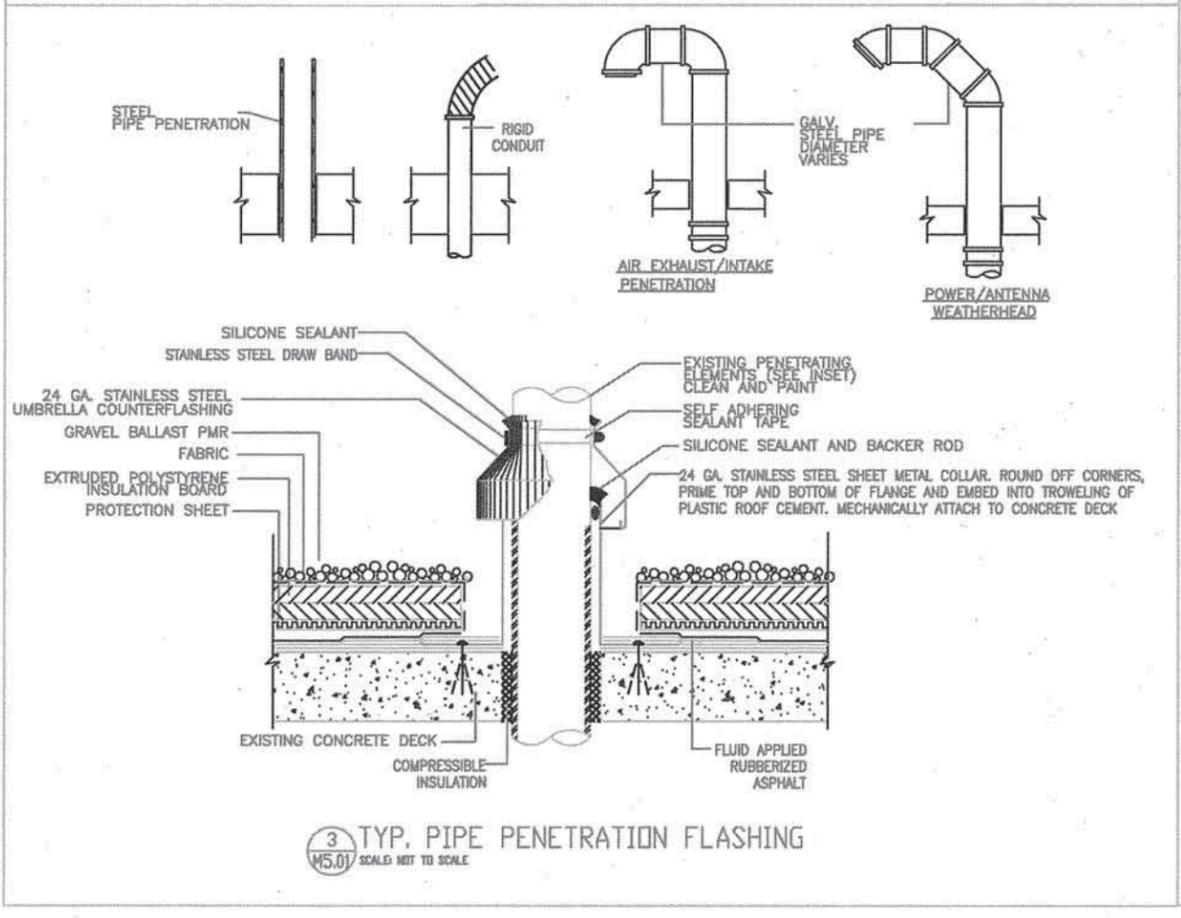
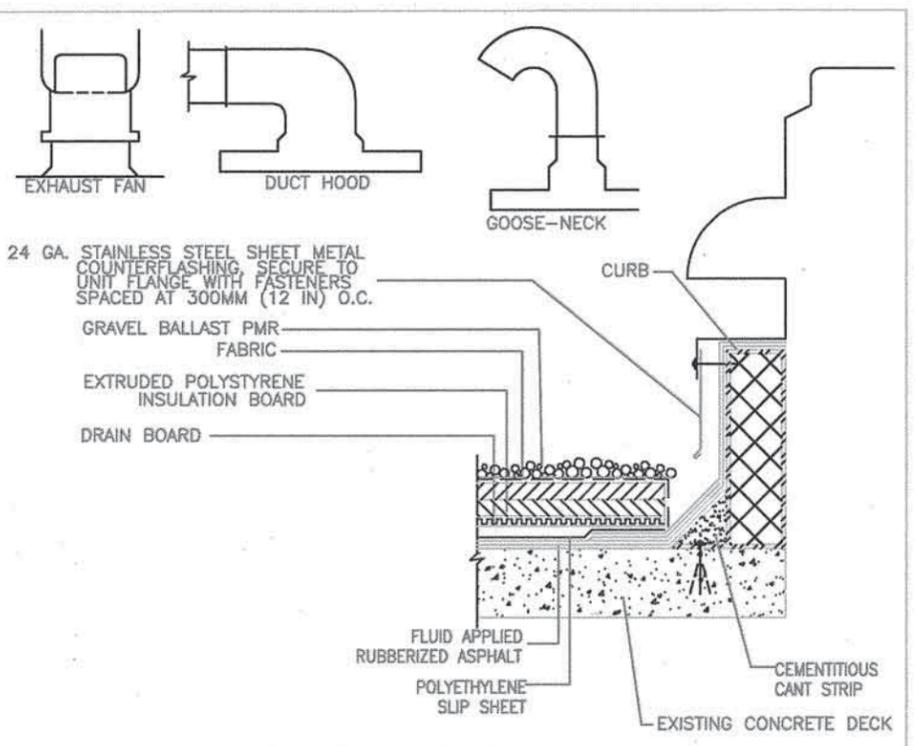
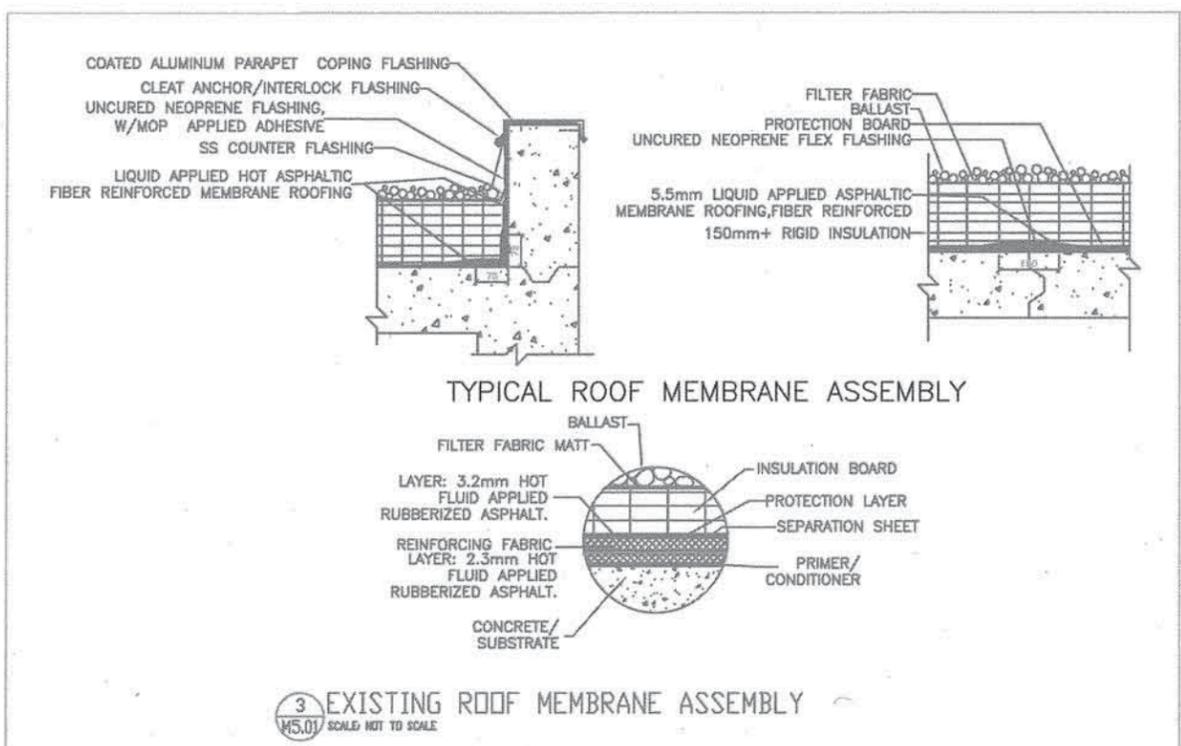
Larger View
From Sheet
ME3.02



CAC #3 - ROOF PLAN - NEW WORK:
- NO SCALE

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

P
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2016**

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**CONSTRUCTION
SKETCHES
FOR CONTRACTOR ORIENTATION**

Rev	Iss. Date	Issued By
1	31 MAY 2005	JWB

Author	Checked	Approved
JWB	JWB	JWB

Scale	Sheet Number
1:100	CACs ME5.01
Classified by	Classification
JWB	SBU

PANEL CAC1-P1 400Y/230V, 3PH, 4 WIRE 100 AMPERE MAIN CB
 LOCATION_RM 801 MOUNTING: SURFACE MIN. 10,000 A.I.C.SYM

CCT NO.	K V A			DESCRIPTION	CCT BRK A B C	PHASE A B C	CCT BRK A B C	DESCRIPTION	K V A			CCT NO.
	A	B	C						A	B	C	
1	1.9			LIGHTING INSIDE	1	20			4.1			
3		0.8		LIGHTING OUTSIDE	1	20		30 3 CAC1-RTU-01		4.1		4
5			1.6	LIGHTING ROAD	1	20					4.1	
7	0.3			SPARE	1	20		15 1 CAC1-EF-01	0.1			8
9		1.8		RECEPTACLES	1	20		60 1 CAC1-EWH-1.01		10.0		10
11			1.8	RECEPTACLES	1	20		20 1 RECEPTACLES			0.5	12
15	2.0			HYDRAUL PUMP-DELTA	3	20		20 1 X-RAY EQUIP.	1.8			14
19		2.0		TELEPHONE CABINET	1	20		20 1 RECEPTACLES		0.2		18
21				SPARE	1	20		20 1 DAMPERS				22
23				GUARD BOOTH	1	20		20 3 GATE CAC1				28
25				SPARE	1	20						30
27				SPARE	1	20						34
29				SPARE	1	20						36
31				SPACE								38
33				SPACE								40
35				SPACE								42
37				SPACE								
39				SPACE								
41				SPACE								

* PROVIDE GFI TYPE CIRCUIT BREAKER

PANEL CAC2-P1 400Y/230V, 3PH, 4 WIRE 50 AMPERE MAIN CB
 LOCATION_RM 1003 MOUNTING: SURFACE MIN. 10,000 A.I.C.SYM

CCT NO.	K V A			DESCRIPTION	CCT BRK A B C	PHASE A B C	CCT BRK A B C	DESCRIPTION	K V A			CCT NO.
	A	B	C						A	B	C	
1	1.2			LIGHTING INTERIOR	1	20			3.0			
3		0.8		LIGHTING OUTSIDE	1	20		20 3 CAC2-RTU-01		3.0		4
5			0.9	RECEPTACLES	1	20					3.0	
7	0.9			RECEPTACLES	1	20		15 1 SPARE	0.1			8
9		0.2		SPACE	1	20		20 1 X-RAY EQUIPMENT		1.8		10
11			0.4	RECEPTACLES	1	20		20 1 RECEPTACLES			0.2	12
13	0.7			RECEPTACLES	1	20		20 1 SPARE	1.8			14
15		3.0		TELEPHONE CABINET	1	20		20 1 SPARE				16
17				POLICE BOOTH	1	20		20 1 SPARE				18
19				SPARE	1	20		20 1 SPARE				20
21				SPARE	1	20		20 1 SPARE				22
23				SPARE	1	20		20 1 SPARE				24
25				RECEPTACLE EXT	1	20		20 1 SPARE				26
27				SPARE	1	20		20 1 SPARE				28
29				SPARE	1	20		20 1 SPARE				30
31				SPACE								32
33				SPACE								34
35				SPACE								36
37				SPACE								38
39				SPACE								40
41				SPACE								42

* PROVIDE GFI TYPE CIRCUIT BREAKER

PANEL CAC3-P1 400Y/230V, 3PH, 4 WIRE 50 AMPERE MAIN CB
 LOCATION_RM 902 MOUNTING: SURFACE MIN. 10,000 A.I.C.SYM

CCT NO.	K V A			DESCRIPTION	CCT BRK A B C	PHASE A B C	CCT BRK A B C	DESCRIPTION	K V A			CCT NO.
	A	B	C						A	B	C	
1	1.5			LIGHTING EXT-SOUTH	1	20			3.0			
3		0.8		LIGHTING INTERIOR	1	20		20 3 CAC3-RTU-01		3.0		4
5			1.6	LIGHTING ROAD	1	20					3.0	
7	2.2			LIGHTS EXT-NORTH	1	20		15 1 CAC3-EF-01	0.1			8
9		0.4		RECEPTACLES	1	20		20 1 CAC3-UH-01		0.1		10
11			0.5	RECEPTACLES EXT	1	20		15 1 CAC3-EF-02			0.8	12
13	2.0			RECEPTACLES	1	20		60 1 CAC3-EWH-1.01	10.0			14
15		2.0		RECEPTACLES	1	20		20 1 X-RAY EQUIPMENT		1.8		16
17			2.0	RECEPTACLES	1	20		20 1 SPARE			0.2	18
21				DELTA BAR.HYDR.PUMP	3	20		20 1 SMOKE DAMPERS 904				20
25				SPARE	1	20		20 1 X-RAY EQ. RM 905				22
27				SPARE	1	20		20 1 POLICE BOOTH				24
29				MANHOLE-PUMP	1	20			3.0			28
31				SPARE	1	20		20 3 GATE OPER. ENTER		3.0		30
33				SPARE	1	20						32
35				SPARE	1	20		20 3 GATE OPER. EXIT		3.0		34
37				SPACE							3.0	36
39				SPACE								38
41				SPACE								40
42				SPACE								42

* PROVIDE GFI TYPE CIRCUIT BREAKER

EXISTING CAC
 PANEL SCHEDULES
 FOR REFERENCE



United States Department of State
 OFFICE OF FOREIGN BUILDINGS OPERATIONS
 Washington, D.C.

**CAC'S-1,2,&3
 HVAC UPGRADE
 2016**

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**CONSTRUCTION
 SKETCHES
 FOR CONTRACTOR ORIENTATION**

Rev Number Description Date

Address For Construction: Embassy Attachment

Building Title: **CAC1, CAC2, & CAC3 ELEC. PANEL SCHED**

File Project Number: New Amend Change Other Cancel

Scale: 1:100

Sheet No: 17 of 17

Drawn By: JWB

Checked By: JWB

Project Number: **CACs**

Classification: **ME6.01**

Sheet Number: **SBU**

EXHIBIT D

PROJECT SPECIFICATIONS

- 011005 Construction Execution and Coordination
- 013205 Project Scheduling
- 013305 Construction Submittals
- 013525 Construction Safety and Occupational Health
- 013550 Construction Security
- 014010 Contractor Quality Control
- 015005 Temporary Facilities and Contols
- 017705 Closeout Procedures
- 017825 Operation and Maintenance Data
- 230505 Common Work Results for HVAC
- 230529 Hangers and Supports for HVAC
- 230503 Testing, Adjusting, and Balancing for HVAC
- 230713 Duct Insulation
- 233113 Metal Ducts
- 233300 Air Duct Accessories
- 237413 Packaged Outdoor Air Handlers (RTUs)
- 238126 Dx Split Systems
- 260505 Common Work Results for Electrical
- 260519 Low Voltage Electrical Power Conductors

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SECTION 011005
CONSTRUCTION EXECUTION AND COORDINATION

1.01 SUBMITTALS

- A. The Contractor shall submit, in accordance with Section 013305, *Construction Submittals*, the following:
 - 1. Organization Chart: Thirty (30) days prior to Site mobilization, submit Project organization charts to the Project Director/COR.
 - 2. Project Execution Schedule – See Section 013205 Project Scheduling

1.02 ON-SITE STAFF REQUIREMENTS

- A. The Contractor shall assign an English speaking Project Manager to be on-site full time.
- B. The Contractor shall provide an adequate professional administrative and supervisory staff on-site for all aspects of the work. This key staff shall be fully coordinated and provide a professional level of Project execution management
- C. From the issuance of the Notice to Proceed for Construction through Substantial Completion, the Contractor shall always have the following personnel at the Site: the Project Manager, the Superintendent, the QC Manager and the Safety Manager. **Subject to satisfactory performance, some of these functions may be combined and performed by a single individual.**
- D. Project Organization Chart: The Contractor shall depict principal staff assignments and contact information on a Project Organization Chart. This chart shall include key administrative and supervisory staff and, as applicable; indicate where multiple functions shall be performed by the same individual. The Contractor shall depict how management, supervisory, and administrative functions shall be performed, to include lines of communication and supervisory responsibility for sub-contractors.
- E. Each trades-person shall be skilled, experienced, and properly equipped to produce the required quality of work.

1.03 USE OF PROJECT SITE

- A. Project Site boundaries and any requirements/restrictions pertaining to the access and utilization of the site will be discussed with the potential contractors on site, prior to the submittal of Bid/Proposal. Minutes of these discussions will become part of the contract.
- B. The Contractor shall perform work in accordance with applicable security requirements specified by the Project Director/COR.

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- C. The Contractor shall ensure that surplus, waste, and rejected material is promptly removed from the Project Site and disposed of according to local law.
- D. Protection of Adjacent Properties: The Contractor shall prevent and repair any damage to surrounding and adjacent properties arising from performance of the work.
- E. The Government reserves the right to place and install equipment as necessary in completed areas of the building and to occupy such completed areas prior to Substantial Completion.

1.04 PROJECT SITE HOURS OF OPERATIONS

- A. Unless otherwise agreed upon in writing, work shall be performed only during the days and hours specified below.
 - 1. The Contractor shall plan execution of the work based on a 5-day workweek excluding local holidays. Work hours shall be 7:00 AM to 6:00 PM.
 - a. Working hours shall be a maximum of 10 hours per day, exclusive of screening time, unless restricted by local custom for one or more given days of the week. In each case, the Contractor shall become familiar with local customs and ensure all Project execution actions are in accordance.
 - b. The building is occupied. Deviating work hours may be required for major demolition or other disruptive work. Disruptive work may be defined as 85 decibels or above. Deviating work hours shall be coordinated with the Project Director/COR.
 - c. Unless otherwise modified in writing by local permit, the working hours for this Project are as specified above.
 - 2. Deliveries - Deliveries of materials to the project are restricted. The Contractor shall refer and abide by local regulations for delivery restrictions.
 - 3. Local Holidays - The Contractor shall observe, independently validate, and plan the work around local national holidays during the construction period. Should any of the holidays fall on a local non-workday, or local custom weekend day, the Contractor shall exercise due diligence to ensure local customs and appropriate compensation issues are addressed.
 - 5. In accordance with Paragraph 1.04 B.1 below, working on a U.S Holiday or a Local Holiday is considered Excepted Operations. As such, the Government's approval of the contractor's request to work on Local or US Holidays will be dependent upon the Contractor's written agreement to compensate the government for all of its additional costs.
- B. Excepted Operations:
 - 1. The only work permitted outside of work hours or days specified above will be due to special circumstances. The Contractor shall provide written request to the Project Director/COR at least one business day in advance of such operations and obtain the written acceptance of the Project Director/COR prior to scheduling any such work.

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ZAGREB, CROATIA

1.05 GENERAL

- A. The Contractor shall remove and replace workmanship that is found non-compliant at no additional cost to the Government.
- B. Except as otherwise indicated, the Contractor shall comply with the following general requirements for the installation and coordination of work:
 - 1. Require each installer to inspect substrates and report unsatisfactory installation conditions.
 - 2. Inspect delivered materials, fabrications, and equipment prior to installation and reject damaged or defective items.
 - 3. Comply with manufacturer's instructions for each installation.

1.06 COORDINATION MEETINGS

- A. Pre-Construction Conference: The Project Director/COR will conduct a pre-construction conference on or near the date of NTP Construction and thirty (30) calendar days prior to the Contractor's mobilization to the Project Site. Agenda items will include a review of the general plans, conditions, procedures, and requirements as necessary for the effective scheduling and prosecution of the construction work. Parties will review security and material delivery requirements, personnel assigned, and Contract communication procedures as established for the Project.
- B. Construction Coordination Meetings: The Contractor and Project Director/COR will hold frequent construction coordination meetings to discuss schedule and status of outstanding issues.
 - 1. The weekly construction coordination meeting shall have an agenda as follows:
 - a) Security
 - b) Safety
 - c) Quality Control
 - d) Project Execution Schedule
 - e) Submittal Register
 - f) Requests For Information (RFI)
 - g) Change Orders
 - h) Correspondence
 - i) Material Tracking Schedule and Procurement Log

END OF SECTION

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ZAGREB, CROATIA

SECTION 013205
PROJECT SCHEDULING

1.01 PURPOSES of the Project Execution Schedule

- A. To provide a complete information and reference plan of execution for project administration, materials submittal preparation, USG submittal review, procurement, shipping, construction and close-out requirements.
- B. To assure coordination of the Contract Work between the Contractor and the subcontractors, material suppliers, and all other parties associated with the project.
- C. To record and report actual performance progress
- D. To be the basis for evaluation of the Work completed and the preparation of the Contractor's monthly payment application.

1.02 SUBMITTALS

- A. Submit the following as prescribed above:
 - 1. Baseline Project Execution Schedule Update (BPES)
 - a. To PD/COR 15 days after contract award.
 - b. Acceptance of the BPES is a prerequisite to the CO issuing the NTP for construction.
 - 2. Project Execution Schedule (PES) Updates
 - a. Submit to the PD/COR monthly--with the Payment Request.
 - b. Weekly 14 day look ahead plan
- B. If the Contractor does not submit acceptable schedules within the times prescribed above, the CO may withhold funds from progress payments in accordance with FAR Section 52.232.

1.03 GOVERNMENT REVIEW PROCESS

- A. For all submittals identified in this section, the USG shall review the schedule and supporting documentation for contract compliance. Formal submittal disposition will be issued within 7 calendar days after receipt of all required information.
- B. The PD/COR will review the updated PES to verify the accuracy of the on-site work progress – activities started, completed, and on-going and their respective completion percentages and process pay application accordingly.

1.04 SCHEDULING SOFTWARE

- A. The scheduling software shall be Microsoft Project, Primavera P3 or P6, or equivalent approved in advance by PD/COR.

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ZAGREB, CROATIA

1.05 SCHEDULE DEVELOPMENT

- A. The detailed Project Execution Schedule (PES) will include tasks and milestones representing the entire Contract Scope of Work.
- B. The PES shall be cost-loaded. The Total Baseline Cost of the PES shall coincide with the Total Contract Amount excluding VATs.
- C. Required Milestones – those below must appear; additional milestones by Contractor or PD/COR may be added
 - 1. Contract Award
 - 2. NTP-Construction
 - 3. Project Substantial Completion
 - 4. Final Acceptance
- D. Provide sufficient detail to show a logical Critical Path beginning with the first schedule activity and ending with the final schedule activity.
- E. All activities except first and last, shall have at least one predecessor and once successor relationship link.

1.06 PAYMENT APPLICATION

- A. Approval is dependent on
 - 1. Percent complete verification of all progressed activities
 - 2. Determination of the Actual Cost from the approved PES Update for the current month
 - 3. Equipment/materials being onsite, secure, and insured.

END OF SECTION

CAC HVAC UPGRADE
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**SECTION 013305
CONSTRUCTION SUBMITTALS**

1.01 GENERAL

- A. The Contractor shall transmit in English all construction submittals to the Project Director/COR.
- B. The Contractor shall review all Contract documents and Project requirements and generate a complete list of deliverables for submittal. The Contractor shall ensure all deliverables are considered in the Project Execution Plan.
- C. Submittal Register: The Contractor shall develop a submittal register encompassing Division 1 and the Contract Technical Specifications and submit it within 21 days after the NTP. Submittals to include:
 - 1. Construction Submittals:
 - a. Product Data:
 - b. Shop Drawings:
 - c. Field Samples:
 - d. Administrative Submittals
 - e. Closeout Submittals
- D. Sample Transmittal Form. A sample Transmittal Form is provided as an attachment to this Section.
- E. Substitutions for Materials or Products:
 - 1. Proposals for substitutions of materials or products required by the Contract construction specifications and drawings shall include a specific description of each substitution in writing and provide justification.
 - 2. Any submittals requesting a substitution shall be clearly marked.

1.02 GOVERNMENT SUBMITTAL REVIEW

- A. General:
 - 1. The Government's review period for submittals is 7 calendar days following the Government's receipt of a submittal.
 - 2. Submittals will be reviewed only for general compliance with intent of Contract Documents and with information given therein. Government acceptance will not:
 - a. Relieve the Contractor of the responsibility for patent or latent errors and omissions, including details, dimensions, material, etc.
 - b. Authorize a departure from the details appearing on accepted construction specifications and drawings.

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3. The Government will have unlimited rights to all drawings, specifications, notes and other work developed in the execution of the works, upon acceptance of each submittal, and upon receipt of "For Information Only" submittals.
- B. Submittal Disposition: Pursuant to the submittal review, Project Director/COR will mark submittals as follows:
7. ACCEPTED AS SUBMITTED (AS): Authorizes the contractor to proceed with the work covered.
 8. ACCEPTED AS NOTED (AN): Authorizes the contractor to proceed with the work covered provided he takes no exception to the corrections noted.
 9. FOR INFORMATION ONLY (IO): Indicates the submittal is for information only.
 10. REJECTED: RESUBMIT (RR):
 - a. Indicates the submittal does not meet the Contract's intent or corrections are required of the proposed work's defects or deficiencies as represented by the submittal.
 - b. The Contractor shall not proceed with the purchase, fabrication, delivery, or other related execution of the work until acceptance is granted.
 - c. The Contractor shall not allow the use of rejected submittals and materials.
 - d. Correction of noted defects or deficiencies shall be resubmitted for the Government's acceptance.
 - e. The Contractor shall bear all risk in the submittal-rejection-re-submittal cycle. Submittal rejection will not justify extension of Contract duration.
- C. Failure of the USG to identify any deficiency does not relieve the contractor from fulfilling their contractual obligation.

JANUARY 2012
 UPDATED MAY 2016

CAC HVAC UPGRADE
 ZAGREB, CROATIA

MATERIAL/PRODUCT SUBSTITUTION REQUEST FORM

Date: _____

Project: _____

Contractor: _____

Within 30 days after the construction NTP, this formal request will be considered for substitution of products specified as minimum standard. After the end of this period, substitution requests will be considered only if the specified product or material is no longer available or deemed unsatisfactory for the intended function.

Specified Material/Product _____

Specification Division – Section _____

Specified Manufacturer/Origin _____

Proposed Substitution _____

Proposed Manufacturer/Origin _____

Proposed Supplier/Source _____

Attached hereto are the specification, data, performance documents and standard laboratory test results supporting the product substitution.

The following criteria has been taken into consideration

- The use of this material/product is applicable to this product in the prescribed location and will be warranted in the same manner as the specified product for a period of ___ years, when applied and used as per the manufacturers guidelines.
- The substitution of this product will not affect the dimensions shown on the drawing in any way.
- This product substitution will not affect the work of other trades working on this product.
- This product will not affect the expected Commissioning Functional Performance Test results.

The advantages of incorporating the proposed substitution into this Project are as follows: _____

Submitted By: _____ **of** _____

This completed form is to be sent to Project Director/COR with the required submittal.

CAC HVAC UPGRADE
ZAGREB, CROATIA

TRANSMITTAL		DATE: 31 December 2009		NEW:	INFORMATION:	ORIGINAL SUBMITTAL DATE: (31 December 2009) (N/A)		
FROM: US Department of State Overseas Building Operations		TO: ABC Contractors, Inc. Field Address Line 1 Field Address Line 2		PROJECT NAME, LOCATION, NUMBER: New Office Building Compound Capital Big City, XYZ Land XJ-AA1234		CONTRACT NUMBER: S-OBO AD 03 - G-12345 Modifications: 001 - ???		
SUBMITTAL								
ITEM NO.	SUBMITTAL NUMBER	SPECIFICATION		TYPE	NUMBER OF COPIES	DRAWING SHEET NUMBER	SUBSTITUTION	STATUS CODE
		SECTION NUMBER	PARAGRAPH NUMBER					
1								
2								
3								
4								
5								
6								
<p>I certify that the submitted items listed in this transmittal have been prepared in strict conformance with the Contract Documents. When submittals propose substitutions or deviations, these are identified on this transmittal form and clearly annotated in the material presented.</p> <p>Bill/Bertha B. Bubba _____ Date Project Manager, ABC CONTRACTORS, INC.</p> <p>ACCEPTANCE: Alex/Any A. Able _____ Date OBO Project Director/COR</p> <p>REMARKS: 1) Remarks 2) Remarks 3) Remarks 4) Remarks</p> <p>TYPE CODES: ADX Administrative/Other PDx Product Data SDx Shop Drawings COx Closeout SAX Field Sample</p> <p>STATUS CODES: AS Accepted as submitted AN Accepted as noted IO Accepted for Information Only RR Rejected; Resubmission Required</p>								

NOTE: Sample is suggested format; Contractor may modify to improve as management tool; see text for code explanation.

END OF SECTION

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SECTION 013525
CONSTRUCTION SAFETY AND OCCUPATIONAL HEALTH

1.01 RELATED DOCUMENTS

- A. Latest edition, U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual, EM 385-1-1 dated 30 November 2014. This document is available at the U.S. Government Printing Office, Washington D.C.
- B. NFPA Code 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
- C. ANSI A10 Series Standards for Safety Requirements for Construction and Demolition.
- D. NFPA Code 51B, Standard for Fire Prevention during Welding, Cutting, and Other Hot Work.
- E. NFPA 10, Standard for Portable Fire Extinguishers.
- F. NFPA 70, National Electrical Code
- G. Department of State, Office of the Procurement Executive, PIB # 2015-05, Combating Trafficking in Persons.

1.02 SUBMITTALS

- A. The Contractor shall submit the following:
 - 1. A Construction Accident Prevention Plan (CAPP) prior to the beginning of any construction activity at the Project Site.
 - 2. Hazardous Work Permit Requests.
 - 3. Material Safety Data Sheets (MSDS).
 - 4. Accident Investigation Report: A report within 24 hours of each accident or mishap, except as otherwise indicated by requirements or governing regulations.

1.03 GENERAL

- A. The contractor shall have a Safety & Health Program Manager on-site when any construction activity is ongoing.
- B. For the duration of construction, the Contractor shall implement and manage a comprehensive safety and health program.
- C. The Project Director/COR, as the Government Contracting Officer's Representative, reserves the right to suspend work when and where the Contractor's safety and health program is operating in an inadequate manner, has severe shortcomings, or is not in compliance with contractual requirements.
- D. Acceptance by the Project Director/COR will not relieve the Contractor of overall responsibility for compliance with the strict interpretation of all safety and health requirements of the Contract.
- E. Accident Investigation:

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1. The Contractor shall investigate and prepare a separate accident report for each accident resulting in lost time, disabling or fatal injuries, or damage to vehicles, property, materials, supplies, furniture, fixtures, and equipment. In each report, the Contractor shall include a statement of Contractor actions taken to prevent recurrence of accident.

- F. Hazardous Materials: The Contractor shall test any material encountered suspected to contain hazardous substances and bring to the immediate attention of the Project Director/COR.
- G. Protective Clothing and Equipment: The Contractor shall issue personal protective clothing and equipment as required by EM 385-1-1.
- H. Welding Safety Plan: The contractor shall submit a Welding Safety Plan for all welding work to the PD before the start of any welding activities.
- I. Safety and Health Training: Tool Box Meetings: The Contractor shall conduct weekly safety meetings. The Contractor shall require attendance by all tradespersons, laborers, foremen, and supervisors at the Project Site, including those of separate contractors. The Contractor shall discuss current construction operations, analyze hazards, and communicate solutions.
- J. Rolling Scaffolding: All rolling scaffolding needs to be part of a complete system from a single manufacturer.
- K. Ladders: All ladders used on the construction site shall be fiberglass. No metal, aluminum or wood ladders are permitted on this project.
- L. Signs shall be provided to give adequate warning and caution of hazards. All signs shall be visible at all times when the hazard or problem exists and shall be removed when the hazard or problem no longer exists. All employees shall be informed as to the meaning of the various signs used throughout the workplace and any special precautions that may be required.

1.04 CONSTRUCTION ACCIDENT PREVENTION PLAN (CAPP)

- A. Prior to beginning work at the Project Site, the Contractor shall prepare and submit to the Project Director/COR, a site-specific CAPP covering all activities for the Contractor and all subcontractors. The CAPP shall contain, at a minimum, the Contractor's understanding of:

- 1. Management and Corporate Commitment: The Contractor shall include a certified statement in the introduction, executed by a senior officer of the construction firm having broad corporate authority, indicating full commitment to the accepted CAPP and the level of authority in assignment of responsibilities at the Project Site.
- 2. Name, qualifications, and duties of Safety & Health Program Manager.
- 3. The CAPP shall incorporate the requirements contained in the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual, EM 385-1-1.

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4. Submit the Fall Protection and Prevention Plan with the CAPP, and update every six (6) months
5. Hazardous Work Permits: The procedure for preparation and approval prior to proceeding with work deemed hazardous.
6. Safety and Health Training: The procedures for implementing training and orientation.
7. Location of facilities and procedures for emergency medical situations.
8. Emergency Plan to include: Escape procedures and routes, method of accounting for employees following emergency evacuation, means of reporting emergencies, and persons to be contacted for information or clarification.
9. Emergency Resources--Establish jointly with the Government, a list of telephone numbers and locations of ambulance, physician, hospital, fire, police and other sources of emergency assistance. The list shall be posted in several locations on the Project site.

1.05 SITE MAINTENANCE, PROTECTION, AND SANITATION

- A. The Contractor shall maintain the site facilities in clean, sanitary, and safe operating conditions to the satisfaction of the Project Director/COR.
- B. The PD/COR will conduct periodic site inspections to verify that the Contractor is maintaining good housekeeping practices
- C. Fire Protection:
 1. The Contractor shall provide temporary portable fire extinguishers..
 2. The Contractor shall prohibit smoking and beetlenut chewing in the building.
 3. During welding, cutting, and burning, the Contractor shall comply with NFPA 51B in areas of fire-hazard exposure. The Contractor shall provide stand-by fire-protection personnel and adequate supervision of operations.
- D. First Aid Medical Facility Requirements:
 1. The Contractor shall provide a first aid kit. A health care professional or competent first aid person shall evaluate and determine the fill contents of each kit.
 2. The Contractor shall provide, place, and test periodically one (1) Automatic External Defibrillator (AED) in the Contractor's Project Site office. A CPR/AED training program shall be given to two (2) persons at each location who shall receive certification in first aid and CPR from the American Red Cross, the American Heart Association, or from an organization whose training adheres to the standards of the International Liaison Committee on Resuscitation. CPR/AED training shall contain a hands-on component. A certificate shall state the date of issue and length of validity.
- E. Construction Site Sanitation and Health Facilities:
 1. Facilities for workers shall be coordinated with PD/COR and FM and completed and ready to use prior to the start of construction..
 2. The Contractor is encouraged to utilize semi-permanent or portable facilities where possible in compliance with the requirements of this Section.

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3. The Contractor shall provide temporary facilities for workers: toilets and lunch area.
4. Toilets Facilities and Restrooms:
 - a. Design the number of toilet fixtures around the anticipated maximum number of workers at the Project Site and allow accessibility to all employees.
 - b. The construction and installation of toilet facilities shall be acceptable to the Project Director/COR and shall be in compliance with applicable jurisdictional codes.
 - c. Provide hand-washing lavatories in close proximity to all toilet facilities
 - d. Maintain an adequate supply of toilet paper and paper towels at all times.
 - e. Comply with the requirements of the authority having jurisdiction for sewage disposal. Where non-sewer waste disposal systems are permitted, they shall be of a type accepted by the local health authorities having jurisdiction. Maintain all disposal systems in a sanitary condition.

END OF SECTION

**SECTION 013550
CONSTRUCTION SECURITY**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section and its attachments provide explanation to the Contractor regarding labor requirements and the security of classified information and Controlled Access Areas (CAAs). The requirements of this Section involve interface with a number of security-related Government entities. These entities are coordinated through the Overseas Buildings Operations (OBO) Contracting Officer's Representative (COR) in coordination with Regional Security Officer (RSO). The requirements include, but are not limited to:
1. General security procedures.
 2. Information security.
 3. Personnel procedures.
 4. Materials security and logistics.
 5. Labor requirements for specific activities.
 6. Site access procedures.
 7. Inspections by the Government.
 8. Prohibited and restricted items and activities.

1.02 RELATED DOCUMENTS

- A. Other General provisions of the Contract, including FAR clauses by reference or as amended in Contract Sections B through J, and other Division 1 Sections of these Contract Specifications apply to requirements of this Section. This Section in turn applies to the Contract Drawings and to Technical Specifications.

1.03 DEFINITIONS

- A. For all terms not understood, request immediate clarification.

1.04 PERFORMANCE REQUIREMENTS:

- A. The Contractor shall comply with the Government's requirements for participating in the Project security procedures as specified in this and subsequent Contract Sections, and Public Law #100-204 (as amended). The Contractor shall also comply with requirements requested subsequent to issuance of the Notice to Proceed (NTP). The Contractor shall afford unrestricted access to work, allow surveillance and inspection by any Government personnel as authorized by the COR, and perform required security work when directed by COR. The Contractor shall maintain security, avoid the compromise of classified information and materials caused by unauthorized disclosures, and obtain appropriate security clearances.
- B. As noted in the Prohibited Countries List Matrix below, the following restrictions apply:
1. Citizens/Firms from the countries listed will not be allowed or used on this Project in any capacity.

2. Non-US or US firms owned or operated by citizens/firms from the countries listed will not be allowed or used on this Project in any capacity.

Prohibited Countries List Matrix	
Country	Citizens/Firms
Belarus	No
Cuba	No
Iran	No
North Korea	No
Peoples Republic of China	No
Russia	No
Venezuela	No
Vietnam	No

General Policy: The use of host country workers, materials, ports of call, and transshipment points from or within the countries listed is permitted for projects in that country. Refer to the FAR for additional information concerning prohibited countries.

List Revised: October 16, 2015

- C. The Department of State (DOS) reserves the right, in its sole discretion, to determine suitability of Contractor personnel at the Project Site or otherwise involved in work related to this Project.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 GENERAL SECURITY PROCEDURES

- A. All security requirements of the Contractor shall apply to all personnel on the project site (to include sub-contractor personnel).

3.02 INFORMATION SECURITY

- A. Project Information Handling: See Contract Section H.6, Diplomatic Security Requirements for Clearances and Handling Classified, SBU and Unclassified Project Information
- B. Security Briefing: See Contract Section H.6.12.
1. Violations:
- a. Failure of the Contractor to comply with required information handling regulations/procedures and similar security requirements may result in removal of culpable individuals from the site, and/or issuance of a cure notice from the Contracting Officer relating to security procedures. The Contractor shall bear all costs of rectifying compromised information and work. These include costs to terminate, remove, and replace offending persons and engaged firms, and to replace compromised work or materials.

- b. Notification and Reporting: The Contractor shall notify the COR and RSO immediately when known or suspected loss or compromise of classified information has occurred. This includes unclassified documents, notes, drawings, sketches, reports, photographs, exposed film, electronic media, or similar information which may affect the security interests of the Government. The Contractor shall extend this requirement to employees and other personnel working on behalf of the Contractor. This responsibility shall be expanded to include prompt reporting of security issues, including observed efforts by unauthorized persons to gain access to the Site or Classified and SBU information.

3.03 PERSONNEL PROCEDURES

- A. Uncleared Personnel: Use of uncleared persons is limited to the areas and tasks described in Section 3.05.
 - 1. Uncleared Labor: Uncleared labor will submit to a background investigation and obtain approval of the COR and RSO before access is granted to Project Site or applicable Support Sites. The Contractor shall submit an Employment Application form, in sufficient time to permit processing prior to the anticipated date of employment. The estimated investigation processing time is 30 days. Uncleared labor is not authorized on the project site prior to a favorably adjudicated background investigation. If the background investigations have exceeded 30 days, the Contractor can provide a priority list with justification of workers needed and the COR may approve temporary I.D. badges for temporary uncleared labor.
 - 2. The COR and RSO reserve the right to allow or deny access of persons and firms proposed to perform work or be present at the Project Site.
 - 3. The RSO must approve Site access for temporary uncleared.
- B. Uncleared Local/Third Country National Subcontractors: Contractor selection of host and third country national subcontractors must be approved by COR/RSO. See Contract Section H.6.16 for requirements.
- C. U.S. Citizens without clearances: When the contractor wishes to assign U.S. citizens at the project site who do not possess security clearances, the contractor shall meet the requirements of Contract Section H.36.3.1. U.S. citizens with unfavorable National Criminal Indices Checks (NCICs) may not be allowed access to the site, subject to determination of RSO.
- D. Special DS Investigation: As determined by the Government's security managers, and as requested through the COR, the Contractor shall accommodate additional special investigations as required for foreign nationals and certain categories of other personnel.
- E. All U.S. citizen Contractor employees are required to adhere to reporting requirements IAW Contract Section H.6.13., as well as any adverse information relating to firms or individual personnel which reflects unfavorably on the trustworthiness or reliability of the firm or individual, suggests that the firm or individual's ability to safeguard classified information may be impaired, or that firm or individual may be subject to exploitation.

- F. Briefings: The Government reserves the right to conduct briefings and debriefings for all persons performing work. Required briefings and debriefings include, but are not limited to, the following:
1. Management personnel are required to attend special security briefings and debriefings concerning reporting requirements on unusual incidents, activities, or information related to Project security as directed by the COR or RSO.
 2. Visitors to the Project Site will be required to attend an appropriate security briefing by the RSO or other Post security management personnel.

3.04 SECURITY REQUIREMENTS AND LABOR FOR SPECIFIC ACTIVITIES

- A. All work shall be performed by uncleared Contractor provided labor.
- B. As determined by Post RSO, work in areas may require Government provided escorts.

3.05 SITE ACCESS PROCEDURES

- A. The Contractor shall comply with Post's access operations and procedures.
- B. The Government may issue identification badges. All personnel, to include cleared American Contractor and sub-contractor personnel, are required to leave their badges upon leaving the Project Site. RSO will provide final direction and guidance on badging requirements.
- C. Uncleared workers will not access CAA Areas.
- D. Search Procedures: The Government reserves the right to conduct searches of all personal belongings at the point of entering and leaving the Embassy Compound and CAA areas.
- E. Visitor Notification: The COR must be notified in advance of proposed Contractor visits. Visitors will be authorized on a demonstrated need-to-know basis. The COR will approve, disapprove, or qualify each Contractor request in advance of each visit. Contractor Country Clearance Request procedures are detailed in Contract Section H.6.2. If Contractor Country Clearance Request has not been received prior to arrival IAW H.6.2.2, visitors will be treated and escorted by their sponsor as if they are uncleared. In addition, the COR may refuse access to the Site until a Contractor Country Clearance Request has been received.

3.10 INSPECTIONS BY THE GOVERNMENT

- A. The Government reserves the unqualified and unlimited right at any time to conduct security-related inspections of the Contractor's work, material, equipment, personnel, and temporary facilities at the Project Site and any off-site support facilities, to include subcontractor offices, or temporary and off-site contractor offices, to include subcontractor offices, or temporary and off-site contractor offices. Contract Section H.6.21 requires the contractor to provide written notification to COR of any off-site locations at which project information will be stored.

1. In instances where authorized work must be disassembled, uncovered, or demolished then reassembled, recovered, or rebuilt to accommodate inspection in compliance with construction specifications and security requirements, resultant costs of such actions will be borne by the Government. The Contractor shall be responsible for resultant costs where inspected work is found to be non-compliant with Project specifications or where work was performed without Government authorization. The Government reserves the right to suspend operations where unauthorized work has been performed and where introduction or attempted introduction of unauthorized material has taken place.
2. Reported Violations: Where an indication, report, or observation of unauthorized access or performance of unauthorized work has occurred, the Government reserves the right to suspend operations and deny access until circumstance and work can be investigated, inspected, tested, and resolved. All costs of such stoppages and resolutions shall be borne by the Contractor, except when alleged violations, after investigation, are determined not to be in violation of security requirements.

3.11 PROHIBITED AND RESTRICTED ITEMS AND ACTIVITIES

- A. Prohibited/Restricted Items and Activities on Project Site include, but are not limited to, the following:

1. Firearms and other weapons, except as specifically authorized by the COR.
2. Electronic media devices, including radios, recorders, transmitters, receivers, cell phones, cell phones with camera, video or audio recording capabilities, laptop computers, personal digital assistants (CORAs), smart phones (i.e. BlackBerrys, iPhones, etc.), media storage devices (i.e. thumb drives, jump drives), and similar items, except for authorized uses as approved by the COR, in accordance with site procedural documentation, and as allowed by Contract Section H.
3. Contract Section H.6.17 and H.6.18.
4. Drugs, including narcotics, barbiturates, marijuana, alcoholic beverages, and similar substances, except for use with a valid medical prescription.
5. Explosives, except for use in specifically limited amounts and under controlled circumstances for work specified to be performed through use of explosives. Such use requires written prior authorization from the COR. As a hazardous material, the Contractor shall treat the use of explosives in accordance with guidance provided under Section 013525, Construction Safety and Occupational Health.
6. Cameras, except in accordance with 3.11.B below.

- B. Photography

1. General: The use of photographic equipment and taking of photographs is restricted on and nearby the Project Site, as determined by the COR. Written requests for approval of photography must be submitted well in advance of time intended for such activity, stating reasons, uses and disposition of imaging media. The COR must review photographs and imaging media prior to

removal from the site. The Government reserves the right to deny such use and release and limit to authorized purposes and distribution IAW Contract Sections H.6.10, H.8 and H.9.

- a. Photography in and nearby the CAA is further limited to instances and areas individually permitted and controlled by the COR and RSO. The COR and RSO will enforce restrictions for the protection and handling of imaging media and prints, in compliance with DOS regulations for classified information. Unauthorized use is prohibited. The Contractor shall deliver all imaging media exposed in the CAA to the COR for secure transmittal to OBO. OBO will ensure appropriate processing and dissemination.

3.12 SUPPLEMENTS

A. The Supplements listed below, following "End of Section," are a part of this Specification:

1. Attachment A – Department of State (DOS) Security Personnel (By U.S. GOVERNMENT).

END OF SECTION

**SECTION 013550
CONSTRUCTION SECURITY
ATTACHMENT A – DEPARTMENT OF STATE (DOS) SECURITY PERSONNEL (BY U.S.
GOVERNMENT)**

1.01 INTRODUCTION

The information provided below complements, but does not replace, information provided in Chapter 2 of the OBO International Codes Supplement (OBO-ICS) IBC. Aside from the COR, who is ultimately responsible for ensuring that construction activities are accomplished in a manner that complies fully with applicable statutes and security regulations, the following types of Government security personnel may be further assigned at the Construction Site to support this Project:

A. REGIONAL SECURITY OFFICER (RSO)

The RSO is the senior security officer for the Post. The RSO provides liaison with local authorities for security outside the Construction Site. If required, the RSO will conduct records checks and appropriate investigations on any local nationals and firms associated with the Project.

B. LOCAL GUARD FORCE

Local Guards may be used at the perimeter and other locations at the construction Site and may be provided through existing Post local guard contracts. The RSO is responsible for the acquisition, supervision, and qualifications of Local Guard Services.

C. MARINE SECURITY GUARDS (MSGs)

If the Construction Site is also the existing Chancery Site under 24-hour MSG control, CAGs may not be required to control access to the Site, work areas, or the SSA, provided the existing MSG Post resources are sufficient to accomplish the security requirements for the duration of the Project.

NOTE: This Project may or may not require all categories of security personnel.

END OF ATTACHMENT A

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SECTION 014010
CONTRACTOR QUALITY CONTROL

1.01 Quality Control

- A. The Quality Control system used during the project construction phase must ensure that the facility meets the contract design, quality and functional standards. To this end the Contractor is required to establish, implement and maintain an effective Construction Quality Control (CQC) Plan. The CQC Plan shall cover all constructions operations both onsite and offsite, and shall be keyed to the proposed construction sequence (definable features of work).
- B. The Construction Quality Control Plan shall include, as a minimum, all quality processes performed by the contractor, subcontractors, fabricators, suppliers, and purchasing agents. ISO 9001:2008 shall be used as a base line for developing the control processes.
- C. The Contractor is responsible for quality control and shall establish and maintain an effective quality control system. The quality control system shall be defined by the CQC Plan, which defines the Contractor's quality policy, lines of authority and responsibility, QC personnel qualifications, and the procedures and organization necessary to produce a finished product that complies with the contract requirements.
- D. The project manager and superintendents will be held accountable for the quality of work and are subject to removal at the direction of the PD/COR for failure to comply with quality requirements specified in the contract. The Contractor's project manager and superintendents in this context shall mean the individuals with responsibility for the overall supervision of field activities for the project.
- E. The Government may schedule performance audits during the construction phase to assess the Contractor's performance against contract requirements and CQC Plan implementation. The Project Director/COR shall use the audit results to evaluate the completed work and progress made against the contract documents and project schedule when reviewing Contractor requests for progress payments.

1.02 Referenced/Related Documents

- A. ISO 9000:2008 Quality Management Systems requirements is a quality program document that the Contractor shall use to develop the CQC.

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CONTRACTOR QUALITY CONTROL

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- 1.03 Submittals: The Contractor shall submit, in accordance with Section 013305, *Construction Submittals* the following:
- A. Contractor's Quality Control Plan (CQC Plan): The CQC Plan shall be submitted within thirty (30) calendar days after Contract Award. No work shall be undertaken before CQC Plan acceptance.
 - B. The name, qualifications (in resume format), duties, responsibilities and authorities of each person assigned to a Quality Control (QC) function shall be submitted to the Government for review. The Government will reject personnel who are not qualified for the positions for which they have been proposed. Changes to QC organization staffing shall only be made after acceptance by the Government of the proposed changes.
 - C. The Contractor shall submit a Quality Control Report (QCR) to the Government daily. Reporting shall begin on the first day the contractor's forces arrive on site and shall continue until the contractor's forces have completely demobilized. Daily reports shall be submitted by 8:00 the following morning and shall include, at a minimum, the information discussed in this section. The report format shall be accepted by the Government prior to use

END OF SECTION

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SECTION 015005
TEMPORARY FACILITIES AND CONTROLS

1.01 TEMPORARY CONSTRUCTION FACILITIES

A. GENERAL:

1. **The installation and use of temporary construction facilities is not expected for this project and if required shall be approved by the PD/COR.** If required, the Contractor is encouraged to utilize semi-permanent or portable facilities where possible in compliance with the requirements of this Section:
2. The Contractor shall comply with the latest version of the US Army Corps of Engineers, Safety and Health Requirements Manual EM385-1-1 with respect to all temporary facilities.
3. The Contractor shall provide temporary enclosures for weather and dust protection, security, visual, and acoustical separation, conservation of energy, comfort and efficiency of tradespersons, and effective separation of work by separate contractors and the Government.
4. The Contractor shall provide support facilities such as toilets, drinking fountains, and similar facilities for all Site personnel (Refer to Section 013525, *Construction Safety and Occupational Health* for details).
5. The Contractor shall provide shops, sheds, storage spaces, and similar durable enclosures for use throughout the construction period.
6. The Contractor shall provide temporary enclosures for the protection of fabricated, installed, or cured work from weather. The enclosures shall secure the Site from possible loss and restricted (classified) access and other reasons as indicated.
7. The Contractor shall provide separate storage for flammable and combustible liquids. Refer to the most updated edition of the US Army Corps of Engineers, Safety and Health Requirements Manual EM 385-1-1 for additional requirements and information.
8. Materials:
 - a. The Contractor shall provide new materials of suitable grade for the intended purpose. Where applicable, the Contractor shall comply with related requirements for permanent work of this project.
 - b. The Contractor shall provide UL-labeled tarpaulins with a flame-spread rating of fifteen (15) or less and translucent, nylon-reinforced, laminations of polyethylene or PVC films, with similar fire-retardant ratings.
 - c. The Contractor shall provide UL-labeled, fire-treated lumber and plywood wherever wooden construction is not otherwise protected or covered to effectively reduce flammability. This shall apply to offices, tool sheds, storage rooms, scaffolds, walkways, fences, sidewalk bridges, other enclosures and barriers, and where contiguous wood exposure exceeds ten (10) square meters.

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- d. Roofing: The Contractor shall provide either UL Class "A" standard weight asphalt shingles (ASTM D 3018) or UL Class "C" mineral-surfaced roll roofing (ASTM D 249) on temporary offices, sheds, and enclosures.
- e. Where appropriate, the Contractor shall provide a translucent-type enclosure to avoid the restriction of daylight.

B. Contractor's Field Office:

- 1. **If required, the installation and use of a field office shall be approved by the PD/COR. A field office is not expected to be required as part of this project.**
- 2. The Contractor shall provide field office space at the Project Site. This office shall include furnishings, fixtures and equipment, and be sized to accommodate the incidental field office needs of the supervision and administrative functions of the Contractor, subcontractors, suppliers, consultants, testing agencies, officials, separate contractors, and others engaged in Project work.
- 2. The entry/exit doors and server room doors shall be either solid core wood or hollow metal doors.
- 3. The Contractor shall provide, design, and install temporary technical security systems (TSS) to include:
 - a. Door contact on the entry/exit doors and server room doors,
 - b. PIR motion detectors
- 4. The field office, furniture and equipment shall remain the property of the Contractor.

1.02 PHYSICAL SECURITY REQUIREMENTS FOR TEMPORARY CONSTRUCTION FACILITIES

- A. Locate office facilities away from vehicle CACs, perimeters accessible to unauthorized vehicles, and maximize setback from the perimeter's anti-ram barriers.
- B. Office facilities for construction support personnel must be of substantial construction defined as follows:
 - 1. Exterior walls and ceilings covered with wood stud construction.
 - 2. Plywood substrate (20mm), with drywall (12mm).
 - 3. Window glazing of laminated glass or treated with an application of eight (8) mil shatter resistant window film.
 - 4. Grilles providing 5-minute FE protection on all exterior windows
 - 5. Reverse bevel exterior doors of solid core wood or hollow metal with metal frames, equipped with non-removable hinges, simplex mechanical pushbutton combination locks, dead bolt locks, and door viewers
- C. The contractor must provide and install duress buttons and door contacts at the entrance doors to office facilities for monitoring by the Post One.

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1.03 TEMPORARY UTILITIES

A. General:

1. The Contractor shall connect to existing utilities for required services, where reasonably possible.

B. Temporary Water:

1. Potable Water: Refer to section 013525, Construction Safety and Occupational Health.

C. Temporary Electricity:

1. If required, the Contractor shall design, install, maintain, and remove temporary electrical service and distribution systems. The Contractor shall comply with the requirements of NFPA 70, National Electrical Code.

D. Temporary Lighting:

1. The Contractor shall provide a combination of sufficient day lighting, general electrical lighting, and plug-in task lighting in every construction area to ensure the proper and adequate performance of work, reading of signs, inspection, testing, and other need-to-see requirements.

END OF SECTION

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**SECTION 017705
CLOSEOUT PROCEDURES.**

1.01 SUBMITTALS

- A. The Contractor shall submit, in accordance with Section 013305, *Construction Submittals*, the following:
1. Request for Certification of Substantial Completion.
 2. Request for Final Inspection and Testing.
 3. Warranty Management Plan

1.02 WARRANTY MANAGEMENT AGENT

- A. The Contractor shall designate a qualified representative, knowledgeable in the operation and maintenance of the various building systems as installed in the works, for a period of one year.

1.03 GENERAL

The Contractor shall comply with the instructions of the Contracting Officer and the Project Director/COR for procedures, sequence, timing, and similar considerations regarding the turnover of facilities to Government personnel.

1.04 SUBSTANTIAL COMPLETION

- A. General: Before requesting the Certificate of Substantial Completion from the Project Director/COR for all work or a defined portion thereof, the Contractor shall complete the following, as applicable:
1. Progress Payment Request: Submit no earlier than the date claimed for Substantial Completion.
 2. Reflect a 100 percent complete status or list non-substantial items that remain incomplete.
 3. Submit Operation and Maintenance Data.
 4. Submit Record Documents.
 5. Deliver extra materials in the manner requested by the Project Director/COR. to include:
 - a. Surplus Government-furnished materials.
 - b. Spare parts.
 - c. Extra stock of materials.
 - d. Keys to locks.
 6. Make physical adjustments, correct minor defects, touch-up finishes, and lubricate operating parts.
- B. Request for Certification of Substantial Completion:
1. Following the inspection, the Contractor's QC Manager shall provide the Project Director/COR with a schedule of defects. Defects deemed to be substantially out of

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compliance with contract quality or performance standards shall be corrected prior to issuance of the Certificate of Substantial Completion.

1.05 FINAL ACCEPTANCE**A. General:**

1. The Contractor shall notify the Project Director/COR at least fifteen (15) calendar days prior to the time when the Contractor believes all work included in the contract will be ready for Final Acceptance.

B. Request for Final Inspection:

1. The Contractor shall submit the following when requesting Final Acceptance of the work:
 - a. Schedule of Defects:
 - b. Final Application for Payment:
 - c. Upon the Contractor's satisfactory completion and correction of work items, the Project Director/COR will recommend issuing the Certificate of Final Acceptance by the Contracting Officer.

1.06 RECORD DOCUMENT SUBMITTALS**A. The Contractor shall develop and maintain an original mark-up set of Contract Documents and Submittals.**

1. Indicate each change by change order number when related to a Contract Modification

C. Final Record Documents:

1. Record Shop Drawings:
 - a. Maintain a full set of accepted shop drawing black-line prints, with marked changes.
2. Operation and Maintenance Data.

1.07 WARRANTY

The General Contractor's Warranty Management commences early in the start-up phase and ends at a period normally one year (12 months) from the issuance of substantial completion, unless otherwise agreed upon.

END OF SECTION

CAC HVAC UPGRADE
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OPERATION AND MAINTENANCE DATA

1.01 SUBMITTALS

A. Schedule

1. O&M Library:

- a. The Contractor shall submit one (1) electronic version of the complete Maintenance Library for all new equipment/systems installed within fourteen (14) calendar days prior to Substantial Completion.
- b. The Government review period will be seven (7) calendar days.

1.02 OPERATIONS AND MAINTENANCE LIBRARY

B. Electronic Format on CD/DVD

- 1. An electronic copy of all submitted O&M library documents shall be created in PDF format.
 - a. Electronic copies must be readable by Adobe Acrobat Reader 8.0.
 - b. All PDF documents shall be word searchable.
 - e. Labeling:
 - 1) Discs shall be labeled and include Post name, and month and year of Substantial Completion.
 - f. CD/DVD Instructions:
 - 1) A brief guide for installing and viewing the library documents shall be located in the CD/DVD root directory. This file shall be named "readme.txt."
 - 2) A hard copy of readme.txt shall be inserted as the back cover of the CD/DVD jewel case.

1.03 O&M LIBRARY REQUIRED DOCUMENTS

- A. A complete listing of all equipment and systems. Specify manufacturer, make, model, size, capacity, serial number, facility name and location on Project Site, and identifying labels consistent with contract documents.

C. O&M Manuals

- 1. Manuals shall be subdivided by specification section. The first document in each section shall be the Specification text followed by a list of all equipment covered under that section.
- 2. The Contractor shall locate documents for each piece of maintained equipment from the list above as follows:
 - a. Product Description to include:
 - 1) Manufacturer name.
 - 2) Model name and number.
 - 3) Component serial numbers.
 - 4) Name, Address, and contact information for Installation subcontractor.
 - b. Preventive Maintenance Schedule:
 - 1) Maintenance tasks, inspections, and tests by required frequencies equally balanced throughout the calendar year

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- for each PM requirement identifying the designated skill trade, with estimated maintenance labor duration.
- 2) Safety and emergency instructions.
- 3) Detailed procedures for detecting faults during scheduled or unscheduled servicing.
- 4) Information on seasonal adjustments, emergency or partial operating procedures, start-up and shut-down detail, and other operationally significant information.
- 5) Maintenance approach.
- 6) Precautions against improper use and maintenance.
- c. Manufacturer's Product Data and Technical Literature:
 - 1) Detailed operating procedures, parameters, and tolerances.
 - 2) Troubleshooting guides..
- d. Manufacturer's Warranty information, (those extending more than one year) including copies of warranties, forms, and expiration dates.
- e. Shop drawings, wiring diagrams, flow charts, and equipment sequence of operations.
- f. Material Safety Data Sheets (MSDS), as required.
- g. List of Materials for Operation and Maintenance (Manufacturer's Spare Parts). Contractor shall provide a detailed list of materials and spare parts required to operate, maintain, and repair all building systems and installed equipment.

1.04

POSTED INSTRUCTIONS

- A. Operation and Maintenance Instructions:
 - 1. Unless otherwise indicated, the Contractor shall post O&M instructions at principal units of operational equipment, components, and building systems. They shall include instructions for safety, security, and mandatory protective devices. Instructions shall include, but not be limited to:
 - a. Start-up and shut-down procedures.
 - b. Control sequences.
 - c. Wiring diagrams and layouts.
 - d. System piping diagrams, valve locations, etc
 - 2. Emergency info. shall be posted in English and host country language.
 - 3. Instructions Mounting and Location:
 - a. Attach to or near each piece of equipment.
 - b. Frame in Plexiglas or similar material.
 - c. Illuminate, as necessary, to ensure readability.
 - d. Provide permanent, protected, tamper-resistant signage, appropriate to the exposure conditions.
 - e. Locate for convenience of O&M personnel, but concealed from others, except in the case of general-usage and emergency facilities.

END OF SECTION

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SECTION 230505 - COMMON WORK RESULTS FOR FIRE-SUPPRESSION, PLUMBING AND HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.

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1.3 PREVENTION OF CORROSION

- A. Not Used.

1.4 SUBMITTALS

- A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

- D. All Division 21, 22, and 23 work shall comply with the most recent version of the International Mechanical Code, The International Plumbing Code, and the International Fuel Gas Code.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

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1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21, 22 and 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 21, 22 and 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 3.2-mm maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 3.2 mm thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

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- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
1. Underground Piping DN 40 and Smaller: Manufactured fitting or coupling.
 2. Underground Piping DN 50 and Larger: AWWA C219, metal sleeve-type coupling.
 3. Aboveground Pressure Piping: Pipe fitting.
- B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 1725-kPa minimum working pressure at 82 deg C.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 1035- or 2070-kPa minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Separate companion flanges and steel bolts and nuts shall have 1035- or 2070-kPa minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 2070-kPa minimum working pressure at 107 deg C.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 2070-kPa minimum working pressure at 107 deg C.

2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

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1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.6-mm minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.

2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With spring clips and chrome-plated finish.
- F. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.8 PAINTING

- A. Painting requirements for Harsh Environments is Not Applicable to this project.

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2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 34.5-MPa, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged

2.10 ACOUSTIC SECURITY

- A. Not Applicable to this project.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems. The routing of piping systems shall be approved in the field by the Post Facility Manager.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.

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- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 50 mm above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 3. Install sleeves that are large enough to provide 6.4-mm annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than DN 150.
 - b. Steel Sheet Sleeves: For pipes DN 150 and larger, penetrating gypsum-board partitions.
 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 25-mm annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 150 mm in diameter.
 2. Install cast-iron "wall pipes" for sleeves 150 mm and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

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- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 25-mm annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - P. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
 - Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
 - R. Verify final equipment locations for roughing-in.
 - S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
 - T. No installation shall be permitted which blocks or otherwise impedes access to any existing machine or system. Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations. All indicators, to include gauges, meters, and alarms shall be mounted in order to be easily visible by people in the area.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

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- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
 - H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping DN 50 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping DN 65 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 09 Section "Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

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1. Construct concrete bases of dimensions indicated, but not less than 100 mm larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 450-mm centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 20.7-MPa, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."
- B. Equipment bases and foundations, when constructed of concrete or grout, shall cure a minimum of 28 or 14 days as specified before being loaded.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.9 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.

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- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 230505

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes hangers and supports for HVAC system piping and equipment.

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design seismic restraint hangers and supports for piping and equipment in accordance with Chapter 16 of the OBO Building Code, in relation to the project-specific location.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Fiberglass pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Powder-actuated fastener systems.
 - 5. Pipe positioning systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

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1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.
6. Special supports/anchors for diesel engine exhaust piping, subject to thermal stress and increased insulation requirements.

C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
 1. Professional Engineer Qualifications: A professional engineer who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped; for equipment that will not have field-applied finish.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner; on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

2.2 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

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- C. Nonmetallic Coatings: Plastic coating, jacket, or liner on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Description: 690-kPa- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier with vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 50 mm (2 inches) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- B. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 3. Design Mix: 30 MPa, 28-day compressive strength.

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PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, DN15 to DN750.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 49 to 232 deg C pipes, DN100 to DN400, requiring up to 100 mm of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, DN20 to DN600, requiring clamp flexibility and up to 100 mm of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, DN15 to DN600, if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes, DN15 to DN100, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, DN20 to DN200.
 7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, DN15 to DN200.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, DN15 to DN200.
 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, DN15 to DN50.
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, DN10 to DN200.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, DN10 to DN80.
 12. U-Bolts (MSS Type 24): For support of heavy pipe, DN15 to DN750.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, DN100 to DN900, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, DN100 to DN900, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, DN65 to DN900, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, DN25 to DN750, from two rods if longitudinal movement caused by expansion and contraction might occur.

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18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, DN65 to DN500, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, DN50 to DN1050, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, DN50 to DN600, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, DN50 to DN750, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, DN20 to DN500.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, DN20 to DN500, if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 150 mm for heavy loads.
 2. Steel Clevises (MSS Type 14): For 49 to 232 deg C piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 49 to 232 deg C piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 340 kg.
 - b. Medium (MSS Type 32): 675 kg.
 - c. Heavy (MSS Type 33): 1350 kg.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

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1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 690-kPa minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.
- H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 32 mm.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 1. Field assemble and install according to manufacturer's written instructions.

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- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- K. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9.

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2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe DN100 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe DN100 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. DN8 to DN90: 300 mm long and 1.22 mm thick.
 - b. DN100: 300 mm long and 1.52 mm thick.
 - c. DN125 and DN150: 450 mm long and 1.52 mm thick.
 - d. DN200 to DN350: 600 mm long and 1.91 mm thick.
 - e. DN400 to DN600: 600 mm long and 2.67 mm thick.
5. Pipes DN200 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor. Piping shall be suspend from above, unless otherwise noted or approved by the PD/COR.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

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1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 0.05 mm (2.0 mils).
 2. Comply with requirements of Division 9 painting requirements.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
 2. Adjusting total HVAC systems to provide indicated quantities.
 3. Measuring electrical performance of HVAC equipment.
 4. Setting quantitative performance of HVAC equipment.
 5. Verifying that automatic control devices are functioning properly.
 6. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.2 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

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- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
 - J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
 - K. Test: A procedure to determine quantitative performance of a system or equipment.
 - L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

1.3 SUBMITTALS

- A. Qualification Data: Within 14 days from Contractor's Notice to Proceed with construction, submit four copies of evidence that testing, adjusting, and balancing agent meets the qualifications specified in "Quality Assurance" Article.
- B. Certified Testing, Adjusting, and Balancing Reports: Submit two copies of reports prepared, as specified in this Section, on forms conforming to requirements of "Quality Assurance" Article.
- C. Instrument calibration reports, including the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.4 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a testing, adjusting, and balancing contractor certified by either Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) or approved equal. Approval of another entity is not guaranteed. The PD/COR shall review/approve alternates.
 - 1. TAB Field Supervisor: Employee of TAB contractor, and certified by AABC or NEBB or approved equal.
 - 2. TAB Technician: Employee of TAB contractor, and certified by AABC or NEBB or approved equal as TAB technician.
- B. Perform testing, adjusting and balancing in accordance with ANSI/ASHRAE Standard 111-1988 – "Practices for Measurement, Testing, Adjusting, and Balancing of Building Ventilation, Air-Conditioning, and Refrigeration Systems."

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- C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" each time a testing, adjusting, and balancing report is created.
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards if AABC report form is used or as described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification" if NEBB report form is used.
- F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.5 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Obtain all Division 23shop drawings of systems to be tested, adjusted and balanced in order to become familiar with installation prior to the day when testing, adjusting and balancing is performed.
- C. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- D. Perform testing, adjusting, and balancing after leakage, pressure tests, and specified flushing, cleaning and chemical treatment on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXECUTION

- A. OBO/CFSM/FAC will inspect the installation and review testing, adjusting, and balancing reports during acceptance testing.

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3.2 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
 - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are provided as required by the design in the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine project record documents described in Division 01 Section "Closeout Procedures."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10 from Air Movement and Control Association (AMCA); or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6 by Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA). Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

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- L. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
 - M. Examine strainers for clean screens and proper perforations.
 - N. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows and design fail-safe positions.
 - O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
 - P. Examine equipment for installation and for properly operating safety interlocks and controls.
 - Q. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices operate by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
 - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.
 - 8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 - 9. Interlocked systems are operating.
 - 10. Changeover from heating to cooling mode occurs according to design values.
 - R. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.
 - S. As applicable, examine signed pre-functional and start-up checklists, pertaining to applicable system/equipment. Ensure they have been submitted by installing contractor and verify that system/equipment is certified to be functioning in accordance with design intent prior to beginning any TAB fieldwork.

3.3 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, chemically treated as specified, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.

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5. Balance, smoke, and fire dampers are fully open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.

3.4 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.5 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- C. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.
- H. Check condensate drains for proper connections and functioning.
- I. Check for proper sealing of air-handling unit components.

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3.6 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

- A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume supply-air systems. These additional procedures are specified in other articles in this Section.
- B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer. If fans have multiple speeds, measure performance at each speed.
1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 2. Measure static pressure across each air-handling unit component.
 3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 4. Adjust fan speed higher or lower than design with the approval of the PD/COR. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
- C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

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- D. Measure terminal outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.
- E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.
 - 1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus-or-minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check expansion tank liquid level.
 - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 - 4. Check flow-control valves for specified sequence of operation and set at design flow.
 - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
 - 6. Set system controls so automatic valves are wide open to heat exchangers.
 - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 HYDRONIC SYSTEMS' BALANCING PROCEDURES

- A. Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:

Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.

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1. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
 2. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 3. Report flow rates that are not within plus-or-minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.
- E. Adjust balancing stations to within specified tolerances of design flow rate as follows:
1. Determine the balancing station with the highest percentage over design flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.
- 3.9 VARIABLE-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES
- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.
- 3.10 PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES
- A. Balance the primary system crossover flow first, then balance the secondary system.
- 3.11 HEAT EXCHANGERS
- A. Measure water flow through all circuits.
- B. Adjust water flow to within specified tolerances.

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- C. Measure inlet and outlet water temperatures.
- D. Record safety valve settings.
- E. Verify operation of steam traps.

3.12 MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating if high-efficiency motor.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data. Verify that minimum frequency (Hz) set points do not allow fans or pumps to operate within “surge portion “ of their respective submitted curves.

3.13 CHILLERS

- A. Balance water flow through each evaporator to within specified tolerances of design flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
 - 1. Evaporator water entering and leaving temperatures, pressure drop, and water flow.
 - 2. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by the chiller manufacturer.
 - 3. Power factor if factory-installed instrumentation is furnished for measuring kW.
 - 4. The kW input if factory-installed instrumentation is furnished for measuring kW.
 - 5. Capacity: Calculate in tons of cooling.
 - 6. Air-Cooled Chillers: Verify condenser-fan rotation and record fan data, including number of fans and entering- and leaving-air temperatures.
- B. Chillers shall be commissioned on-site by the manufacturer and accepted by Project Director/COR based on input from OBO designated mechanical engineer.

3.14 CONDENSING UNITS

- A. Verify proper rotation of fans and measure entering- and leaving-air temperatures. Record compressor data.

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3.15 HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
1. Entering- and leaving-water temperatures.
 2. Water flow rate.
 3. Water pressure drop.
 4. Dry-bulb temperatures of entering and leaving air.
 5. Wet-bulb temperatures of entering and leaving air for cooling coils designed for less than 3540 L/s.
 6. Airflow.
 7. Air pressure drop.

3.16 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.17 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Verify free travel and proper operation of control devices such as damper and valve operators.
- F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
- G. Confirm interaction of electrically operated switch transducers.
- H. Confirm interaction of interlock and lockout systems.
- I. Verify main control supply-air pressure and observe compressor and dryer operations.

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- J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.18 AIR LEAKAGE TEST TOLERANCE VERIFICATION

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans: Plus 10 to minus 5 percent.
 - 2. Air Outlets and Inlets: Plus 10 to minus 5 percent.
 - 3. Heating-Water Flow Rate: Plus 10 to minus 5 percent.
 - 4. Cooling-Water Flow Rate: 10 to minus 5 percent.

3.19 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.20 FINAL REPORT

- A. Submit final test reports to Project Director/COR for forwarding to the OBO/CFSM/FAC Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database.
- B. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- C. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- D. Final Report Contents: In addition to the certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.

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4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- E. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
1. Title page.
 2. Name and address of testing, adjusting, and balancing Agent.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of testing, adjusting, and balancing Agent who certifies the report.
 10. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 11. Nomenclature sheets for each item of equipment.
 12. Data for terminal units, including manufacturer, type size, and fittings.
 13. Notes to explain why certain final data in the body of reports vary from design values.
 14. Test conditions for fans and pump performance forms, including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- F. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Tag identification numbers for major equipment, valve and damper components,
- G. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

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1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in mm, and bore.
 - i. Sheave dimensions, center-to-center and amount of adjustments in mm.
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.

2. Motor Data: Include the following:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in mm, and bore.
 - f. Sheave dimensions, center-to-center and amount of adjustments in mm.

3. Test Data: Include design and actual values for the following:
 - a. Total airflow rate in L/s.
 - b. Total system static pressure in Pa.
 - c. Fan rpm.
 - d. Discharge static pressure in Pa.
 - e. Filter static-pressure differential in Pa.
 - f. Preheat coil static-pressure differential in Pa.
 - g. Cooling coil static-pressure differential in Pa.
 - h. Heating coil static-pressure differential in Pa.
 - i. Outside airflow in L/s.
 - j. Return airflow in L/s.
 - k. Outside-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

- H. Apparatus-Coil Test Reports: For apparatus coils, include the following:
 1. Coil Data: Include the following:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in mm o.c..
 - f. Make and model number.
 - g. Face area in sq. m.

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- h. Tube size in DN.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data: Include design and actual values for the following:
- a. Airflow rate in L/s.
 - b. Average face velocity in m/s.
 - c. Air pressure drop in Pa.
 - d. Outside-air, wet- and dry-bulb temperatures in deg C.
 - e. Return-air, wet- and dry-bulb temperatures in deg C.
 - f. Entering-air, wet- and dry-bulb temperatures in deg C.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg C.
 - h. Water flow rate in L/s.
 - i. Water pressure differential in kPa.
 - j. Entering-water temperature in deg C.
 - k. Leaving-water temperature in deg C.
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in kPa.
 - n. Refrigerant suction temperature in deg C.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data: Include the following:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in mm, and bore.
 - h. Sheave dimensions, center-to-center and amount of adjustments in mm.
 - 2. Motor Data: Include the following:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in mm, and bore.
 - f. Sheave dimensions, center-to-center and amount of adjustments in mm.
 - g. Number of belts, make, and size.
 - 3. Test Data: Include design and actual values for the following:
 - a. Total airflow rate in L/s.
 - b. Total system static pressure in Pa.
 - c. Fan rpm.
 - d. Discharge static pressure in Pa.

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- e. Suction static pressure in Pa.
- J. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
- 1. Report Data: Include the following:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg C.
 - d. Duct static pressure in Pa.
 - e. Duct size in mm.
 - f. Duct area in sq. m.
 - g. Design airflow rate in L/s.
 - h. Design velocity in m/s.
 - i. Actual airflow rate in L/s.
 - j. Actual average velocity in m/s.
 - k. Barometric pressure in Pa.
- K. Air-Terminal-Device Reports: For terminal units, include the following:
- 1. Unit Data: Include the following:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Test apparatus used.
 - d. Area served.
 - e. Air-terminal-device make.
 - f. Air-terminal-device number from system diagram.
 - g. Air-terminal-device type and model number.
 - h. Air-terminal-device size.
 - i. Air-terminal-device effective area in sq. m.
 - 2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in L/s.
 - b. Air velocity in m/s.
 - c. Preliminary airflow rate as needed in L/s.
 - d. Preliminary velocity as needed in m/s.
 - e. Final airflow rate in L/s.
 - f. Final velocity in m/s.
 - g. Space temperature in deg C.
- L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
- 1. Unit Data: Include the following:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Room or riser served.

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- d. Coil make and size.
 - e. Flowmeter type.
2. Test Data: Include design and actual values for the following:
- a. Airflow rate in L/s.
 - b. Entering-water temperature in deg C.
 - c. Leaving-water temperature in deg C.
 - d. Water pressure drop in kPa.
 - e. Entering-air temperature in deg C.
 - f. Leaving-air temperature in deg C.
- M. Packaged Chiller Reports: For each chiller, include the following:
1. Unit Data: Include the following:
- a. Unit identification.
 - b. Make and model number.
 - c. Manufacturer's serial number.
 - d. Refrigerant type and capacity in L.
 - e. Starter type and size.
 - f. Starter thermal protection size.
2. Condenser Test Data: Include design and actual values for the following:
- a. Refrigerant pressure in kPa.
 - b. Refrigerant temperature in deg C.
3. Evaporator Test Reports: Include design and actual values for the following:
- a. Refrigerant pressure in kPa.
 - b. Refrigerant temperature in deg C.
 - c. Entering-water temperature in deg C.
 - d. Leaving-water temperature in deg C.
 - e. Entering-water pressure in kPa.
 - f. Water pressure differential in kPa.
4. Compressor Test Data: Include design and actual values for the following:
- a. Make and model number.
 - b. Manufacturer's serial number.
 - c. Suction pressure in kPa.
 - d. Suction temperature in deg C.
 - e. Discharge pressure in kPa.
 - f. Discharge temperature in deg C.
 - g. Oil pressure in kPa.
 - h. Oil temperature in deg C.
 - i. Voltage at each connection.
 - j. Amperage for each phase.
 - k. The kW input.

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- l. Crankcase heater kW.
 - m. Chilled water control set point in deg C.
 - n. Refrigerant low-pressure-cutoff set point in kPa.
 - o. Refrigerant high-pressure-cutoff set point in kPa.
5. Refrigerant Test Data: Include design and actual values for the following:
- a. Oil level.
 - b. Refrigerant level.
 - c. Relief valve setting in kPa.
 - d. Unloader set points in kPa.
 - e. Percentage of cylinders unloaded.
 - f. Bearing temperatures in deg C.
 - g. Vane position.
 - h. Low-temperature-cutoff set point in deg C.
- N. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Unit make and model number.
 - d. Manufacturer's compressor serial numbers.
 - e. Compressor make.
 - f. Compressor model and serial numbers.
 - g. Refrigerant weight in kg.
 - h. Low ambient temperature cutoff in deg C.
 2. Test Data: Include design and actual values for the following:
 - a. Inlet-duct static pressure in Pa.
 - b. Outlet-duct static pressure in Pa.
 - c. Entering-air, dry-bulb temperature in deg C.
 - d. Leaving-air, dry-bulb temperature in deg C.
 - e. Condenser entering-water temperature in deg C.
 - f. Condenser leaving-water temperature in deg C.
 - g. Condenser water temperature differential in deg C.
 - h. Condenser entering-water pressure in kPa.
 - i. Condenser leaving-water pressure in kPa.
 - j. Condenser water pressure differential in kPa.
 - k. Control settings.
 - l. Unloader set points.
 - m. Low-pressure-cutout set point in kPa.
 - n. High-pressure-cutout set point in kPa.
 - o. Suction pressure in kPa.
 - p. Suction temperature in deg C.
 - q. Condenser refrigerant pressure in kPa.

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- r. Condenser refrigerant temperature in deg C.
 - s. Oil pressure in kPa.
 - t. Oil temperature in deg C.
 - u. Voltage at each connection.
 - v. Amperage for each phase.
 - w. The kW input.
 - x. Crankcase heater kW.
 - y. Number of fans.
 - z. Condenser fan rpm.
 - aa. Condenser fan airflow rate in L/s.
 - bb. Condenser fan motor make, frame size, rpm, and horsepower.
 - cc. Condenser fan motor voltage at each connection.
 - dd. Condenser fan motor amperage for each phase.
- O. Heat-Exchanger Test Reports: For hot-water heat exchangers, include the following:
- 1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
 - f. Ratings.
 - 2. Primary Water Test Data: Include design and actual values for the following:
 - a. Entering-water temperature in deg C.
 - b. Leaving-water temperature in deg C.
 - c. Entering-water pressure in kPa.
 - d. Water pressure differential in kPa.
 - e. Water flow rate in L/s.
 - 3. Secondary Water Test Data: Include design and actual values for the following:
 - a. Entering-water temperature in deg C.
 - b. Leaving-water temperature in deg C.
 - c. Entering-water pressure in kPa.
 - d. Water pressure differential in kPa.
 - e. Water flow rate in L/s.
- P. Pump Test Reports: For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.
- 1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.

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- e. Model and serial numbers.
 - f. Water flow rate in L/s.
 - g. Water pressure differential in kPa.
 - h. Required net positive suction head in kPa.
 - i. Pump rpm.
 - j. Impeller diameter in mm.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
2. Test Data: Include design and actual values for the following:
- a. Static head in kPa.
 - b. Pump shutoff pressure in kPa.
 - c. Actual impeller size in mm.
 - d. Full-open flow rate in L/s.
 - e. Full-open pressure in kPa.
 - f. Final discharge pressure in kPa.
 - g. Final suction pressure in kPa.
 - h. Final total pressure in kPa.
 - i. Final water flow rate in L/s.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
- Q. Instrument Calibration Reports: For instrument calibration, include the following:
1. Report Data: Include the following:
- a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.21 ADDITIONAL TESTS

- A. Not used.
- B. Seasonal Test Periods:
 - 1. Not Required.

END OF SECTION 230593

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SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; adhesives, field-applied jackets; accessories and attachments; and sealing compounds.

1.2 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Removable insulation sections at access panels
 - 2. Application of field-applied jackets.
 - 3. Applications at linkages for control devices.
- C. Samples: For each type of insulation and field-applied jacket. Identify each Sample, describing product and intended use. Submit 300-mm (12-inches) square sections of each sample material.
- D. Manufacturer's Color Charts: Show the full range of colors available for each type of field-applied finish material indicated.
- E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
- F. Material Safety Data Sheets (MSDS): Submit MSDS for all listed solvent, glue, adhesive, mastic, insulation, and jacket materials.
- G. Installer Certificates: Signed by the Contractor certifying that installers comply with manufacturers requirements.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

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1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.
- B. Insulation work will be inspected by the Project Director/COR during installation and at acceptance for compliance with drawing and specifications. Deficiencies shall be corrected before acceptance by the Government.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

1.6 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available manufacturers: Subject to conformance with requirements, manufacturer offerings products that may be incorporated into this work include but are not limited to:
1. Mineral-Fiber Insulation:
 - a. Schuller International, Inc.
 - b. CertainTeed.
 - c. Knauf Fiberglass.
 - d. Owens Corning.
 - e. GAF.
 2. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries.
 - b. Rubatex Corp.

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2.2 INSULATION MATERIALS

- A. Flexible Elastomeric Thermal Insulation: Closed cell, sponge or expanded rubber materials. Comply with ASTM C534, Type II for sheet materials.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. Ultraviolet Protective Coating: As recommended by insulation material manufacturer.

2.3 ACCESSORIES AND ATTACHMENTS

- A. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.4 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation and or adhesive application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thickness required for each duct system.

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- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the fewest number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- M. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
 - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
- N. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- O. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations. Sleeve and fire stop.
- P. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
 - 1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

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- Q. Insulation shall not impede access to duct covers/doors used for duct cleaning and/or maintenance.
- R. Fibrous duct insulation shall be used only on duct exteriors. It shall not be allowed inside the ductwork.

3.4 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Project Director/COR. Vary first and second coats to allow visual inspection of the completed Work.

3.5 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses shall conform with the latest version of the International Mechanical Code (IMC) and the International Energy Conservation Code (IECC).
- B. Insulate the following plenums and duct systems:
 - 1. Indoor concealed supply- and outside-air ductwork.
 - 2. Indoor exposed supply and outside-air ductwork.
 - 3. Indoor exposed range-hood exhaust ductwork.
 - 4. Indoor concealed range-hood exhaust ductwork.
 - 5. Indoor exposed oven and dishwasher exhaust ductwork.
 - 6. Indoor concealed oven and dishwasher ductwork.
- C. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Metal ducts with duct liner.
 - 2. Factory-insulated flexible ducts.
 - 3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 - 4. Flexible connectors.
 - 5. Vibration-control devices.
 - 6. Testing agency labels and stamps.
 - 7. Nameplates and data plates.
 - 8. Access panels and doors in air-distribution systems.
 - 9. Interiors of duct with fibrous insulation.

3.6 ACCEPTANCE

- A. Insulation work will be inspected by the Project Director/COR and designated Systems Engineer/Condition Monitoring Office/Predictive Testing Group as applicable during

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installation and at substantial completion for compliance with drawing and specifications. Deficiencies shall be corrected before acceptance by the Government.

END OF SECTION 230713

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SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 500 to plus 2500 Pa. The duct construction shall comply with the requirements of Table 4-1 of SMACNA HVAC Duct Leakage Test Manual. A schedule of all duct work sections and their maximum operating static pressure, Pressure Class, and Seam Type shall be provided. Duct construction is critical to maintaining the noise standards for the building. Metal ducts include the following:
1. Rectangular ducts and fittings.
 2. Single-wall, round spiral-seam ducts and formed fittings.
 3. Duct liner.
- B. Related Sections include the following:
1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC."
 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. NUSIG: National Uniform Seismic Installation Guidelines.

1.3 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Project Director/COR. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 SUBMITTALS

- A. Product Data: For duct liner and sealing material.
- B. Shop Drawings: Show details of the following:

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1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating pressure classifications and sizes on plans.
3. Fittings.
4. Reinforcement and spacing.
5. Seam and joint construction.
6. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

- C. Welding Certificates: Copies of certificates indicating welding procedures and personnel comply with requirements in "Quality Assurance" Article.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. NFPA Compliance:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for range hood ducts, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having Z275 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- C. Tie Rods: Galvanized steel, 6-mm minimum diameter for lengths 900 mm or less; 10-mm minimum diameter for lengths longer than 900 mm.

2.2 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

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- B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- C. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- D. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- E. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.3 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 100 mm thick.
 - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 100 mm thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
 - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.

2.4 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

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- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
 - 1. Duct Size: Maximum 750 mm wide and up to 500-Pa pressure class.
 - 2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 480 mm and larger and 0.9 mm thick or less, with more than 0.93 sq. m of nonbraced panel area unless ducts are lined.

2.5 ROUND DUCT AND FITTING FABRICATION

- A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.
- B. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- C. Duct Joints:
 - 1. Ducts up to 500 mm in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 - 2. Ducts 535 to 1830 mm in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 - 3. Ducts Larger Than 1830 mm in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
 - 4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
- D. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- E. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- F. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
 - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

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2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 500 to plus 500 Pa:
 - a. Ducts 75 to 915 mm in Diameter: 0.85 mm.
 - b. Ducts 940 to 1270 mm in Diameter: 1.0 mm.
 - c. Ducts 1320 to 1525 mm in Diameter: 1.3 mm.
 - d. Ducts 1575 to 2130 mm in Diameter: 1.6 mm.
 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 500 to 2500 Pa:
 - a. Ducts 75 to 660 mm in Diameter: 0.85 mm.
 - b. Ducts 685 to 1270 mm in Diameter: 1.0 mm.
 - c. Ducts 1320 to 1525 mm in Diameter: 1.3 mm.
 - d. Ducts 1575 to 2130 mm in Diameter: 1.6 mm.
 4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
 5. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
 6. Round Elbows 200 mm and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 7. Round Elbows 225 through 355 mm in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 8. Round Elbows Larger than 355 mm in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
 9. Die-Formed Elbows for Sizes through 200 mm in Diameter and All Pressures 1.0 mm thick with 2-piece welded construction.
 10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
 11. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.
 12. Pleated Elbows for Sizes through 355 mm in Diameter and Pressures through 2500 Pa: 0.55 mm.

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PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
1. Supply Ducts: 250 Pa.
 2. Supply Ducts (before Air Terminal Units): 500 Pa.
 3. Supply Ducts (after Air Terminal Units): 250 Pa.
 4. Supply Ducts (in Mechanical Equipment Rooms): 500 Pa.
 5. Return Ducts (Negative Pressure): 250 Pa.
 6. Exhaust Ducts (Negative Pressure): 250 Pa.
 7. Outdoor Air Ducts (Negative Pressure): 250 Pa.
- B. All ducts shall be galvanized steel except as follows:
1. Range Hood Exhaust Ducts: Comply with NFPA 96.
 - a. Concealed: Carbon-steel sheet.
 - b. Exposed: Type 304, stainless steel with finish to match kitchen equipment and range hood.
 - c. Weld all seams and joints.
 - 1) Provide flange connections when connecting to range hood and exhaust fan.

3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round ducts in lengths not less than 3.7 m unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 300 mm, with a minimum of three screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 25 mm.

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- I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- J. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- K. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 38 mm.
- M. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are specified in Division 07 Section "Penetration Firestopping."
- N. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

3.3 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
- B. Seal and successfully pressure test ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

- A. Install rigid round and rectangular metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."
- B. Support horizontal ducts within 600 mm of each elbow and within 1200 mm of each branch intersection.
- C. Support vertical ducts at maximum intervals of 5 m and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

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1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 100 mm thick.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

- A. PD/COR and designated team shall inspect ductwork during installation and acceptance phases.
- B. Cleanliness Verification:
 1. Visually inspect metal ducts for contaminants.
 2. Where ducts are connected to equipment, inspect all locations to ensure debris has not entered equipment.
 3. Where contaminants are discovered, re-clean and reinspect ducts. Clean equipment/coils as required.

END OF SECTION 233113

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SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Turning vanes.
 - 3. Duct-mounted access doors.
 - 4. Flexible connectors.
 - 5. Duct accessory hardware.

- B. Related Sections include the following:
 - 1. Not Used.

1.2 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.3 SUBMITTALS

- A. A.Product Data: For the following:
 - 1. Backdraft dampers.
 - 2. Turning Vanes
 - 3. Duct-mounted access doors.
 - 4. Flexible connections.
 - 5. Duct accessory hardware.

- B. Shop Drawings - General: Detail equipment assemblies and indicate dimensions, weight, loading, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
 - 1. Special fittings and manual and automatic volume damper installations.
 - 2. Penetration details through fire rated floor and wall assemblies.

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1.3 EXTRA MATERIALS

- A. Not Used.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having minimum G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 6-mm (1/4-inch) minimum diameter for lengths 900 mm (36 inches) or less; 10-mm (3/8-inch) minimum diameter for lengths longer than 900 mm (36 inches).

2.2 BACKDRAFT DAMPERS

- A. Description: Multiple-blade, parallel action gravity balanced, with blades of maximum 150-mm width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- B. Frame: 1.3-mm thick, galvanized sheet steel, with welded corners and mounting flange.
- C. Blades: 0.6-mm thick, roll-formed aluminum.
- D. Blade Seals: Vinyl.
- E. Blade Axles: Nonferrous.
- F. Tie Bars and Brackets: Galvanized steel.
- G. Return Spring: Adjustable tension.

2.3 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

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- B. **Manufactured Turning Vanes:** Fabricate 38-mm wide, double-vane, curved blades of galvanized sheet steel set 19 mm o.c.; support with bars perpendicular to blades set 50 mm o.c.; and set into vane runners suitable for duct mounting.
- C. **Acoustic Turning Vanes:** Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.4 DUCT-MOUNTED ACCESS DOORS

- A. **General Description:** Fabricate doors airtight and suitable for duct pressure class.
- B. **Door:** Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 25-by-25-mm butt or piano hinge and cam latches.
 - 1. **Frame:** Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 2. **Provide number of hinges and locks as follows:**
 - a. **Less Than 300 mm Square:** Secure with two sash locks.
 - b. **Up to 450 mm Square:** Two hinges and two sash locks.
 - c. **Up to 600 by 1200 mm:** Three hinges and two compression latches.
 - d. **Sizes 600 by 1200 mm and Larger:** Four hinges and two compression latches with outside and inside handles.
- C. **Seal around frame attachment to duct and door to frame with neoprene or foam rubber.**
- D. **Insulation:** Minimum 25-mm thick, fibrous-glass or polystyrene-foam board, or matching duct construction requirements.

2.5 FLEXIBLE CONNECTORS

- A. **General Description:** Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. **Metal-Edged Connectors:** Factory fabricated with a fabric strip 89 mm wide attached to two strips of 70-mm wide, 0.7-mm thick, galvanized sheet steel or 0.8-mm thick aluminum sheets. Select metal compatible with ducts.
- C. **Indoor System, Flexible Connector Fabric:** Glass fabric double coated with neoprene.
 - 1. **Minimum Weight:** 880 g/sq. m.
 - 2. **Tensile Strength:** 84 N/mm in the warp and 63 N/mm in the filling.
 - 3. **Service Temperature:** Minus 40 to plus 93 deg C.

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PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

- A. Install duct accessories according to construction documents and to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. For ducted chiller condenser exhausts, only install backdraft dampers if multiple condenser fans exist. Condenser air flow shall not be able to short circuit through non-energized condenser fans.
- D. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
 - 1. Downstream from backdraft dampers and equipment.
- E. Install the following sizes for duct-mounted, rectangular access doors:
 - 1. One-Hand or Inspection Access: 200 by 125 mm.
- F. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- G. For fans developing static pressures of 1250 Pa and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

3.2 ADJUSTING

- A. Adjust, test, and inspect duct accessories to ensure proper settings.

END OF SECTION 233300

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SECTION 237413 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
 - 1. Direct-expansion cooling.
 - 2. Heat-pump refrigeration components.
 - 3. Hot-gas reheat.
 - 4. Electric-heating coils.
 - 5. Integral, space temperature controls.
 - 6. Roof curbs.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

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1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design RTU supports to comply with wind and seismic performance requirements of the installed location, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of units of sections of units showing the full range of colors available for units with factory applied color finishes.
- D. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
 - 2. Wind and Seismic Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which RTUs will be attached.
 - 2. Roof openings
 - 3. Roof curbs and flashing.
- B. Field quality-control test reports.
- C. Warranty: Special warranty specified in this Section.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

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1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. (If not direct drive) Fan Belts: Three (3) set for each belt-driven fan.
 2. Filters: Three (3) sets of filters for each unit.

1.9 QUALITY ASSURANCE

- A. ARI Compliance:
1. Comply with ARI 203/110 and ARI 303/110 for testing and rating energy efficiencies for RTUs.
 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- B. ASHRAE Compliance:
1. Comply with ASHRAE 15 for refrigeration system safety.
 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- E. UL Compliance: Comply with UL 1995.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
1. The entire system shall have a minimum one (1) year warranty from the date of substantial completion for parts and labor.
 2. Warranty Period for Compressors: Manufacturer's standard, but not less than five (5) years from date of Substantial Completion.
 3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three (3) years from date of Substantial Completion.

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PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. York.
 2. Carrier Corporation; a unit of United Technologies Corp.
 3. Trane.
 4. Other manufacturers may be provided if approved by the PD/COR

2.2 CASING

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Exterior Casing Material: Galvanized steel with factory-painted enamel baked finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
- C. Inner Casing Material shall be Galvanized steel.
- D.
- E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
1. Materials: ASTM C 1071, Type I.
 2. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
 3. Liner Adhesive: Comply with ASTM C 916, Type I.
- F. Condensate Drain Pans: Formed sections of stainless steel sheet, a minimum of 50 mm deep, and complying with ASHRAE 62.1.
1. Drain Connections: Threaded nipple.
 2. Pan-Top Surface Coating: Corrosion-resistant compound.

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- G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.3 FANS

- A. Direct-Driven or Belt-Driven fans are acceptable. Plug/Plenum-type Centrifugal fans or Double width Centrifugal fans are acceptable. Fans and motors shall be permanently lubricated. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
- B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
- C. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces required of the installed geographical zone when fan-mounted frame and RTU-mounted frame are anchored to building structure.
- D. Fan Motor: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.4 COILS

- A. Supply-Air Refrigerant Coil:
1. Aluminum plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 3. Coil Split: Interlaced.
 4. Condensate Drain Pan Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.
- B. Outdoor-Air Refrigerant Coil:
1. Aluminum plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

2.5 REFRIGERANT CIRCUIT COMPONENTS

- A. Number of Refrigerant Circuits: One
- B. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.
1. Refrigerant: R-410A, R-407C, R-134A.
 2. Expansion valve with replaceable thermostatic element.
 3. Refrigerant filter/dryer.

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4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.

2.6 AIR FILTRATION

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 1. MERV 8 Minimum.

2.7 GAS FURNACE

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
 1. CSA Approval: Designed and certified by and bearing label of CSA.
- B. Burners: Stainless steel.
 1. Fuel: Natural gas.
- C. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

2.8 DAMPERS

- A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized operation. Outdoor air damper shall automatically open to a preset position during occupied run hours and shall remain closed during unoccupied run hours.
- B. Outdoor- and Return-Air Mixing Dampers: Opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 1. Damper Motor: Modulating with adjustable positions.
 2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood. Relief air pressure set point shall be adjustable to meet project specific space pressurization requirements.

2.9 ELECTRICAL POWER CONNECTION

- A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection. Where unit mounted/installed disconnect cannot be provided, the contractor shall furnish and install a disconnect on or local to the equipment.

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2.10 CONTROLS**A. Basic Unit Controls:**

1. Control-voltage transformer.
2. Wall-mounted 7-day programmable thermostat with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. Automatic changeover.
 - e. Adjustable deadband.
 - f. Exposed set point.
 - g. Exposed indication.
 - h. Degree C indication.
 - i. Unoccupied/occupied scheduling.
 - j. Unoccupied-period-override push button.
 - k. Unoccupied/occupied control over outdoor air (OA) damper.
 - l. Data entry and access port to input temperature set points, occupied and unoccupied periods, operating mode, and status.

B. Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:
 - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
 - b. Fire Alarm Control Panel Interface: Provide control interface to coordinate/communicate with existing fire alarm system.
 - c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 4 deg C (adjustable).
3. Scheduled Operation: Occupied and unoccupied periods on [seven] [365]-day clock with a minimum of four programmable periods per day.
4. Unoccupied Period:
 - a. Heating Setback: 10 deg C.
 - b. Cooling Setback: System off.
 - c. Override Operation: One (1) hours.

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5. Supply Fan Operation:
 - a. Occupied Periods: Run fan continuously.
 - b. Unoccupied Periods: Cycle fan to maintain setback temperature.

6. Refrigerant Circuit Operation:
 - a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain room temperature. Cycle condenser fans to maintain maximum hot-gas pressure.
 - b. Unoccupied Periods: Compressors off. Cycle natural gas burner and supply fan to maintain minimum setback temperature.
 - c.

7. Fixed Minimum Outdoor-Air Damper Operation:
 - a. Occupied Periods: Open to 25 percent (Adjustable from 0% - 25%).
 - b. Unoccupied Periods: Close the outdoor-air damper.

C. Interface Requirements for HVAC Instrumentation and Control System:

1. Regardless of whether the new equipment will be integrated with a Building Automation System (BAS) or any form of Control System, the new equipment shall be furnished with an Interface Relay for scheduled operation.
2. Regardless of whether the new equipment will be integrated with a Building Automation System (BAS) or any form of Control System, the new equipment shall be furnished with an Interface Relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Regardless of whether the new equipment will be integrated with a Building Automation System (BAS) or any form of Control System, the new equipment shall be furnished with a BACnet compatible interface for central HVAC control workstation for the following:
 - a. Adjusting set points and start/stop.
 - b. Monitoring supply fan start, stop, and operation.
 - c. Monitoring compressor fan start, stop, and operation.
 - d. Inquiring data to include outdoor-air damper position and room-air temperature.
 - e. Monitoring occupied and unoccupied operations.
 - f. Monitoring alarm status.
 - g. Monitoring differential pressure across filter bank.

2.11 ACCESSORIES

- A. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss. Shall be capable of providing pressure differential reading via BACnet or energizing alarm for filter change via BACnet.
- B. Coil guards of painted, galvanized-steel wire.

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- C. Hail guards of galvanized steel, painted to match casing.

2.12 ROOF CURBS

- A. Existing roof curbs shall be reused wherever possible. Replacement of roof curbs shall be approved by the PD/COR. Where new roof curbs are required, the contractor shall be responsible for all materials and labor to complete the modifications and shall comply with the following:
 - B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or II.
 - 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
 - C. Curb Height: Shall be reviewed and approved by PD/COR and FM.
 - D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION

A. Equipment Mounting:

1. Install RTUs on existing roof curbs unless otherwise noted. Install RTUs on curbs and coordinate roof penetrations and flashing with roof existing roof construction and secure RTUs to upper curb rail, and secure curb base (if new) to roof framing or concrete base with anchor bolts.
2. Unit Support: Install unit level on structural curbs. Coordinate roof penetrations and flashing with roof construction. Secure RTUs to structural support with anchor bolts.

3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Install natural gas piping and valve train accessories.
- C. Install electrical service with new code compliant disconnect.
- D. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 1. Install ducts to termination at top of roof curb.
 2. Remove roof assembly only as required for passage of ducts. Do not cut out decking under entire roof curb. No cutting shall be performed without approval from the PD/COR and FM.
 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 4. Install return-air duct continuously through roof structure.
 5. The concrete roof/structure should not be altered. No concrete shall be removed or modified without approval from the PD/COR and FM.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.

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2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

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21. Calibrate thermostats.
 22. Adjust and inspect high-temperature limits.
 23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
 24. Start refrigeration system and measure and record the following when ambient is a minimum of 8 deg C above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
 25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.

3.6 CLEANING AND ADJUSTING

- A. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 237413

SECTION 238126 - SPLIT-SYSTEM AIR CONDITIONERS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts. The equipment shall be equipped with a wired wall-mounted thermostat/controller.

1.3 ACTION SUBMITTALS

- A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics. Manufacturers' product data for refrigerants, including printed statement that refrigerants are free of HCFCs.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring. On roof mounted units, provide details of roof supports and dimensioned locations on project roof drawings to coordinate with roofing subcontractor (if required).
- C. Samples for Initial Selection: Manufacturer's color charts consisting of units of sections of units showing the full range of colors available for units with factory applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Field Quality Control reports
- B. Warranties: Special warranties specified in this Section.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For split-system air-conditioning units, include in the manufacturer's maintenance manuals.
- B. Installation Instructions: For split-system air-conditioning units, include in the manufacturer's installation manuals.

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1.6 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.
- C. The units shall be rated in accordance with the Air-conditioning, Heating, and Refrigeration Institutes, (AHRI) Standard 240 and bear the ARI Certification label.
- D. Energy-Efficiency Ratio (EER) and Coefficient of Performance (COP): System EER and COP shall be equal to or greater than prescribed by ASHRAE/IESNA 90.1 "Energy efficient Design of New Buildings except Low-Rise Residential Buildings." Compressors and evaporator coils shall be tested in accordance with ARI standards.
- E. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to the environmental protection set by the International Standard Organization (ISO).
- F. A dry holding charge shall be provided.

1.7 COORDINATION

- A. Coordinate size and location of bases for units.
- B. Coordinate sizes and locations of equipment supports with actual equipment provided.
- C. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations. Existing roof curbs, equipment supports, and roof penetrations shall be reused where applicable. Supports and Anchorages are specified further in specifications section 230505.

1.8 WARRANTY

- A. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components identified below of split-system air-conditioning units which fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. The compressor shall have minimum five (5) year warranty from date of substantial completion.
 - b. The entire system shall have a minimum one (1) year warranty from the date of substantial completion for parts and labor.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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1. Filters: Three set of filters for each unit.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS

A. Acceptable Manufacturers:

1. Carrier
2. Trane
3. York
4. Other manufacturers may be provided if approved by the PD/COR

- B. Product Description: Split system consisting of air handling unit and condensing unit including cabinet, evaporator fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, air filters, controls, condensate pumps, outdoor air (OA) fans, air handling unit accessories, condensing unit accessories, and refrigeration specialties.

- C. Refrigerants: R-134a, R-410A and R-407c

2.2 CEILING-MOUNTING, EVAPORATOR-FAN COMPONENTS (INDOOR UNIT)

- A. Panels/Cabinet: Galvanized steel with baked enamel finish. Color selected by PD/COR. Cabinet shall be furnished with duct collars on inlets and outlets. Cabinet shall have sloped condensate drain pans with drain connection.

- B. Auxiliary and Secondary Drain Systems: The indoor unit shall be equipped with an auxiliary protection system in compliance with the International Mechanical Code (IMC) section 307.2.3. Options include:

1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1 1/2 inches (38 mm), shall not be less than 3 inches (76 mm) larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion-resistant material. Galvanized sheet steel pans shall have a minimum thickness of not less than 0.0236 inch (0.6010 mm) (No. 24 gage). Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).
2. A separate overflow drain line shall be connected to the drain pan provided with the equipment. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.
3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water-level detection device conforming to UL 508 that will shut off the equipment served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.
4. A water-level detection device conforming to UL 508 shall be provided that will shut off the equipment served in the event that the primary drain is blocked. The device shall be

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installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.

C. Refrigerant Coil:

1. Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
2. All tube joints shall be brazed with phos-copper or silver alloy.
3. The coils shall be pressure testing in the factory.
4. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil.

D. Fan/Motor:

1. Centrifugal fan.
2. Direct drive with high efficiency motor.
3. Motor shall be permanently lubricated with built-in overload protection.
4. The fan shall be statically and dynamically balanced.
5. The indoor fan shall have multiple speeds. Three (3) speeds minimum.

E. Filters: Return air filters shall have a minimum of MERV 8 rating.

F. Electrical: New equipment shall be selected to operate on the same electrical infrastructure as the existing equipment. New electrical disconnects shall be provided with new equipment. Modifications required to make the existing electrical service compatible with the new equipment is the responsibility of the contractor under this contract. Where new systems are being installed the contractor shall be responsible for all electrical infrastructure upgrades.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS (OUTDOOR UNIT)

A. The outdoor unit shall be compatible with the indoor unit. All units (indoor/outdoor) shall be the same manufacturer.

B. Casing: Galvanized Steel, with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. With removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing. Assembly hardware shall be cadmium plated or stainless steel (304 or 316 grade).

C. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. The compressor shall be mounted so as to avoid the transmission of vibration. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Reciprocating or Scroll.
2. With manual-reset high-pressure switch and automatic-reset low-pressure switch.

D. Refrigerant Coil:

1. Copper tube, with mechanically bonded flat aluminum fins, complying with ARI 210/240, and with liquid subcooler.
2. All refrigerant lines between the outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements. Refrigerant lines shall be insulated with flexible, closed-cell, CFC-free (ozone depletion potential of zero) elastomeric material.

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- E. Heat Pump Components:
1. Reversing valve and low-temperature air cut-off thermostat.
 2. Heat Pumps shall have emergency/back-up electric resistance heat coils.
 3. All necessary controls and components for an automatic defrost cycle.
- F. Fan: Aluminum-propeller type, directly connected to motor. The condenser fan shall start prior to the compressor start-up and shall turn-off after the compressor has stopped running.
- G. Motor: Permanently lubricated, with integral thermal-overload protection.
- H. Electrical: The new equipment shall be powered by the existing electrical infrastructure. New electrical disconnects shall be provided with new equipment. Modifications required to make the existing electrical service compatible with the new equipment is the responsibility of the contractor under this contract. Where new systems are being installed the contractor shall be responsible for all electrical infrastructure upgrades.
- I. The outdoor unit shall be complete factory assembled, piped, and wired.
- J. Ambient Design Conditions:
1. See SOW documentation. Obtain project specific information from PD/COR if not provided.
- K. Equipment Selection Requirements:
1. See SOW documentation. Obtain project specific information from PD/COR if not provided.
- L. Mounting Base: Where a new base is required, the contractor shall be responsible for the work a submit a recommended new base solution to the PD/COR. Base material/size/location is subject to review/approval by the Facility Manager and PD/COR.
- M. Acoustics: Outdoor unit sound level shall not exceed: 45 dBA. Contractor shall confirm compliance with facility requirements and local (in country) ordinances.

2.4 ACCESSORIES

- A. Thermostat: All new systems shall receive new wired thermostats functioning to remotely control compressor and evaporator fan, with the following features:
1. Compressor time delay.
 2. 7 Day Programmable, with 24-hour time control of system stop and start.
 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 4. Fan-speed selection, including auto setting.
 5. Lockable cover
 6. Temperature changes shall be in 1 Deg. F increments with a setting range from 61-88 Deg. F. (16-31 Deg. C).
 7. If new heat pumps are installed with emergency/back-up electric resistance heat, the thermostats shall have adequate capacity to control electric resistance heat and provide an indication on the display that the emergency electric resistance heat is on/in-use.

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- B. Automatic-reset timer to prevent rapid cycling of compressor.
 - C. Heat pumps (if installed) shall have an automatic defrost sequence.
 - D. The systems shall be capable of automatically restarting and operating at the previously selected conditions when the power is restored after power interruption.
 - E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
 - F. New units shall be provided with new canvas flex transition fittings at connections to supply, return, and outdoor air ductwork.
 - G. New plenum rated condensate pumps shall be provided and installed, where condensate drain pans cannot adequately gravity drain. See section 2.2, B in this specification for additional drain requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure. Seismic restraints shall be provided to meet zone 3 classification design to restrict horizontal seismic forces in two direction, transverse and longitudinal directions.
- C. Install ground mounted, compressor-condenser components on equipment bases. Seismic restraints shall be provided to meet zone 3 classification design to restrict horizontal seismic forces in two direction, transverse and longitudinal directions.
- D. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 FIELD QUALITY CONTROL

- A. Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.
- B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Verify that condensate drains freely at design operating conditions.
- F. Verify overflow/leak detection devices shut down systems as required.

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3.3 CLEANING

- A. Clean all dirt, dust, debris from equipment and surrounding area with brooms, vacuum and manufacturer recommended cleaning supplies, to avoid intake into filters, and leave interior and exterior surfaces in new condition.

3.4 STARTUP SERVICE

- A. Verify that units are installed and connected according to the Contract Documents.
- B. Lubricate bearings, adjust belt tension, and change filters.
- C. Perform startup checks according to manufacturer's written instructions and do the following:
 - 1. Fill out manufacturer's checklists.
 - 2. Check for unobstructed airflow over coils.
 - 3. Check operation of condenser capacity-control device.
 - 4. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Government maintenance personnel to adjust, operate, and maintain units.
 - 1. Train the Government's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units.
 - 2. Review data in maintenance manuals. Refer to Division 01 Section "Closeout Procedures."
 - 3. Schedule training with Project Director/COR with at least seven days' advance notice.

END OF SECTION 238126

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SECTION 260505 – COMMON WORK RESULTS FOR ELECTRICAL, COMMUNICATIONS AND ELECTRONIC SAFETY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Supporting devices for electrical components.
 - 2. Electrical identification.
 - 3. Sleeves and sleeve seals
 - 4. Touchup painting.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 SYSTEM CHARACTERISTICS

- A. Facility Voltages: These characteristics apply to work of all Sections for this project.
 - 1. In accordance with Host Country utility voltage. Contractor shall confirm all site conditions.
 - a. 480/230 V, 60 Hz system
 - 2. Control Voltage: In accordance with voltage for associated controlled equipment.

1.4 QUALITY ASSURANCE

- A. Comply with the OBO Electrical Code (NFPA 70 “National Electrical Code” as amended by OBO).

1.5 COORDINATION

- A. Coordinate arrangement, mounting and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations

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3. To allow right of way for piping and conduit installed at required slope
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment
- B. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- C. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.
- G. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to Project Director/COR.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 14-mm-diameter slotted holes at a maximum of 50 mm o.c., in webs.
- D. Slotted-Steel Channel Supports: Comply with Metal Framing Manufacturers Association MFMA-4 and Division 05 Section "Metal Fabrications" for slotted channel framing.
1. Channel Thickness: Selected to suit structural loading.
 2. Fittings and Accessories: Products of the same manufacturer as channel supports.

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- E. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 14-mm- diameter holes at a maximum of 200 mm o.c., in at least one surface.
 - 1. Fittings and Accessories: Products of the same manufacturer as channels and angles.
 - 2. Rated strength: Selected to suit specified load criteria
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- H. Expansion Anchors: Carbon-steel wedge or sleeve type.
- I. Toggle Bolts: All-steel springhead type.

2.2 ELECTRICAL IDENTIFICATION

- A. Refer to Division 26 Section "Identification for Electrical Systems."

2.3 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 1.3- or 3.5-mm (0.05- or 0.14-inch) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable. NBR material shall be used where there could be a presence of oil or petrol residues.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 TOUCH-UP PAINT

- A. Equipment Not Exposed to Harsh Environment: Equipment manufacturer's paint.
- B. Equipment Enclosures Not Exposed to Harsh Environment: Manufacturer's standard finish for indoor installations in non-harsh environments.
- C. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.
- D. Paints for Applications Exposed to Harsh Environments: For all outdoor applications and for indoor applications in harsh environment refer to Division 09 Section "High Performance Coatings." Metallic materials shall be protected against corrosion. Materials shall be approved by the PD/COR.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

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- F. Project Specific Design Requirements (Confirm with PD/COR): Electrical equipment shall be designed and rated to operate in project-specific unusual environmental conditions such as wind-blown sand, salt atmosphere, flooding, ultraviolet rays due to altitude, high winds such as hurricanes and tornadoes, etc. Meet at local jurisdiction design requirements. Where standard ratings are not available to match environmental conditions, equipment shall be derated as required to compensate for factors such as high altitude and ambient temperature. These additional requirements will be listed in the Statement of Work documentation or indicated by the PD/COR if required. Equipment installed in conditioned spaces shall be designed and rated for the conditioned ambient.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 90-kg design load.

3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 6-mm diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 40-mm and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

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- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 600 mm from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Steel: Welded threaded studs or spring-tension clamps on steel.
 - 6. Field Welding: Comply with AWS D1.1.
 - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.5 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:

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1. Supporting devices for electrical components.
2. Touchup painting.
3. Sleeves and Seals

3.6 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 09 painting sections. Obtain paint information and material approval from PD/COR.
1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.7 DEMONSTRATION

- A. Demonstrate, to Project Director/COR and appropriate post electrical staff the proper installation and substantial completion for work to completed under this specification.

END OF SECTION 260505

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 SUBMITTALS

- A. Product Data - General: For each type of product indicated.
- B. Product Data - Products Manufactured to International Standards: Identify variations from U.S. standards.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Comply with the OBO Electrical Code (NFPA 70 "National Electrical Code" as amended by OBO).
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NFPA 70, Article 100 by a testing agency acceptable to Project Director/COR based upon input from designated OBO engineer, and marked for intended use.
- B. Products Manufactured to International Standards: Variations from U.S. standards require evaluation and approval by Project Director/COR with input from designated OBO engineer.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Conductor Material: Copper only complying with NEMA WC 70; solid conductor for 6.0 mm² and smaller, stranded for 10.0 mm² and larger. Copper shall be 98 percent conductivity and hard drawn.
- B. Conductor Insulation Types: Type THHN-THWN, XHHW, SO, or XHHW-2 complying with NEMA WC 70

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1. International Type Conductors and Cables: If requests are approved for international type conductors and cables, conductor and cable ampacities for applications of 600-VAC or less shall not exceed ampacities listed in National Electrical Code Table 310.16.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type XHHW or XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- I. Fire Alarm Circuits: Type THHN-THWN, in raceway.
- J. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- K. Class 2 Control Circuits: Type THHN-THWN, in raceway.
- L. Class 3 Control Circuits: Type THHN-THWN, in raceway.
- M. Control wiring shall be minimum of 2.5 mm² (#14 AWG) stranded copper and shall be rated for 600-volt service.

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- N. Neutral Conductor: Where a secondary distribution system requires a neutral conductor, a full-sized neutral conductor shall be used throughout the system, such that neutral conductor is not shared with any other branch circuit or feeder. If the secondary distribution system supports computers or other equipment that generates harmonics, double size neutrals shall be run from the subpanel boards feeding this equipment back to the MDP or service entrance. Neutral buses shall be sized to accommodate these conductors.
- O. Ground Conductor: Insulated equipment grounding conductors run with branch circuits shall be installed such that that conductor is not shared with any other branch circuit.

3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Common Work Results for Electrical, Communications and Electronic Safety."
- F. Seal around cables penetrating fire-rated elements according to Division 07 Section "Penetration Firestopping."
- G. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- H. Each electronic equipment rack shall be fed by an individual circuit breaker protected branch circuit.

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 300 mm of slack.

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3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

END OF SECTION 260519