



**THE COUNTY COMMISSIONERS
OF
OTTAWA COUNTY**

**RIVERVIEW HEALTHCARE
CAMPUS RENOVATION AND ADDITION**

8180 W. STATE ROUTE 163
OAK HARBOR, OH 43449

COMMISSION NUMBER 1601

ADDENDUM #1

October 13, 2017

This addendum is a modification of the Contract Documents for this project. It is to be considered in the Proposals and covers additions to or changes in the Contract Documents as follows:

This addendum consists of (2) page, plus (15) attachments in 8.5”X11” format

GENERAL

BIDDERS ATTENTION IS CALLED TO PAGE 00 2113-3; ARTICLE 3.05 AND 00 4324-1 FOR SPECIFIC REQUIREMENTS CONCERNING QUESTIONS DURING THE BID PERIOD. ALL INQUIRIES SHALL BE DIRECTED TO THE ARCHITECT AND NOT TO THE OWNER.

ITEM- #1	PRE-BID MEETING MINUTES (10/09/17)	5 pages
	PRE-BID MEETING SIGN IN SHEET (10/9/17)	2 pages
ITEM- #2	BID GUARANTY – PERFORMANCE/PAYMENT BOND	2 pages

SPECIFICATIONS

REVISED SECTIONS

ITEM- #3	00 0110 TABLE OF CONTENTS	5 pages
	Page 00 0110-4 Insert new section in its entirety	
	a. Section 23 6213 Air Cooled Condensing Units – Added	
	b. Section 23 7300 Air Handling Units – Added	
ITEM- #4	00 2113 INSTRUCTIONS TO BIDDERS:	
	Page 00 2113-4, revise paragraph 5.01 B to read:	
	“To demonstrate qualification for performing the work, bidders <u>are required</u> to submit AIA A305”.	

ITEM- #6	22 0513 COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT	3 pages
	a. Insert revised Section in its entirety.	
ITEM- #7	22 1319 SANITARY WASTE PIPING SPECIALTIES	4 pages
	a. Insert revised Section in its entirety.	
ITEM- #8	22 3400 FUEL FIRED DOMESTIC WATER HEATERS	7 pages
	a. Insert revised Section in its entirety.	
ITEM- #9	22 4000 PLUMBING FIXTURES	13 pages
	a. Insert revised Section in its entirety.	
ITEM- #10	23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC	10 pages
	a. Insert revised Section in its entirety.	
ITEM- #11	23 0713 DUCT INSULATION	4 pages
	a. Insert revised Section in its entirety.	
ITEM- #12	23 8126 SPLIT SYSTEM AIR CONDITIONERS/HEAT PUMP	4 pages
	a. Insert revised Section in its entirety.	
ITEM- #13	28 3100 ADDRESSABLE FIRE ALARM SYSTEM	15 pages
	a. Insert revised Section in its entirety.	

NEW SECTIONS

ITEM- #14	23 6213 AIR COOLED CONDENSING UNITS	4 pages
	a. Insert new Section in its entirety	
ITEM- #15	23 7300 AIR HANDLING UNITS	5 pages
	a. Insert new Section in its entirety	

ARCHITECTURAL DRAWINGS

None

END OF ADDENDUM #1



**RIVERVIEW HEALTHCARE CAMPUS RENOVATION
PRE-BID MEETING
OCTOBER 9, 2017**

IN ATTENDANCE:

Kendra German
Will Clymer

Riverview Healthcare Campus, Administrator
Riverview Healthcare Campus, Director Environmental
Services

Commissioner Jim Sass
Mark Messa
Jim Adkins
David Bills
Phyllis Bills
Rod Gillespie

Ottawa County Commissioner
Ottawa County, Director of Regional Planning Commission
Ottawa County, Superintendent of Facilities
Design Group 3, LLC
Design Group 3, LLC
BEC Associates, Civil Engineer

ITEMS TO BE DISCUSSED:

1. This project requires Prevailing Wages to be paid and certified payroll reports shall be submitted directly to Mark Messa, Director of the Regional Planning Commission for his review and approval.
2. Project Description:

The Ottawa County Nursing Home (Riverview Healthcare Campus) is located at 8180 W. State Route 163, Oak Harbor, Ohio. The existing facility is approximately 100,000 square feet in area and is owned by the Ottawa County Commissioners.

The scope of the project includes the renovation of portions of the existing building, and the addition referred to on the drawings as Areas "A", "B", "C", "D", "E", and "F" to improve the internal environment for the residents, families and staff of Riverview.

The existing campus is divided into 6 buildings by existing fire walls. The buildings are numbered 1 through 6.

All areas of the campus are constructed of Type IIB Construction. Footings and foundations are cast-in-place concrete. Portions of the existing building are built over a basement or crawl space. The balance of the building is constructed slab on grade. Exterior walls are either masonry or light gage metal structural load-bearing stud walls with brick and concrete block veneer on the lower levels and EFIS on the upper part of some walls and gables ends on others. Interior load-bearing structures are either light gage metal structural studs, structural steel, or masonry construction. Roof structures are either steel joists or fire-retardant treated wood trusses with fire-retardant treated plywood sheathing. Existing exterior walls are sheathed primarily in brick with limited areas of EIFS.

Intended Use: I-2 Institutional, I-1 Assisted Living, and B Business / Office in limited areas.

3. Phasing - Utilities and Service Interruptions – The Riverview Healthcare Campus (RHC) is an active facility and will remain in operation throughout the construction schedule. All phasing is to be developed and implemented by the successful bidder once reviewed and approved by the RHC prior to construction. Any shutdowns or interruptions need to be coordinated with site personnel a minimum of **48 hours in advance** and approved prior to beginning work.

A phasing plan is included in the drawings and illustrates the steps necessary to complete the project and allow for the complete operation of the Riverview facility. Each phase designates an exterior door to be used by contractors accessing the work areas. Workers shall not enter the work areas through the other areas of the building. The successful bidder is invited to review the proposed phasing plan and offer suggestions for any adjustments to the phasing, which will be reviewed by the Owner. If the contractor chooses to utilize the area designated on the drawings as the construction trailer area then most of the project is directly accessible from there. Areas A and C are not as easy to access and coordination with the Riverview staff for work in those areas will be required.

The Owner is open to the GC's approach to phasing the project. If there is a better way to phasing then the Owner is open to discussing it. The Owner realizes that time is money and the quicker the project can be done the better for everyone involved.

Cleanliness is critical in this working environment. Work areas shall be sealed off from other adjacent areas of the building to control dust and noise. HVAC systems shall be sealed off during construction to prevent the accumulation of dust in the ductwork. A daily walk through of the work area is required with either Will or Jim and a daily log of these activities is required. Riverview is subject to surprise inspections by the State of Ohio and documentation of these activities is critical.

Safety of residents, the general public, and staff is critical. Do not leave tools or materials out where anyone, especially residents, can have access to them and possibly harm themselves or others.

4. Bid Submittal Due Date: Sealed bids shall be received by 11:00 AM, October 26, 2017 and should be sent to: the Office of the Ottawa County Commissioners, 315 Madison St., First Floor Reception, Port Clinton, Ohio 43452. Any bids received after this time will not be opened and shall be returned to the bidder. Two copies of each bid are to be submitted.
5. Additional site visits (if necessary) are acceptable. The building hours are Monday - Friday 8:00 am – 4:00 pm. Call ahead a minimum of 24 hours if you need to have access to the inside the building and notify on-site staff when arriving.
6. Channel of Communications – All communications and questions shall be sent via email to David Bills of DG3 (in writing), with copies to Jim Adkins and Will Clymer. DG3 will respond as quickly as possible to your questions and if deemed appropriate include the question and

response in an addendum for all bidders. The deadline for questions and clarifications is October 18, 2017.

The Owner's Team emphasized the importance of communication during and after the bidding. We would rather over communicate than under communicate!

7. This project will be awarded as a single prime contract.
8. Alternates for specific parts of the project are listed in Section 01 2300 of the specifications. The designation of each alternate is as follows: A (Architecture Drawings) -D (Area D) -1 (First Alternate in the area). Alternates include the following:
 - A. Add Alternate No. A-D-1 Drywall Sprinkler Soffit
 - i. Base Bid: Existing ceiling pad sprinkler soffit to remain in Unit 7.
 - ii. Alternate: Remove existing ceiling pad soffit and replace with drywall sprinkler soffit in Unit 7.
 - B. Add Alternate No. A-E-1 Assisted Living on ALU Doors
 - i. Base Bid: Provide corridor doors and frames without wood trim.
 - ii. Alternate: Provide corridor doors and frames in the Assisted Living Unit with wood trim on the corridor side only.
 - C. Add Alternate No. A-F-1 Assisted Living on ALU Doors
 - i. Base Bid: Provide corridor doors and frames without wood trim.
 - ii. Alternate: Provide corridor doors and frames in the Assisted Living Unit with wood trim on the corridor side only.
 - D. Add Alternate No. EL-B-1: New LED Light Fixtures
 - i. Base Bid: Existing fluorescent lighting fixtures in recessed cove to remain.
 - ii. Alternate: Remove existing fluorescent lighting fixtures in recessed cove and replace with new LED Light Fixtures.
 - E. Add Alternate No. EL-C-1: New LED Light Fixtures
 - i. Base Bid: Existing fluorescent lighting fixtures in recessed cove to remain.
 - ii. Alternate: Remove existing fluorescent lighting fixtures in recessed cove and replace with new LED Light Fixtures.
 - F. Add Alternate No. EL-C-2: New LED Light Fixtures with color changing drivers
 - i. Base Bid: Existing fluorescent lighting in recessed cove to remain.
 - ii. Alternate: Remove existing fluorescent lighting fixtures in recessed cove and replace with new LED Light Fixtures with color changing drivers.

G. Add Alternate No. EL-D-1: New LED Light Fixtures

- i. Base Bid: Existing 2x4 fluorescent lighting fixtures to remain.
- ii. Alternate: Remove existing 2x4 fluorescent lighting fixtures and replace with new 2x4 LED Light Fixtures.

H. Add Alternate No. EL-E-1: New LED Light Fixtures

- i. Base Bid: Existing fluorescent lighting in recessed cove to remain.
- ii. Alternate: Remove existing fluorescent lighting fixtures in recessed cove and replace with new LED Light Fixtures.

9. Basis of Award - The award of this contract is based on the lowest responsive and responsible bidder(s) to the Base Bid pricing request as determined by the architect and Ottawa County. Bidders may submit the pre-qualification information to Dave Bills when it is available.
10. The project is State of Ohio sales tax exempt.
11. Awarding of Project Timeline - Once bids are received the architect must first review the bids and make a determination of the lowest responsible and responsive bid. Their recommendations will be forwarded to the Ottawa County Commissioners for final review and approval. The county is prepared to award the project as soon as the recommendation for award is prepared by DG3.
12. The project schedule is slated to be delivered no later than 660 calendar days from agreed upon start date. The schedule includes periods of inspections by the Ottawa County Health Department, the Ottawa County Building Department, The State of Ohio Fire Marshal, and Life Safety Inspections by the Ohio Department of Health. This project does contain a liquidated damages clause. Notice to Proceed is anticipated during a meeting of the Ottawa County Commissioners' Board Meeting in November.
13. Front-End - Bidders are encouraged to read the "front-end" section of the specifications not only to familiarize themselves with the administrative rules, but if there are any questions or problems during construction, the "front-end" is what will govern.
14. Bid Guaranty: Pursuant to Section 153.54 of the Ohio Revised Code, the bidder shall submit a Bid Guaranty as noted in the Invitation to Bidders.
15. Application and Certificate for Payment – A pencil copy of the Application and Certificate for Payment shall be submitted to DG3, LLC on the 25th of each month and projected to the end of the month. A notarized and signed copy of the Application and Certificate for Payment shall be submitted by the first of the month to DG3, LLC for submission to the County. Assuming that all of the paperwork is submitted correctly and in a timely manner, payment should come within 30 days.

16. Submittals – The requirements for Submittals is noted in 3.06, 3.07, 3.08, 3-09, and 3-10 in Section 01 3000 Administrative Requirements in the specifications.
17. The General Building Permit for this project has been attained and paid for by the Owner. The permit drawings for the two kitchens will be submitted to the Ottawa County Health Department by the Owner. All applicable trades' permit applications shall be the responsibility of the General Contractor or subcontractors. Separate permit applications are required for sprinklers, truss drawings, and electric locking systems. Jim Adkins is working on a permit with the EPA.
18. The project will start with a job meeting every two weeks. Weekly meetings may be required, depending on where the project is in the process.
19. The existing facility has been built in phases. Portions are over a basement, crawl space, or slab on grade depending on where you are in the building. Crawl spaces have access doors.
20. Riverview will take care of moving furniture and equipment, except for the high density file system in employee records. Riverview will move the actual files and the GC will relocate the filing system equipment.
21. All contractors' employees are required to wear an identification badge at all times while on site. Id's should show the name of the individual, the company he/she represents. And include a photograph.
22. The minutes to this meeting will be issued in Addendum No. 1.
23. A tour of the facility was made after the meeting

These minutes reflect the understanding of the conversation by David Bills. Any comments, corrections, and additions are welcomed and should be directed to the author as soon as possible.

10-9-2017 RVNCC PRE-BID MEETING 1:00

NAME	Bus. NAME	EMAIL	PHONE #
TIM ADKINS	COMMISSIONERS	JADKINS@CO.OTTAW.ON.US	419-262-2866
WILL CLYMER	Dir. of Env. & Natural Serv.	Wclymer@Co.ottawa.on.us	567-262-3685
JIM SASS	COMMISSIONER		
KENDRA GERMAN	ADMINISTRATOR		
DAVE BELLS	DB3	davebells@edgelle.com	937-371-8836
GARY F. HAAS	INFINITY CONSTRUCTION	GHAAS@INFINITYCONSTRUCTION.COM	419-262-0320
Ashley Stenger	RL	ashley.stenger@rlgbuilds.com	507-494-3593
James Gregg	Buyers Inc	Jgregg@buyersinc.com	419-661-3933
MIKE TORRES	MOSSER CONST.	mtorres@mossers.com	419-334-3801
Mike Pafferty	Superior Insul	mpafferty@superior-insulation.com	
GARY GAST	ADENA CORP	GGAST@ADENACORPORATION.COM	419-529-4456
Ben Dotson	The Dotson Co.	ben@dotsoncompany.com	419-877-5176
Mark Dotson	The Dotson Co.	mark@dotsoncompany.com	419-877-5176
MIKE DEATON	LAIBE ELECTRIC	MIKED@LAIIBE.COM	419-724-8200
MARY GEZEE	TRANSTAR ELECTRIC	maryg@TRANSTARCORP.COM	419-704-0637
Arcie Wheeler	Wheeler Sheet Metal	whelearsme@gmail.com	419-668-0481
Bill Tiplady	Positive Trades Group	bill.tiplady@positivetradesgroup.com	419-392-3206
Nick Laub	Spearing Heating	nick.laub@thespearingcompany.com	419-261-1152
Matt Leonard	ACT Const. Co. Inc	M.Leonard@dmdconstruction.com	419-595-4224
Lynn Niederkahr	Vaughn Industries	lniederkahr@vaughnindustries.com	419-396-3900 Ext. 208
Tim Krack	Warner Mech Corp	TKrack@Warnermech.com	(419) 332-7116
Rob Craig	Simple Plumb Inc	RCRAIG@Simpleplumb.com	419-380-2678
MIKE FURNAS	ROT CONCEPTS	MFURNAS@ROTCONCEPTS.COM	419-308-0075
MARIZ HALL	GEO GRADEL Co.	Estimating@geogradelco.com	419-691-7123
Rob Glespe	BEL Assoc.	rglespe@belsocenters.net	419-288-9200
Craig White	VM Systems	Craig.W@VMsystemsinc.com	419-535-1044
Kevin Lewis	OHIO LECET	Lewisbasketball@comroadrunner.com	684 315 1589

Ron Sheehan DIMECH rjsheehan@dimech.com 4197270111
MIKE DAUMHAER Comm Insur. miked@rogersbcglobe.com 419-269-5242
Matthew Denis Shook mdanis@shookconstruction.com 937-276-6666
Mark Younker Westfield myounker@westfieldgroups.com 419-862-0078
Andrew Nytray Westfield anytray@westfieldgroups.com 419-862-0078
Mark Messa Ottawa Regional Planning mmessa@co.ottawa.on.ca 419-734-6770
Jim Sasse Ottawa Co Commis j.sasse@co.ottawa.on.ca 419 734 6705
Kendra German RVHC Administrator kgerman@co.ottawa.on.ca
EIBNER EIBNERBLATT 419 541 0814

BID GUARANTY - PERFORMANCE/PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned

(Full name or legal title of Contractor and address) as Principal and

(Full name or legal title of Surety)

are hereby held and firmly bound unto _____
(Full name or legal title of Owner)

Hereinafter called the Obligee, in the penal sum of the dollar amount of the bid submitted by the Principal to the Obligee on _____ to undertake the project known as

The penal sum referred to herein shall be the dollar amount of the Principal's bid to the Obligee, incorporating any additive or deductive alternate proposals made by the Principal on the date referred to above to the Obligee, which are accepted by the Obligee. In no case shall the penal sum exceed the amount of _____ Dollars (\$_____). If this item is left blank, the penal sum will be the full amount of the Principal's bid, including alternates. Alternatively, if completed, the amount stated must not be less than the full amount of the bid, including the alternatives in dollars and cents. A percentage is not acceptable.

For the payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

The condition of the above obligation is such that whereas the above named Principal has submitted a bid on the above referred to project;

Now, therefore, if the Obligee accepts the bid of the Principal and the Principal fails to enter into a proper contract in accordance with the bid, plans, details, specifications and bills of material; and in the event the Principal pays to the Obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified in the bid and such larger amount for which the Obligee may in good faith contract with the next lowest bidder to perform the work covered by the bid; or in the event the Obligee does not award the contract to the next lowest bidder and resubmits the project for bidding, the Principal pays to the Obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified in the bid, or the costs, in connection with the re-submission, of printing new contract documents, required advertising, and printing and mailing notices to prospective bidders, whichever is less, then this obligation shall be null and void, otherwise to remain in full force and effect. If the Obligee accepts the bid of the Principal and the Principal within ten (10) days after the awarding of the contract enters into a proper contract in accordance with the bid, plans, details, specifications and bills of material, which said contract is made a part of this bond the same as though set forth herein;

If the said Principal shall well and faithfully perform each and very condition of such contract; and indemnify the Obligee against all damage suffered by failure to perform such contract according to the provisions thereof and in accordance with the plans, details, specifications, and bills of material therefore; and shall pay all lawful claims of subcontractors, material-men, and laborers, for labor

performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any material-man or laborer having a just claim, as well as for the Obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions, in or to the terms of the said contract or in or to the plans and specifications therefore shall in any way affect the obligations of said surety on this bond, and it does hereby waive notice of any such modifications, omissions or additions to the term of the contract or to the work or to the specifications.

Signed and Sealed this _____ day of _____, 20_____.

Principal

By: _____

Title: _____

Surety

By: _____
Attorney-In-Fact

Surety Company Address:

Surety Agent's Name and Address:

SECTION 00 0110
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PROCUREMENT AND CONTRACTING REQUIREMENTS

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- C. 00 1113 – Invitation to Bidders
- D. 00 2113 – Instructions to Bidders
- E. 00 3100 – Available Project Information
- F. 00 4100 – Bid Form
- G. 00 4323 – Alternates Form
- H. 00 4324 – Request for Information and Clarification
- I. 00 4336 – Proposed Contractors Form
- J. 00 4373 – Proposed Schedule of Values Form
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- A. 01 1000 – Summary
- B. 01 2100 – Allowances
- C. 01 2300 – Alternates
- D. 01 3000 – Administrative Requirements
- E. 01 4000 – Quality Requirements
- F. 01 5000 – Temporary Facilities and Controls
- G. 01 6000 – Product Requirements
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2.02 DIVISION 02 – EXISTING CONDITIONS

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- B. For Pavements and Site Improvements, see Division 32
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- B. 10 2601 – Wall and Corner Guards
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2.11 DIVISION 11 – EQUIPMENT

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- B. 21 0400 – Through-Penetration Fire Stopping for Fire Protection Systems
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- D. 22 0516 – Expansion Fittings and Loops for Plumbing Piping
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- C. 23 0513 – Common Motor/Electrical Requirements for HVAC Equipment
- D. 23 0516 – Expansion Fittings and Loops for HVAC Piping
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2.20 DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

- A. 28 1600 – Access Control System
- B. 28 3100 – Addressable Fire Alarm System

2.21 DIVISION 31 – EARTHWORK

- A. See specifications on drawings

2.22 DIVISION 32 – EXTERIOR IMPROVEMENTS

- A. See specifications on drawings

2.23 DIVISION 33 – UTILITIES

- A. See specifications on drawings

**SECTION 22 0513
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Single Phase Electric Motors
- B. Three Phase Electric Motors

1.02 RELATED SECTIONS

- A. Section 26 0533 – Raceways
- B. Section 26 2913 – Electrical Control Panels

1.03 REFERENCES

- A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirement for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

- A. Conform to NFPA 70.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

- A. See General Requirements for additional warranty requirements.
- B. Provide one (1) year manufacturer warranty for motors.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Baldor Electric
- B. Louis Allis
- C. Westinghouse
- D. General Electric
- E. Emerson Electric
- F. Substitutions: See General Requirements

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. The Plumbing Contractor shall furnish all special control items and motors required for the operation of all equipment provided under their sections of the work.
- B. The Electrical Contractor shall furnish all necessary starters and disconnect switches, except on equipment, which is to be provided with starters or disconnect switches as part of the assembly. The Electrical Contractor will furnish all power wiring through starters and disconnect switches to motors.
- C. **Equipment provided with starters shall include phase loss protection as part of the starter package.**
- D. Plumbing Contractor shall provide all power wiring for controls, control and/or interlock wiring required for his particular work. Plumbing Contractor shall also include any wiring required as noted in the individual sections of the Specifications. All wiring required by this Contractor shall be in accordance with provisions as set forth under the National Electric Code and Division-26 Electrical Work of these Specifications.
- E. Where electrical requirements and/or motor horsepower for the equipment supplied varies from that shown on the Plumbing Drawings or as specifically called out in the Plumbing Specifications, the Electrical Drawings and Specifications shall govern and be adhered to as to electrical power characteristics for the supplied equipment.
- F. Electrical Service:
 - 1. Refer to Section 26 0533 for required electrical characteristics.
 - 2. Motors Under 1/2 HP: 115 Volts, Single Phase, 60 Hz
 - 3. Motors 1/2 HP and Larger: Three Phase, 60 Hz (See drawings for electrical power characteristics)

G. Construction:

1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 40 degrees C environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

H. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

I. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

J. AIC (AMP-INTERRUPTING CAPACITY) RATING

1. All equipment operating at 120/1/60 shall have components with a minimum AIC Rating of 10K.
2. All equipment operating at 277/1/60 shall have components with a minimum AIC Rating of 14K.
3. All equipment operating at 208/1/60 or 208/3/60 shall have components with a minimum AIC Rating of 65K.
4. All equipment operating at 460/1/60 or 460/3/60 shall have components with a minimum AIC Rating of 42K.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 22 0513

SECTION 22 1319
SANITARY WASTE PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Floor Drains
- B. Cleanouts

1.02 RELATED SECTIONS

- A. Section 22 1313 – Facility Sanitary Piping
- B. Section 22 3000 – Plumbing Equipment
- C. Section 22 4000 – Plumbing Fixtures
- D. Section 26 0533 – Raceways

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirement for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Certificates: Certify that grease or oil interceptors meet or exceed specified requirements.
- E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- F. Project Record Documents: Record actual locations of equipment, cleanouts.
- G. Operation Data: Indicate frequency of treatment required for interceptors.
- H. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Accept specialties on site in original factory packaging. Inspect for damage.

1.06 EXTRA MATERIALS

- A. See General Requirements for additional provisions.

PART 2 – PRODUCTS

2.01 DRAINS

A. Manufacturers

1. Josam Company
2. Jay R. Smith Manufacturing Company
3. Zurn Industries, Inc.
4. Mifab
5. Substitutions: See General Requirements

B. Floor Drain (FD-1)

1. Dura-coated cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer. Equal to Zurn ZN-415-6B. Provide Z1072-ZShield barrier trap seal device (ASSE 1072).

C. Floor Drain (FD-2)

1. Dura-coated cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with polished bronze funnel or anti-splash rim. Equal to Zurn ZN-415-P-6B with Zurn ZN-328 Funnel. Provide Z1072-ZShield barrier trap seal device (ASSE 1072).

D. Floor Drain (FD-3)

1. Dura-coated cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and square, adjustable nickel-bronze strainer. Equal to Zurn ZN-415S (6" x 6" strainer). Provide Z1072-ZShield barrier trap seal device (ASSE 1072).

E. Floor Drain (FD-4)

1. 8 inch x 8 inch x 6 inch deep cast iron body, 1/2 square slotted medium duty grate, white acid resisting porcelain enamel interior and top and aluminum anti-splash interior bottom dome strainer. Equal to Zurn Z-1910-2 Sani-Flor receptor. Provide Z1072-ZShield barrier trap seal

device (ASSE 1072).

F. Floor Drain (FD-5)

1. 12 inch x 12 inch x 8 inch deep cast iron body, 1/2 square slotted medium duty grate, white acid resisting porcelain enamel interior and top and aluminum anti-splash interior bottom dome strainer. Equal to Zurn Z-1901-2 Sani-Flor receptor. Provide Z1072-ZShield barrier trap seal device (ASSE 1072).

2.02 CLEANOUTS

A. Manufacturers

1. Jay R. Smith Manufacturing Company
2. Josam Company
3. Zurn Industries, Inc.
4. Mifab
5. Substitutions: See General Requirements

B. CO

1. Cleanout plug for cast iron hub & spigot shall be screwed brass.
2. Cleanout plug for cast iron no hub shall be a blind plug.
3. Cleanout plug for PVC shall be a cleanout adapter with cleanout plug.

C. FCO

1. Finished floor cleanout, Zurn ZN-1400-T, with cast iron body and adjustable nickel bronze top.
2. Floor cleanout for carpeted area, Zurn ZN-1400-T-CM, with cast iron body, adjustable nickel bronze top and carpet marker.
3. Floor cleanout for PVC or glass piping; Zurn ZP-1404 with ABS body and nickel bronze top.

D. WCO

1. Wall cleanout, Zurn Z-1469. Smooth stainless steel wall access cover with securing screw. Cleanout tee by Contractor.

E. COTG

1. Exterior cleanout, Zurn Z-1406-HD-VP, heavy duty with vandalproof screwed top.

2.04 KITCHEN GREASE INTERCEPTOR

A. Manufacturers

1. Jay R. Smith Company
2. Josam Company
3. Mifab
4. Rockford Separators
5. Zurn Industries Inc.

B. Interior Interceptor

1. Acid resisting epoxy coated interior and exterior grease trap with integral extended height for recessed installation, P.D.I., (Plumbing Drainage Institute) rated at 15 GPM and 30 pounds grease capacity with 3 inches threaded low inlet and 3 inches high outlet, internal air relief by-pass, bronze cleanout plug and visible double wall trap seal with removable pressure equalizing/flow diffusing baffle and sediment container. Gas and watertight gasketed non-skid cover secured with recessed and covered center securing handle, enzyme port opening having bronze plug, complete with flow control fitting; Zurn Z-1170E.

C. Solids Interceptor

1. Acid resistant composite interceptor, in lieu of fixture 'P' trap, for on-floor installation with removable PVC sediment bucket. 2 inch threaded low inlet and 2 inch high outlet. Zurn Z1180.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Install floor cleanouts at elevation to accommodate finished floor.

END OF SECTION 22 1319

SECTION 22 3400
FUEL FIRED DOMESTIC WATER HEATERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Commercial Domestic Fuel Fired Water Heaters
- B. Water Storage Tanks
- C. Diaphragm Type Compression Tanks
- D. Circulating Pump
- E. Circulating Pump Control
- F. Thermostatic Mixing Valve

1.02 RELATED SECTIONS

- A. Section 22 0547 – Seismic Controls for Plumbing Piping and Equipment
- B. Section 22 0548 – Vibration Controls for Plumbing Piping and Equipment
- C. Section 26 0533 – Raceways

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirement for submittal procedures.
- B. Product Data
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Provide electrical characteristics and connection requirements.
- C. Shop Drawings
 - 1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.
- D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 CERTIFICATIONS

- A. Water Heaters: NSF approved.
- B. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1 or ANSI Z21.10.3, as applicable, in addition to requirements specified elsewhere.
- C. Water Tanks: ASME labeled, to ASME (BPV VIII, 1).
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

- A. See General Requirements for additional warranty requirements.
- B. Provide three (3) year manufacturer warranty for domestic water heaters.

PART 2 – PRODUCTS

2.01 WATER HEATER MANUFACTURERS

- A. A.O. Smith Water Products Co.
- B. Lochinvar Corporation
- C. State Industries
- D. Bradford White Corporation
- E. PVI Industries, Inc.
- F. Patterson-Kelly
- G. Substitutions: See General Requirements

2.02 GAS-FIRED WATER HEATER

A. Boiler

The WATER HEATER shall be a LOCHINVAR ARMOR X2 Model AWN1000PM having a modulating input rating of 999,999 Btu/Hr, a recovery capacity of 1,164 gallons per hour at a 100°F rise and shall be operated on Natural Gas. The WATER HEATER shall be capable of full modulation firing down to 10% of rated input with a turn down ratio of 10:1.

The WATER HEATER shall bear the ASME "HLW" stamp and shall be National Board listed. There shall be no banding material, bolts, gaskets or "O" rings in the header configuration. The stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The complete heat exchanger assembly shall carry a five (5) year limited warranty.

The WATER HEATER shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.10.3 test standard for the US and Canada. The WATER HEATER shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The WATER HEATER shall operate at a minimum of 96% thermal efficiency. The WATER HEATER shall be certified for indoor installation.

The WATER HEATER shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The WATER HEATER shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating WATER HEATER firing rates for maximum efficiency. The WATER HEATER shall operate in a safe condition with gas supply pressures as low as 4 inches of water column.

The WATER HEATER shall utilize a 24 VAC control circuit and components. The control system shall have a Liquid Crystal touch screen display for water heater set-up, water heater status, and water heater diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The WATER HEATER shall be equipped with; a high limit temperature control certified to UL353, ASME certified pressure relief valve, outlet water temperature sensor, inlet water temperature sensor, a flue temperature sensor, low water flow protection, built-in freeze protection and a condensate trap for the heat exchanger condensate drain. The manufacturer shall verify proper operation of

the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

The WATER HEATER shall feature the "Smart System" control with a Liquid Crystal touch screen display with password security, pump delay with freeze protection, pump exercise, and a PC port connection. The WATER HEATER shall feature night setback for the domestic hot water tank. The WATER HEATER shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or setpoint and enable/disable of the water heater. The WATER HEATER shall have a built-in cascading sequencer. The cascading sequencer shall be capable of rotation while maintaining modulation of up to eight water heaters without utilization of an external controller. The control shall be compatible with optional Modbus communication. Supply voltage shall be 120 volt / 60 hertz / single phase.

The WATER HEATER shall be equipped with two terminal strips for electrical connection. A low voltage connection board with data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Alarm Contacts, Runtime Contacts, Flow Switches, Tank Thermostat, Tank Sensor, Building Management System Signal, Modbus Control Contacts and Cascade Control Circuit. A high voltage terminal strip shall be provided for supply voltage. The high voltage terminal strip plus integral relays are provided for independent control of the Domestic Hot Water Pumps.

B. Vertical Storage Tanks

The STORAGE TANK shall be a Lochinvar Lock-Temp "Energy Saver" tank, Model RGA0257 with vertical construction having a storage capacity of 257 gallons. The tank shall be constructed with an inner chamber baffle designed to receive all circulation to and from the water heater to eliminate turbulence in the tank. The baffled tank shall supply 80% of tank capacity without a drop in outlet temperature, regardless of rate of draw.

The STORAGE TANK shall be constructed in accordance with ASME Boiler and Pressure Vessel Code requirements, "HLW" stamped and registered with the National Board of Boiler and Pressure Vessel Inspectors. The tank shall be furnished with the following connections: two 3" NPT dielectric circulating connections, one 2" NPT dielectric hot water outlet, one 1-1/4" NPT relief valve connection, one 3/4" NPT aquastat opening and one 1" NPT drain connection.

The STORAGE TANK shall have a working pressure of 125 PSI. The interior of the STORAGE TANK shall be glass lined and fired to 1600° F to ensure a molecular fusing of glass and steel, furnished with magnesium anodes and carry a five (5) year limited warranty.

The STORAGE TANK shall be constructed with a heavy gauge galvanized steel jacket assembly, primed and pre-painted on both sides with a minimum dry film thickness of 0.70 mills. The STORAGE TANK shall be completely encased in a

minimum of 2" thick, high density polyurethane foam insulation to meet the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard.

C. Pumps

1. Type: All bronze, in-line circulation pump mounted on boiler, controlled by tank mounted immersion thermostat.
2. Electrical Characteristics:
 - a. 3/4 hp
 - b. 120 volts, single phase, 60 Hz

2.03 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers

1. Amtrol Inc.
2. ITT Bell & Gossett
3. Taco, Inc.
4. Substitutions: See General Requirements

B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.

2.04 CIRCULATING PUMP

A. Manufacturers

1. ITT Bell & Gossett
2. Gould
3. Taco, Inc.
4. Thrush
5. Aurora
6. Armstrong
7. Peerless
8. Grundfos

B. Pump shall be with capacity and electrical characteristics as indicated on the Drawings.

- C. The pump shall be in-line type, close coupled, single stage, bronze fitted construction, mechanical seal, stainless steel shaft, bronze bearings, motor and flexible motor couplings.
- D. A replaceable shaft sleeve shall be employed to completely cover the wetted area under the seal or packing.
- E. The impeller shall be of the enclosed type, hydraulically and dynamically balanced, and keyed to the shaft and secured by a suitable locking cap screw.
- F. Motors through 2 HP shall be resilient mounted, equipped with oil lubricated journal bearings.
- G. The pump shall be factory tested, thoroughly cleaned and painted with at least one coat of high grade machinery enamel.

2.05 CIRCULATING PUMP CONTROL

- A. Manufacturers
 - 1. Johnson Controls
 - 2. Honeywell
 - 3. White Rogers
 - 4. Culley
 - 5. Schlee
 - 6. Penn
- B. Provide a 2-wire, single-pole, single throw control to automatically open the circuit on temperature rise and close the circuit on temperature drop. Control to be surface mounted type for direct mounting. Operating range as indicated on the Drawings. Penn A19DAC

2.06 THERMOSTATIC MIXING VALVE

- A. Re-Circulating Valve shall be digital of lead free stainless steel/polymer construction.
- B. DRV shall have 2" inlet/outlet connections, deliver a mixed water flow of 73GPM @ 7.5ft/sec and shall have no minimum system draw off requirement.
- C. DRV shall be supplied pre-piped and pressure tested with a lead free re-circulation return manifold with check valves.
- D. DRV shall have all of the following operational capabilities:
 - 1. +/- 2F water temperature control
 - 2. 2F minimum inlet to outlet water temperature differential
 - 3. Automatic shutoff of hot water flow upon cold water inlet supply failure.
 - 4. Automatic shutoff of hot water flow in the event of a power failure

5. Programmable set point range of 81-158°F (27-70°C)
 6. Programmable thermal disinfection mode
 7. Programmable 1st level hi/lo temp alarm display
 8. Programmable temperature error level for safety shutdown
- E. DRV shall have all of the following connectivity capabilities:
1. SPCO relay outputs which are energized during operation.
 2. LCD display which indicates: set point, delivered temperature, error codes and alarm conditions.
 3. MODBUS 485 port for remote set point adjustment and remote operating temperature visibility.
 4. RS485 Serial Port for connection to a performance matched hot water monitoring system.
- F. DRV shall be compliant with ASSE Standard 1017 and CSA B125 and so certified and identified.
- G. DRV shall be UL listed and identified.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related electrical work to achieve operating system.
- C. Domestic Water Storage Tanks
1. Provide steel pipe support, independent of building structural framing members.
 2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

END OF SECTION 22 3400

**SECTION 22 4000
PLUMBING FIXTURES**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Water Closets
- B. Lavatories
- C. Sinks
- D. Electric Water Coolers
- E. Bathtubs
- F. Showers
- G. Clinical Sinks

1.02 RELATED SECTIONS

- A. Section 22 0716 – Plumbing Equipment Insulation
- B. Section 22 1119 – Domestic Water Piping Specialties
- C. Section 26 0533 – Raceways

1.03 REFERENCES

- A. ANSI Z124.1 – American National Standard for Plastic Bathtub Units; 1995.
- B. ANSI Z124.2 – American National Standard for Plastic Shower Units; 1995.
- C. ANSI Z124.1.2. – American National Standard for Plastic Bathtub and Shower Units; 2005.
- D. ANSI Z358.1 – American National Standard for Emergency Eyewash and Shower Equipment; 2004.
- E. ARI 1010 – Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 2002.
- F. ASME A112.6.1M – Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).
- G. ASME A112.18.1 – Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.

- H. ASME A112.19.1M – Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R2004).
- I. ASME A112.19.2 – Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2003.
- J. ASME A112.19.3 – Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers; 2000 (R2004).
- K. ASME A112.19.4M – Porcelain Enameled Formed Steel Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R2004).
- L. ASME A112.19.5 – Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirement for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory

packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

- A. See General Requirements for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

1.09 EXTRA MATERIALS

- A. See General Requirements for additional provisions.
- B. Supply two sets of faucet washers.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers listed may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance. Burden of proof for equality of plumbing fixtures is on the proposer.
- B. Manufacturers: Subject to compliance with requirements, provide products in each category, by one of the following listed for that category:
 - 1. Water Closets:
 - a. Kohler
 - b. American Standard
 - c. Crane
 - d. Eljer
 - e. Zurn
 - 2. Lavatories:
 - a. Kohler
 - b. American Standard
 - c. Crane
 - d. Eljer
 - e. Zurn
 - 3. Electric Water Coolers:
 - a. Oasis
 - b. Elkay
 - c. Halsey Taylor

- d. Haws
- 4. Sinks:
 - a. Elkay
 - b. Just
 - c. Belvedere
- 5. Shower Mixing Valves (Thermostatic):
 - a. Powers
 - b. Kohler
- 6. Shower Stalls:
 - a. Clarion
 - b. Aquarius
 - b. Fiat Products
 - c. Lasco
 - d. AquaGlass
- 7. Bathtubs:
 - a. Kohler
 - b. American Standard
 - c. Arjo
 - d. Eljer
 - e. AquaGlass
- 8. Clinical Sinks:
 - a. Kohler
 - b. American Standard
 - c. Crane
 - d. Eljer
- 9. Toilet Seats:
 - a. Olsonite
 - b. Church
 - c. Beneke
 - d. Sperzel
- 10. Carriers or Supports:
 - a. Zurn
 - b. Josam
 - c. Smith

- d. Mifab
11. Faucets:
- a. Chicago
 - b. Kohler
 - c. American Standard
 - d. Speakman
 - e. Delta
 - f. Moen
 - g. Elkay
 - h. Zurn
 - i. T&S Brass
 - j. Encore Plumbing by Component Hardware Group
12. Miscellaneous Trim (Traps, Supplies, Strainers):
- a. Dearborn Brass
 - b. Brass Craft
 - c. Chicago
 - d. Kohler
 - e. American Standard
 - f. McGuire
 - g. Royal Brass
 - h. T & S Brass
 - i. Zurn
 - j. Component Hardware Group
13. Drain and Supplies Insulation Kits:
- a. True-Bro
 - b. Skal-Gard
 - c. PlumberEX
 - d. ProFlo
 - e. Dearborn Safety Series

2.02 FIXTURE DESIGNATIONS

A. Water Closet, WC-1: Kohler K-3979 (ADA, Floor Set, Tank Type)

- 1. Material: Vitreous China
- 2. Color: White
- 3. Bowl Type and Operation: Elongated, Siphon Jet with trip lever on the left side of the tank.
- 4. Mounting and Outlet: Floor Mounted, Floor Outlet
- 5. Fixture Bolt Caps: White, Plastic
- 6. Rim Height: 16-1/2 inches for ADA
- 7. Design Water Consumption: 1.6 Gallons per flush

8. Trap Passageway: 2" minimum
9. Fittings and Accessories: Provide the following compatible components:
 - a. Supply: Brass Craft SCR-1912-DL-C, 1/2" x 3/8" supply stop and riser
 - b. Toilet Seat: Olsonite 95-SSC, commercial, heavy duty solid plastic, elongated, open front without cover, self-sustaining check hinges

B. Water Closet, WC-2: Kohler K-3979-RA (ADA, Floor Set, Tank Type)

1. Material: Vitreous China
2. Color: White
3. Bowl Type and Operation: Elongated Siphon Jet with trip lever on the right side of the tank.
4. Mounting and Outlet: Floor Mounted, Floor Outlet
5. Rim Height: 16-1/2 inches
6. Design Water Consumption: 1.6 Gallons per flush
7. Trap Passageway: 2" minimum
8. Fittings and Accessories: Provide the following compatible components:
 - a. Supply: Brass Craft SCR-1912-DL-C, 1/2" x 3/8" supply stop and riser
 - b. Toilet Seat: Olsonite 95-SSC, commercial, heavy duty solid plastic, elongated, open front without cover, self-sustaining check hinges

C. Lavatory, LV-1: Kohler K-2030

1. Material: Vitreous China
2. Lavatory Type: Wall Hung, 8" Faucet Centers
3. Dimensions: 20" x 18"
4. Color: White
5. Fittings and Accessories: Provide the following compatible components:
 - a. Faucet: Chicago 786-GN2FC (rigid gooseneck with wrist blades)
 - b. Supplies: Brass Craft SCR-1912-AC (1/2" x 3/8" angle stop, compression type, loose-key)
 - c. Drain: Kohler K-7129-A (perforated grid strainer and tailpiece)
 - d. Trap: Dearborn Brass 707-1, 1-1/4" with cleanout, 17 gauge
 - e. Carrier: Zurn Z-1231
 - f. Drain and Supplies Insulation Kit: True Bro Model #102W (when exposed)
 - g. Temperature Control Valve (ASSE 1070): Powers Hydroguard E480

D. Lavatory, LV-2: Solid surface countertop with integral bowl (provided by others)

1. Fittings and Accessories: Provide the following compatible components:
 - a. Faucet: Chicago 786-GN2FC (rigid)

- b. Supplies: Brass Craft SCR-1912-AC (1/2" x 3/8" angle stop, compression type, loose-key)
- c. Drain: Kohler K-7129-A (perforated grid strainer and tailpiece)
- d. Trap: Dearborn Brass 707-1, 1-1/4" with cleanout, 17 gauge
- e. Drain and Supplies Insulation Kit: True Bro Model #102W (when exposed)
- f. Temperature Control Valve (ASSE 1070): Powers Hydroguard E480

E. Water Cooler, EWC-1: Oasis PG8EBFSL (Split-Level, Bottle Filler)

- 1. Water Cooler Types: Wall Hung, Two Front Touch Pads
- 2. Capacity: 8.0 GPH cooled to 50° with air ambient temperature of 90°F.
- 3. Cabinet Material: Vinyl Covered Heavy-Gauge Steel
- 4. Color or Finish: Sandstone, Vinyl
- 5. Mounting: Wall Hanging
- 6. Fittings and Accessories: Provide the following compatible components:
 - a. Supply: Brass Craft SCR-1912-AC
 - b. Trap: Dearborn Brass 707-1, 1-1/4" with cleanout, 17 gauge
 - c. Carrier: Zurn Z-1225-BL

F. Water Cooler, EWC-2: Oasis PG8EBF (Bottle Filler)

- 1. Water Cooler Type: Wall Hung, Two Front Touch Pads
- 2. Capacity: 7.8 GPH cooled to 50° with air ambient temperature of 90°F.
- 3. Cabinet Material: Vinyl Covered Heavy-Gauge Steel
- 4. Color or Finish: Sandstone, Vinyl
- 5. Mounting: Wall Hanging
- 6. Fittings and Accessories: Provide the following compatible components:
 - a. Supply: Brass Craft SCR-1912-AC
 - b. Trap: Dearborn Brass 707-1, 1-1/4" with cleanout, 17 gauge
 - c. Carrier: Zurn Z-1225

G. Sink, SK-1: Elkay LRAD-252165-3 (ADA)

- 1. Material: 304 Stainless Steel
- 2. Gage: 18
- 3. Sink Type: Single Bowl with 3 Faucet Holes
- 4. Dimensions: 25" x 21-1/4" x 6-1/2"
- 5. Mounting: Counter Mounting, Self-Rimming
- 6. Color or Finish: Stainless Steel with Satin Finish
- 7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Elkay LKD-2442C (kitchen style)
 - c. Strainer: Elkay LK-35
 - d. Trap: Dearborn Brass 704A-1, 1-1/2", 17 gauge
 - e. Protective Enclosure: Truebro Basin Guard

H. Sink, SK-2: Elkay LRAD-291865-3 (ADA)

1. Material: 304 Stainless Steel
2. Gage: 18
3. Sink Type: Double Bowl with 3 Faucet Holes
4. Dimensions: 29" x 18-1/2" x 6-1/2"
5. Mounting: Counter Mounting, Self-Rimming
6. Color or Finish: Stainless Steel with Satin Finish
7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Speakman SEF-1800-CA-8-LF-TW (8" gooseneck faucet with integrated eyewash, laminar flow outlet and mixing valve for eyewash)
 - c. Strainer: Elkay LK-18B
 - d. Trap: Dearborn Brass 704A-1, 1-1/2", 17 gauge
 - e. Protective Enclosure: Truebro Basin Guard

I. Sink, SK-3: Elkay LRAD-252165-3 (ADA)

1. Material: 304 Stainless Steel
2. Gage: 18
3. Sink Type: Single Bowl with 3 Faucet Holes
4. Dimensions: 25" x 21-1/4" x 6-1/2"
5. Mounting: Counter Mounting, Self-Rimming
6. Color or Finish: Stainless Steel with Satin Finish
7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Speakman SEF-1800-CA-8-LF-TW (8" gooseneck faucet with integrated eyewash, laminar flow outlet and mixing valve for eyewash)
 - c. Strainer: Elkay LK-18B
 - d. Trap: Dearborn Brass 704A-1, 1-1/2", 17 gauge
 - e. Protective Enclosure: Truebro Basin Guard

J. Sink, SK-4: Beveledere 3800 (Shampoo Sink)

1. Material: Enameled Cast Iron
2. Color: Selection by Architect
3. Sink Type: Single Bowl with Faucet Holes
4. Dimensions: 18-3/4" x 19-1/2" x 8-3/4"
5. Mounting: Wall Bracket #9070296
6. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft SCR-1912-AC
 - b. Hair Trap: Zurn Z-1176
 - c. Faucet, Strainer, Whiz Spray and Vacuum Breaker:

- 1) Faucet: 622T-228C
- 2) Vacuum Breaker: 403
- 3) Strainer: 5001394
- 4) Whiz Spray: 50900288

K. Sink, SK-5: Elkay LR-1716-3

1. Material: 304 Stainless Steel
2. Gage: 18
3. Sink Type: Single Bowl with 3 Faucet Holes
4. Dimensions: 22" x 19-1/2" x 7-1/2"
5. Mounting: Counter Mounting, Self-Rimming
6. Color or Finish: Stainless Steel with Satin Finish
7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Chicago 786-E36-245ABCP (wrist blades/rigid gooseneck)
 - c. Strainer: Elkay LK-35
 - d. Trap: Dearborn Brass 704A-1, 1-1/2", 17 gauge

L. Sink, SK-6: Elkay LR-1716-3

1. Material: 304 Stainless Steel
2. Gage: 18
3. Sink Type: Single Bowl with 3 Faucet Holes
4. Dimensions: 22" x 19-1/2" x 7-1/2"
5. Mounting: Counter Mounting, Self-Rimming
6. Color or Finish: Stainless Steel with Satin Finish
7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Chicago 786-GNC2FC245ABCP (wrist blades/rigid gooseneck)
 - c. Strainer: Elkay LK-18B
 - d. Trap: Dearborn Brass 704A-1, 1-1/2", 17 gauge

I. Sink, SK-7: Elkay LRAD-252140-3 (ADA)

1. Material: 304 Stainless Steel
2. Gage: 18
3. Sink Type: Single Bowl with 3 Faucet Holes
4. Dimensions: 25" x 21-1/4" x 4"
5. Mounting: Counter Mounting, Self-Rimming
6. Color or Finish: Stainless Steel with Satin Finish
7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Chicago 786-E36-245ABCP (wrist blades/rigid gooseneck)
 - c. Strainer: Elkay LK-35

- d. Trap: Dearborn Brass 704A–1, 1-1/2", 17 gauge
- e. Disposer: Insinkerator Evolution Compact, 3/4 hp, 120v/1/60
- f. Protective Enclosure: Truebro Basin Guard

J. Sink, SK-8: Elkay LRAD-252165-3 (ADA)

- 1. Material: 304 Stainless Steel
- 2. Gage: 18
- 3. Sink Type: Single Bowl with 3 Faucet Holes
- 4. Dimensions: 25" x 21-1/4" x 6-1/2"
- 5. Mounting: Counter Mounting, Self-Rimming
- 6. Color or Finish: Stainless Steel with Satin Finish
- 7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Elkay LKD-2443C (kitchen style w/hand spray)
 - c. Strainer: Elkay LK-35
 - d. Trap: Dearborn Brass 704A–1, 1-1/2", 17 gauge
 - e. Protective Enclosure: Truebro Basin Guard

I. Sink, SK-9: Elkay LR-2521-3

- 1. Material: 304 Stainless Steel
- 2. Gage: 18
- 3. Sink Type: Single Bowl with 3 Faucet Holes
- 4. Dimensions: 25" x 21-1/4" x 7-7/8"
- 5. Mounting: Counter Mounting, Self-Rimming
- 6. Color or Finish: Stainless Steel with Satin Finish
- 7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Chicago 786-E36-245ABCP (wrist blades/rigid gooseneck)
 - c. Strainer: Elkay LK-35
 - d. Trap: Dearborn Brass 704A–1, 1-1/2", 17 gauge
 - e. Disposer: Insinkerator Evolution Compact, 3/4 hp, 120v/1/60

J. Sink, SK-10: Elkay LRAD-191865-3 (ADA)

- 1. Material: 304 Stainless Steel
- 2. Gage: 18
- 3. Sink Type: Single Bowl with 3 Faucet Holes
- 4. Dimensions: 19" x 18" x 6-1/2"
- 5. Mounting: Counter Mounting, Self-Rimming
- 6. Color or Finish: Stainless Steel with Satin Finish
- 7. Fittings and Accessories: Provide the following compatible components:
 - a. Supplies: Brass Craft OCR-1912-AC
 - b. Faucet: Chicago 786-E36-245ABCP (wrist blades/rigid gooseneck)
 - c. Strainer: Elkay LK-35

- d. Trap: Dearborn Brass 704A-1, 1-1/2", 17 gauge
- e. Protective Enclosure: Truebro Basin Guard

K. Shower, SH-1: Clarion MP3036(L/R)BF34 (Barrier-Free Shower-ADA)

- 1. Dimensions: 60" x 36" x 76-3/4"
- 2. Fitting and Accessories: Provide the following compatible components:
 - a. Shower Valve, Hand Spray, Slide Bar and Vacuum Breaker: Powers Thermostatic/ Pressure Balance E420S12---L-W
 - b. #504426TS Grab Bar
 - c. #400-29-SDL Folding Seat
 - d. #660 Soap Dish
 - e. Brass Drain
 - f. #CR-56 1/4 Curtain Rod
 - g. Shower Curtain
 - h. Collapsible Threshold Kit 2.5a
 - i. 1.5 gpm flow rate

L. Shower, SH-2: Shower Walls, Base and Curtain Rod by Others (ADA)

- 1. Dimensions: See Drawings
- 2. Fitting and Accessories: Provide the following compatible components:
 - a. Shower Valve, Hand Spray, Slide Bar and Vacuum Breaker: Powers Thermostatic/ Pressure Balance E420S12---L-W
 - b. 1.5 gpm flow rate
 - c. Trap: 3" C.I. P-Trap
 - d. Drain: Floor Drain (FD-3)

M. Clinical Sink, CS-1: Kohler K-6676

- 1. Material: Vitreous China
- 2. Bowl Type: Blowout Action
- 3. Mounting and Outlet: Pedestal Mounted, Bottom Outlet
- 4. Rim Height: 30 inches
- 5. Color: White
- 6. Fittings and Accessories: Provide the following compatible components:
 - a. Flush Valve: Sloan Valve Company, Sloan Model 117-H-YJ (Note: Add suffix O for offset vacuum breaker)
 - b. Faucet: Chicago 815-VB
 - c. Rim Guard: Kohler K-8935
 - d. Strainer: Kohler K-13864
 - e. Bed Pan Washer: Chicago 910-G-777-19K with vacuum breaker mounted at 7-0" A.F.F.
 - f. 10" High Precast Terrazzo Base: Creative Industries Terrazzo Model 12-24-12

- N. Bathtub, BT-1: Existing Fixture - Relocated
 - 1. Floor drain – FD-5

- O. Bathtub, BT-2: American Standard 3060.109.SXX (Walk-in Tub)
 - 1. Material: Enameled Cast Iron with Safeguard Bottom
 - 2. Dimensions: 66" x 30" x 18" high
 - 3. Color: White
 - 4. Fittings and Accessories:
 - a. Premium fast-fill tub faucet and handheld showering wand
 - b. Watertight door system with a lifetime warranty (door seal)
 - c. Quick Drain fast water removal system
 - d. Safety bar and textured tub floor
 - e. Pressure-balance valve

- P. Bathtub, BT-3: Arjo Parker Bath (Height-adjustable reclining sit bath)
 - 1. Integrated thermostatic water controls for filling and showering
 - 2. Built-in battery back-up system (24V)
 - 3. GRP (glass-reinforced plastic) construction
 - 4. Supplied with pop-up drain and surface overflow outlet
 - 5. Provide optional autofill feature that pre-fills the footwell.
 - 6. Emergency Stop
 - 7. 120V/1/60 (max 800 VA)

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify roughing-in for potable cold water, hot water supplies, waste and vent piping systems to verify actual locations of piping, prior to installing.

3.02 PREPARATION

- A. Install carriers and hangers for wall-mounted fixtures in walls before wall surface is complete.

3.03 INSTALLATION

- A. Install fixtures and fitting in accordance with manufacturer's instruction.
- B. Install fixtures plumb and level.
- C. Install fixtures at height designated on architectural drawings.

- D. Set floor sinks in leveling bed of cement grout.
- E. Install removable key stop valve in an accessible location in each water supply to fixture.
- F. Install trap on fixture outlet except for the fixtures have integral trap.
- G. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.
- H. Seal fixtures to walls, floors and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant with sealant color to match fixture color.

3.04 TESTING, ADJUSTING AND CLEANING

- A. Test fixtures to demonstrate proper operation upon completion of Installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
- B. Operate and adjust faucets and controls. Replace damaged and malfunctioning faucets, fittings and controls.
- C. Replace washers of leaking and dripping faucets and stops.
- D. Adjust water pressure, electric water coolers, faucets, shower valves, and flush valves having controls, to provide proper flow and stream.
- E. Clean fixtures, fittings, spout, and drain strainers with manufacturer's recommended cleaning methods and materials.

END OF SECTION 22 4000

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Testing, Adjustment, and Balancing of Air Systems
- B. Testing, Adjustment, and Balancing of Hydronic, and Refrigerating Systems
- C. Measurement of Final Operating Condition of HVAC Systems

1.02 RELATED SECTIONS

- A. Section 01 2100 Allowances

1.03 REFERENCES

- A. AABC MN-1 – AABC National Standards for Total System Balance; Associated Air Balance Council.
- B. ASHRAE Std 111 – Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- C. NEBB (TAB) – Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau.

1.04 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirement for submittal procedures.
- B. Qualifications: The agency selected shall be a fully certified member of the National Environmental Balancing Bureau or Associated Air Balance Council (ABC), or an independent firm whose principals are registered Professional Engineers.
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit to the Commissioning Authority or Owner Representative within two weeks after completion of testing, adjusting, and balancing.

2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
4. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency
 - c. Telephone Number of Testing, Adjusting, and Balancing Agency
 - d. Project Name
 - e. Project Location
 - f. Project Architect
 - g. Project Engineer
 - h. Project Contractor
 - i. Project Altitude
 - j. Report Date

D. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.05 QUALITY ASSURANCE

- A. All work shall be done with the best modern practices and equipment.
- B. All instruments used for measurement shall be accurate, and calibration for each instrument shall be available for examination. The Architect has the right to request instrument recalibration, or the use of other instruments, where accuracy of readings is questionable.
- C. Perform Work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, or registered Professional Engineer experienced in performance of this Work and licensed at the State in which the Project is located.

PART 2 – EXECUTION

2.01 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed complete and operable.
 3. Proper thermal overload protection is in place for electrical equipment.
 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 5. Duct systems are clean of debris.

6. Fans are rotating correctly.
 7. Fire and volume dampers are in place and open.
 8. Air coil fins are cleaned and combed.
 9. Access doors are closed and duct end caps are in place.
 10. Air outlets are installed and connected.
 11. Duct system leakage is minimized.
 12. Hydronic systems are flushed, filled, and vented.
 13. Pumps are rotating correctly.
 14. Proper strainer baskets are clean and in place.
 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- C. Beginning of work means acceptance of existing conditions.
- D. The Balancing Subcontractor shall consult all drawings, construction details, job site and confer and cooperate with other Contractors to avoid interference.
- E. The Balancing Subcontractor shall check all control interlocks and cooperate with the Control Contractor in adjusting and calibration of control equipment.
- F. The Balancing Subcontractor shall deliver to the Engineer in writing, all comments regarding the systems and any and all deficiencies found during the balancing of the systems. Preferably this should be done before the final system balance to allow any corrective procedures to take place.
- G. Any ceiling tile that is damaged by the Balancing Subcontractor shall be replaced with new tile identical to that damaged.

2.02 MISCELLANEOUS TESTS

- A. Building pressure tests with outside temperature and wind velocity noted at points of typical location inside building on both lee and windward side of building. Tests to be made with all supply and exhaust systems in normal operation and with supply systems at minimum outside air at approximately nominal wind velocity outside.
- B. Smoke and flame detector tests in conjunction with Control Contractor (Witness Tests).
- C. Record instrument tests to confirm performance of air or water systems.
- D. All electrical interlocking shall be tested and verified. This work shall be accomplished with a representative of the Heating, Ventilating and Air Conditioning Contractor and Control Contractor present and assisting.

2.03 FINAL OBSERVATION AND ACCEPTANCE

- A. At the time of the final observation and, if requested, the Balancing Contractor shall recheck, in the presence of the Architect, random selections of data (water and air quantities, air motion), recorded in the certified report. Points or areas for recheck shall be selected by the Architect.
- B. A measured flow deviation of plus or minus 5 percent or more from the certified report listing, at 10 percent or more of the selected recheck stations, shall automatically result in the rejection of the report. In the event the report is rejected, all systems shall be re-balanced and new certified reports submitted and another observation made at no additional cost to the Owner.
- C. Following final acceptance of certified report by the Architect, the settings of all valves, splitters, dampers and other adjustment devices shall be permanently marked so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

2.04 INSTRUCTIONS

- A. The Mechanical Contractor shall coordinate with the Test and Balance Contractor the necessary information, data, etc., in order to adequately instruct the Owner's representative in the proper operation and routine maintenance of the mechanical systems. The instruction sessions shall be for a period of two (2) working days (minimum).

2.05 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

2.06 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

2.07 RECORDING AND ADJUSTING

- A. Field Logs: Maintain Written Logs Including:
 - 1. Running log of events and issues
 - 2. Discrepancies, deficient or uncompleted work by others
 - 3. Contract interpretation requests
 - 4. Lists of completed tests
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- F. TAB Verification: Project Manager shall randomly select measurements documents in the final report to be rechecked. The rechecking shall be limited to 5% of the total measurements recorded or what can be measured in (1) eight hour period.
- G. Seasonal Testing: If initial TAB procedures were not performed during near peak summer and winter conditions, perform additional testing, inspection and adjusting during near peak summer or winter conditions.

2.08 AIR SYSTEM PROCEDURE

- A. Prior to final inspection of the building, all air handling and distribution systems shall be adjusted as necessary to provide required design supply, return, and exhaust air quantities for each component. Balancing of all systems shall be conducted under conditions approximating actual operation.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of ducts and include locations for confirming readings taken. Temperature of the traverse and static pressure existing at the point of traverse shall be noted.
- C. Ducts having velocities of 700 FPM and higher shall have flow measured with inclined manometer having suitable scales and increments.
- D. Ducts having velocities lower than 700 FPM shall have air flow measured with micromanometers, hook gauges, or similar low velocity instruments.

- E. Instrument test holes shall be approved for location and number and shall be re-plugged with permanent closure on completion of work.
- F. Measurement of air quantities at each air inlets and outlets shall be determined by methods approved by manufacturer of terminal or cognizant authority.
- G. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- H. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Volume control by means of air terminal adjustment or duct internal devices other than dampers and splitters are not permitted.
- I. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- J. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- K. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- L. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- M. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- N. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- O. On fans with variable frequency drives, the belt drive fan speed shall be set so that the fan is operating at 100 percent rated horsepower when the variable speed drive is at 100 percent. The variable frequency drive shall then be set to deliver the designed air flow.

2.09 WATER SYSTEM PROCEDURE

- A. Prior to final inspection of the building or project, all heating and cooling water systems shall be adjusted as necessary to provide required or design quantities or each component.

- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity (as designed) is less than total flow requirements of individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.
- G. Pressure drop through three-way valve bypasses shall be adjusted to balance drop through the system and the components served.

2.10 SCOPE

- A. Test, Adjust, and Balance the following:
 - 1. HVAC Pumps
 - 2. Boilers
 - 3. Packaged Terminal Air Conditioning Units
 - 4. Air Coils
 - 5. Terminal Heat Transfer Units
 - 6. Air Handling Units
 - 7. Fans
 - 8. Air Filters
 - 9. Air Inlets and Outlets

2.11 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer
 - 2. Model/Frame
 - 3. HP/BHP
 - 4. Phase, Voltage, Amperage; Nameplate, Actual, No Load
 - 5. RPM
 - 6. Service Factor
 - 7. Starter Size, Rating, Heater Elements

8. Sheave Make/Size/Bore

B. V-Belt Drives:

1. Identification/Location
2. Required Driven RPM
3. Driven Sheave, Diameter and RPM
4. Belt, Size and Quantity
5. Motor Sheave Diameter and RPM

C. Pumps:

1. Identification/Number
2. Manufacturer
3. Size/Model
4. Impeller
5. Service
6. Design Flow Rate, Pressure Drop, BHP, RPM
7. Actual Flow Rate, Pressure Drop, BHP, RPM
8. Discharge Pressure
9. Suction Pressure
10. Total Operating Head Pressure
11. Shut Off, Discharge and Suction Pressures
12. Shut Off, Total Head Pressure

D. Cooling Coils:

1. Identification/Number
2. Location
3. Service
4. Manufacturer
5. Air Flow, Design and Actual
6. Entering Air DB Temperature, Design and Actual
7. Entering Air WB Temperature, Design and Actual
8. Leaving Air DB Temperature, Design and Actual
9. Leaving Air WB Temperature, Design and Actual
10. Water Flow, Design and Actual
11. Water Pressure Drop, Design and Actual
12. Entering Water Temperature, Design and Actual
13. Leaving Water Temperature, Design and Actual
14. Saturated Suction Temperature, Design and Actual
15. Air Pressure Drop, Design and Actual

E. Heating Coils:

1. Identification/Number
2. Location
3. Service

4. Manufacturer
5. Air Flow, Design and Actual
6. Water Flow, Design and Actual
7. Water Pressure Drop, Design and Actual
8. Entering Water Temperature, Design and Actual
9. Leaving Water Temperature, Design and Actual
10. Entering Air Temperature, Design and Actual
11. Leaving Air Temperature, Design and Actual
12. Air Pressure Drop, Design and Actual

F. Air Moving Equipment:

1. Location
2. Manufacturer
3. Model Number
4. Serial Number
5. Arrangement/Class/Discharge
6. Air Flow, Specified and Actual
7. Return Air Flow, Specified and Actual
8. Outside Air Flow, Specified and Actual
9. Total Static Pressure (Total External), Specified and Actual
10. Inlet Pressure
11. Discharge Pressure
12. Fan RPM
13. Supply Air Temperature Dry Bulb/Wet Bulb

G. Exhaust Fans:

1. Location
2. Manufacturer
3. Model Number
4. Serial Number
5. Air Flow, Specified and Actual
6. Total Static Pressure (Total External), Specified and Actual
7. Inlet Pressure
8. Discharge Pressure
9. Fan RPM

H. Duct Traverses:

1. System Zone/Branch
2. Duct Size
3. Area
4. Design Velocity
5. Design Airflow
6. Test Velocity
7. Test Air Flow
8. Duct Static Pressure

9. Air Temperature
10. Air Correction Factor

I. Flow Measuring Stations:

1. Identification/Number
2. Location
3. Size
4. Manufacturer
5. Model Number
6. Serial Number
7. Design Flow Rate
8. Design Pressure Drop
9. Actual/Final Pressure Drop
10. Actual/Final Flow Rate
11. Station Calibrated Setting

J. Air Distribution Tests:

1. Air Terminal Number
2. Room Number/Location
3. Terminal Type
4. Terminal Size
5. Area Factor
6. Design Velocity
7. Design Air Flow
8. Test (Final) Velocity
9. Test (Final) Air Flow
10. Percent of Design Air Flow

END OF SECTION 23 0593

**SECTION 23 0713
DUCT INSULATION**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Duct Insulation
- B. Insulation Jackets

1.02 RELATED SECTIONS

- A. Section 23 0000 – Basic Heating, Ventilation & Air Conditioning (HVAC) Requirements
- B. Section 23 3113 – Metal Ducts and Duct Liner
- C. Section 23 3116 – Non-Metal Ducts

1.03 REFERENCES

- A. ASTM E 2336 – Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
- B. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. SMACNA (DCS) – HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirement for submittal procedures.
- B. See Section 23 0000 for low VOC submittal requirements.
- C. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- D. Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 – PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:

1. Knauf Fiber Glass
2. Johns Manville International, Inc.
3. Owens Corning Corp.
4. Certainteed Corporation
5. Substitutions: See General Requirements

- B. The following ducts shall be externally insulated with one and 1-1/2 inch thick flexible duct wrap insulation, maximum thermal conductivity (k) at 75 degrees F mean temperature 0.27 BTU/hr square foot F degrees/inch, with foil-reinforced Kraft vapor barrier facing. Apply with mastic, mechanical fasteners, staples and tape as per manufacturer's recommendations. Lap and seal all joints. All fastening device penetrations shall be vapor-proofed. Insulation shall be Owens-Corning ED-100-FRK-25.

1. Outside air intake ducts concealed above ceilings and in shafts.
2. Supply ducts concealed above ceilings and in shafts.
3. Return ducts concealed above ceilings and in shafts.
4. Exhaust and relief ducts above ceilings and in shafts from backdraft or motorized damper to louver.
5. Runout ducts to registers, grilles and diffusers.
6. Linear slot diffuser plenums if they are not internally insulated.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:

1. Knauf Fiber Glass
2. Johns Manville International, Inc.
3. Owens Corning Corp.
4. Certainteed Corporation
5. Substitutions: See General Requirements

- B. The following ducts shall be externally insulated with one and 1-1/2 inch thick, 3.0 pound minimum density semi-rigid fiberglass insulation, maximum thermal conductivity (k) at 75 degrees F mean temperature, 0.23 BTU/hr square foot F°/inch, with foil-reinforced Kraft vapor barrier facing. Apply with pins, mastic and clips as per manufacturer's recommendations. Lap and seal all joints. In exposed areas, i.e. mechanical equipment rooms, welded pins shall be provided with self-locking capped speed washers equivalent to those manufactured by H.A. Jones Company. Cup head pins will also be acceptable. Insulation shall be Owens-Corning 703-FRK.
1. Outside air intake ducts in mechanical equipment rooms.
 2. Supply ducts in mechanical equipment rooms.
 3. Return ducts in mechanical equipment rooms.
- C. The following ducts shall be externally insulated with 1-1/2 inch thick rigid basalt-based insulation, 12 pound density designed for temperatures up to 1200 degrees F. Insulation blocks shall be applied with edges tightly butted and joints staggered, with all voids filled with an insulating cement. Attach blocks to ducts with weld pins with speed washers, on centers. Insulation shall be Owens-Corning high-temperature industrial board. Where exposed in mechanical rooms, boiler rooms, and penthouses, cover insulation with glass cloth facing. On boiler flues, use pre-molded high temperature pipe insulation when breaching size is such to make it practical. When used on boiler flues, product shall be rated for flue temperatures.
1. Kitchen hood exhaust ductwork including entire vertical riser.
- D. In lieu of calcium silicate, Thermal Ceramics Fire Master Fast Wrap XL; ESR-2213, Thermal Ceramics Pyroscat Duct Wrap XL; ESR-2832, Unifrax Fire Wrap Max 2.0; ESR-2224 or 3M Fire Barrier 20A; ESR-1255 duct wrap may be utilized. Insulation shall consist of two (2), one and 1-1/2 inch layers which when applied per manufacturers instructions. Provide a 2-hour fire rating with zero clearance to combustibles, meets NFPA 96 latest edition for commercial cooking operations and tested to ASTM E-2336. UL classified per ASTM E-2236 and labeled for grease duct enclosures per International Mechanical Code and Uniform Mechanical Code latest editions. The outer layer of insulation shall be provided with foil facing on one side.
1. Kitchen hood exhaust ductwork including entire vertical riser.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Duct shall be kept clean and dry during installation.

- D. Any exposed insulated ductwork passing through a floor where it is subject to damage shall be covered with a 0.032 inch (minimum) thick aluminum jacket 18 inches high.

END OF SECTION 23 0713

**SECTION 23 6213
AIR COOLED CONDENSING UNITS**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section includes the design, controls and installation requirements for air-cooled condensing units.

1.02 RELATED SECTIONS

- A. Section 23 0513 – Common Motor Requirements for HVAC Equipment
- B. Section 23 2113 – Hydronic Piping
- C. Section 23 2114 – Hydronic Specialties
- D. Section 23 0993 – Sequence of Operation for HVAC Controls
- E. Section 23 7300 – Air Handling Units
- F. Section 26 2914 – Power Equipment

1.03 QUALITY ASSURANCE

- A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

1.04 SUBMITTALS:

- A. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances, and connection details. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.05 WARRANTY

- A. Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance and refrigerant.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. AAON
- B. Trane
- C. Daikin

2.02 CONDENSING UNITS

A. General Description:

1. COND-E-1 & 2 Condensing unit shall include compressors, air-cooled condenser coils, condenser fans, filter drier, and suction and liquid connection valves.
2. Unit shall be factory assembled and tested including leak testing of the coil and run testing of the completed unit. Run test report shall be supplied with the unit in the control compartment.
3. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
4. Unit nameplate shall be provided.

B. Construction:

1. Unit shall be complete factory assembled, piped, and wired and shipped in one section.
2. Unit shall be specifically designed for outdoor applications.
3. Access to compressors and control components shall be through hinged access door with quarter turn, lockable handles.
4. COND-E-1 & 2 Access to condenser coils and fans is through removable access panels.

C. Electrical:

1. Control circuit transformer and wiring shall provide 24 VAC control voltage from the line voltage provided to the unit.
2. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
3. Unit shall be provided with factory installed and factory wired 115V, 12 amp GFI outlet in the unit control panel.

D. Refrigeration System:

1. COND-E-1 Unit shall be provided with two independently circuited R-410A scroll compressors with thermal overload protection. Lead compressor shall be a variable capacity scroll capable of modulation from 10-100% of it capacity.
2. COND-E-2 Unit shall be provided with two tandem circuited R-410A scroll compressors with thermal overload protection. The lead tandem set shall include a variable capacity scroll compressor on the first compressor of the set which shall be capable of modulation from 10-100% of its capacity.
3. Each compressor shall be furnished with a crankcase heater and carry a 1 year non-prorated warranty, from the date of original equipment shipment from the factory.
4. COND-E-1 & 2 Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators and mounted on an elevated compressor deck, to reduce any transmission of noise from the compressors into the building area.
5. COND-E-1 & 2 Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided and installed. Field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, insulated hot gas reheat line, and insulated suction line.
6. Unit shall include a factory holding charge of R-410A refrigerant and oil.
7. COND-E-1 Unit shall include 2 stages of capacity control.
8. COND-E-2 Unit shall include 4 stages of capacity control.
9. COND-E-1 The unit shall be capable of stable cooling operation to a minimum of 55°F outdoor temperature.
10. COND-E-1 & 2 Lead refrigeration circuit shall be provided with modulating hot gas reheat valves, electronic controller, liquid line receiver, supply air temperature sensor and a dehumidification control signal terminal that enables the dehumidification mode of operation, and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. The matching indoor air handler must include a hot gas reheat coil.

E. Fans:

1. COND-E-1 & 2 Condenser fan shall be vertical discharge, axial flow, direct drive fans.

F. Coils:

1. [COND-E-1][COND-E-2] Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
2. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
3. Coils shall be hydrogen or helium leak tested.

G. Controls:

1. Units shall be provided with a terminal block for field installation of controls. Option shall include factory installed isolation relays.

PART 3 – EXECUTION

3.01 INSTALLATION, OPERATION, AND MAINTENANCE:

- A. Installation, Operation and Maintenance manual shall be supplied with the unit.
- B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.

END OF SECTION 23 6213

**SECTION 23 7300
AIR HANDLING UNITS**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section includes the design, controls, and installation requirements for indoor air handling units.

1.02 RELATED SECTIONS

- A. Section 23 0000 – Basic Heating, Ventilation and Air Conditioning (HVAC) Requirements
- B. Section 23 0513 – Common Motor/Electrical Requirements for HVAC Equipment
- C. Section 23 0593 – Testing, Adjusting, and Balancing for HVAC
- D. Section 23 0916 – Variable Frequency Drives
- E. Section 23 0923 – Direct Digital Control System
- F. Section 23 6213 – Air Cooled Condensing Units

1.03 QUALITY ASSURANCE

- A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- B. AHU-E-1 & 2 Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- C. AHU-E-2 Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Building.
- D. AHU-E-1 & 2 Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

1.04 SUBMITTALS

- A. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, clearances, and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with detail for power and control systems and differentiate between factory installed and field installed wiring.

1.05 WARRANTY

- A. Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment start up or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation, and maintenance have been followed. Warranty excludes part associated with routine maintenance, such as belts and air filters.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. AAON
- B. Daikin
- C. Trane

2.02 AIR HANDLING UNITS

A. General Description

1. Indoor air handling units shall include filters, supply fans, DX evaporator coil, reheat coil, hot water coil, mixing box, and unit controls.
2. Unit shall have a draw-through supply fan configuration.
3. Unit shall be factory assembled and tested including leak testing of the DX coil, leak testing of the hot water coil, and run testing of the supply fans and factory wired electrical system. Run test report shall be supplied with the unit.
4. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
5. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment’s hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break.

4. Access to filters shall be through hinged access door with quarter turn fasteners.
5. Access to cooling coil, heating coil, reheat coil and dampers, shall be through hinged access door with lockable quarter turn handles.
6. Units shall include sloped 304 stainless steel drain pan.
7. Cooling coil shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.

C. Electrical:

1. AHU-E-1 Unit shall be provided with an external control panel with separate low voltage control wiring with conduit and high voltage power wiring with conduit between the control panel and the unit. Control panel shall be field mounted.
2. AHU-E-2 Unit shall be provided with an internal control panel with separated low and high voltage control wiring.
3. Unit shall be provided with standard power block for connecting power to the unit.
4. Unit shall include a factory installed 24V control circuit transformer.

D. Supply Fans:

1. Unit shall include direct drive, unhooded, backward curved, plenum supply fans.
2. Blower and motor assembly shall be dynamically balanced.
3. Motor shall be a high efficiency electronically commutated motor (ECM).
4. Blower and motor assembly shall be mounted on rubber isolators.
5. ECM driven supply fan CFM setpoint shall be set with factory installed potentiometer within the control compartment.
6. AHU-E-1 ECM driven supply fan speed shall be controlled with the factory installed WattMaster controller.
7. AHU-E-2 ECM driven supply fan speed shall be controlled with field provided 0-10 VDC control signal.

E. Cooling Coil:

1. AHU-E-1 & 2 Coil shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
2. Coil shall two circuits and interlaced circuitry.
3. Coil shall be 6 row high capacity and 12 fins per inch.
4. Coil shall be hydrogen or helium leak tested.
5. Coil shall be furnished with factory installed thermostatic expansion valves. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.

F. Refrigeration System:

1. Air handling unit and matching condensing unit shall be capable of operation as an R-410A split system air conditioner.
2. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
3. AHU-E-1 & 2 Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, check valve, liquid line receiver, electronic controller, supply air temperature sensor and a dehumidification control signal terminal that enables the dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Modulating reheat valves and receiver shall be factory installed in the matching condensing unit. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

G. Heating Coil:

1. Coil shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.
2. AHU-E-1 & 2 Coil shall be designed and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
3. AHU-E-1 Coil shall have single serpentine circuitry, 2 row and 12 fins per inch.
4. AHU-E-2 Coil shall have half serpentine circuitry, 2 row and 12 fins per inch.
5. Coils shall be located in the preheat position upstream of the cooling coil.

H. Filters:

1. AHU-E-1 & 2 Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 50% and MERV rating of 10, upstream of the cooling coil.

I. Mixing Box:

1. Unit shall contain a mixing box with top return air opening and front outside air opening.

2. Return air opening shall contain an adjustable, motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Dampers shall be controlled by a 2 position actuator.
3. AHU-E-1 & 2 Outside air opening shall contain an adjustable, motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Dampers shall be controlled by a 2 position actuator.
4. AHU-E1&2 Field Installed DDC Controls by Others
 - a. Controls shall be field provided and field installed by others. Unit shall be provided with a terminal block and a supply air setpoint potentiometer.

PART 3 - EXECUTION

3.01 – INSTALLATION AND MAINTENANCE

- A. Installation, Operation and Maintenance manual shall be supplied with the unit.
- B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.
- C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION 23 7300

SECTION 23 8126
SPLIT SYSTEM AIR CONDITIONERS/HEAT PUMP

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Ductless Split System
- B. Controls

1.02 RELATED SECTIONS

- A. Section 23 2300 – Refrigerant Piping
- B. Section 26 0533 - Raceways

1.03 REFERENCES

- A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association.
- B. UL 207 - Refrigerant-Containing Components and Accessories, Non-Electrical; Underwriters Laboratories Inc.

1.04 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirement for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Project Record Documents: Record actual locations of components and connections.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.05 WARRANTY

- A. See Closeout Submittals, for additional warranty requirements.
- B. Unit shall have one (1) year warranty. Provide an extended four (4) year replacement warranty for the refrigeration compressors after the first year full replacement warranty (parts and labor). The four (4) year warranty shall be for compressor replacement only; all labor charges will be the responsibility of the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Mitsubishi
- B. Daikin AC, Inc.
- C. Carrier
- D. Sanyo
- E. LG

2.02 SYSTEM DESIGN

- A. Furnish and install a complete ductless split (air conditioning) or (heat pump) system with the capacity as scheduled. System shall include an indoor fan coil unit, outdoor condensing unit, refrigerant piping and (wired) or (wireless) remote control.

2.03 INDOOR UNIT

- A. Provide indoor, direct-expansion, wall-mounted fan coil. Unit shall be complete with (cooling) or (cooling/heating) coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall-mounting bracket, mounting hardware, and thermistor interconnection cable.
- B. Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.
- C. Fan shall be tangential direct-drive blower type with air intake at the upper front face of the unit and discharge at the bottom front. Automatic, motor-driven horizontal air sweep shall be provided standard. Air sweep operation shall be user selectable. Vertical direction may be manually adjusted and horizontal air sweep may be manually set.

- D. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins will be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap and auxiliary drip pan under coil header.
- E. Motors shall be open drip proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall have 3 speeds.
- F. Provide mounting frames as required for unit installation.
- G. Condensate Pump:
 - 1. The condensate pump shall remove condensate from the drain pan when gravity drainage cannot be used. Pump shall be designed for quiet operation and shall not be mounted external to the unit in the space. Pump shall consist of two parts: an internal reservoir/sensor assembly, and a remote sound-shielded pump assembly. The lift capability of the condensate pump shall be 10 feet. A level sensor on the condensate pan shall stop cooling operation if the level in the condensate pan is unacceptable.

2.04 OUTDOOR UNITS

A. Outdoor Unit:

(AC-B-1)

- 1. Provide a matching outdoor-mounted, air-cooled split system condensing unit outdoor section suitable for rooftop and grade installation. Unit shall consist of a rotary compressor, an air-cooled coil, draw-thru propeller-type condenser fans, accumulator, cooling refrigerant capillary tubes, refrigerant charge, and control box. Unit shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air-to-air cooling system. Provide low-ambient kit.

OR

(AC-E-1 and AC-E-2)

- 1. Provide a matching outdoor-mounted, air cooled split system heat pump unit outdoor section suitable for rooftop installation. Unit shall consist of a high performance hermetic; inverter driven, variable speed, rotary compressor, an air cooled coil, draw-thru propeller-type condenser fans, accumulator, cooling refrigerant capillary tubes, refrigerant charge, and control box. Unit shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air-to-air cooling system. Provide low ambient kit.

2. Design is based on refrigerant type HFC-410A. Other HFC refrigerants shall be submitted for Engineer's approval. CFC and HCFC type refrigerants shall not be accepted.

B. Controls:

1. Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 64 degrees F to 84 degrees F.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

END OF SECTION 23 8126

SECTION 28 3100
ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

- A. This Specification describes the requirements to furnish and install a microprocessor controlled, supervised, intelligent, addressable fire alarm voice system. The equipment shall include but is not limited to master control panel, manual pull stations, combination horn/strobes, annunciator, smoke detectors, water flow switches, door holders, gate valve supervisory switches.
- B. Extent of fire alarm system work is indicated by Drawings and Schedules.
- C. Fire alarm vendor shall be employed by Electrical Contractor for supervision, programming, final termination, verification of complete operational system and final inspection.

1.03 QUALITY ASSURANCE:

- A. Manufacturer: Firm regularly engaged in manufacture of fire alarm systems, of types, sizes, and electrical characteristics required, whose products have been in satisfactory use in similar service for not less than five years.
- B. NEC Compliance: Comply with NEC as applicable to construction and installation of fire alarm system components and accessories.
- C. UL Compliance and Labeling: Provide fire alarm system components which are UL-listed and labeled. All control equipment shall be listed under UL 864 UOJZ as a single control unit. Partial listing is not acceptable.
- D. FM Compliance: Provide fire alarm system and accessories which are FM approved
- E. NFPA Compliance:
 - 1. NFPA 72 National Fire Alarm Code
 - 2. NFPA 72E Automatic Fire Detectors
 - 3. NFPA 101 Life Safety Code
 - 4. NFPA 70 National Electrical Code

6. Local, State and National Codes, Local and State Fire Marshal Codes. It shall be the Contractor's responsibility to obtain approval from all reviewing agencies.

1.04 WARRANTY:

- A. This Contractor shall warranty all equipment, labor on equipment, and all wiring free from mechanical and electrical defects for a period of two years from the date of installation. All warranty labor service shall be included in this warranty, including work required during premium time (i.e., nights, weekends and holidays).

1.05 SUBMITTALS:

- A. Shop drawings shall be prepared by persons with the following qualifications:
 1. Trained and certified by manufacturer in fire alarm system design.
 2. Fire alarm certified by NICET, minimum Level III.
 3. Licensed or certified by a state or local authority.
- B. Shop drawings shall include the following items:
 1. System Operation Description: Detailed description for this project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 2. Device Address List: Coordinate with final system programming.
 3. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
 4. Wiring Diagrams: Power, signal and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
 5. Batteries: Size calculations.
 6. Floor Plans: Indicate final outlet locations showing each device. Show size and route of cable and conduits.
 7. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculations and single-line connection diagram.
 8. Equipment data sheets for each product.
 9. NAC voltage drop calculations with power supply loading capacity.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data:

1. Fire alarm system to include operation and maintenance manuals. Include abbreviated operating instructions for mounting at the FAP.
 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner and Architect. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Hard copies on paper to Owner and Architect.
 - b. Electronic media shall be provided to Architect.
 3. The manufacturer representative shall supply the Owner with four sets of building wiring diagrams, equipment, schematics and/or necessary tools to maintain the system along with equipment operating instructions. Building wiring diagrams to indicate point-to-point wiring, strobe candela values, speaker dB/wattage tap values and notification circuit loads. NOTE: All drawings shall be prepared utilizing AutoCAD (latest version) and electronic files (pdf's) turned over to the Owner at the end of the project.
 4. The manufacturer representative shall supply the Owner with a record copy of the site specific program file and access password(s) per NFPA 72.
- E. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated contract drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- F. Documentation:
1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner and Architect.

1.06 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.
1. Smoke and Heat Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
 2. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
 3. Pull Stations: Quantity equal to 10 percent of amount installed, but not less than 2 units.
 4. Keys and Tools: One extra set for access to locked and tamper proof

components.

5. Audible and Visual Notification Appliances: 5% (minimum 5) of each type installed.
 6. Notification Appliance Guards: Two of each type installed.
 7. Fuses: Two of each type installed in the system.
 8. Indoor Protection Shield: Two of each type installed.
- B. The Contractor shall include installation of 5% (minimum 5) spare notification devices (horn/strobes and strobe lights, etc.) to be field located during construction. The installed notification devices shall be taken from the pool of extra materials.

1.07 FIELD QUALITY CONTROL:

- A. System Installer: Installation and programming of fire alarm system shall be by persons with all of the following qualifications:
1. Factory trained and certified on installed equipment.
 2. Fire alarm certified by NICET, minimum Level II.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.
1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
 3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged or non-functional equipment, and correct before beginning tests.
 4. Testing: Follow procedure and record results complying with requirements in NFPA 72:
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
 - b. Field measure audible signal volume levels in a representative sample of locations, to assure volume level compliance.
 5. Test and Inspection Records: Prepare according to NFPA 72, including

demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

1.08 ADJUSTING:

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions.
- B. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semi-annual and annual periods. Use forms developed for initial tests and inspections.

1.09 DEMONSTRATION:

- A. A factory-authorized service representative shall demonstrate the complete operation of the system and all associated accessories, shutdown functions and remote alarms, for the designated Owner's Maintenance personnel. This demonstration shall be scheduled with at least one week written notice with the Owner and shall not be combined with any final system checkout or field testing procedure.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide a fire alarm system of one of the following:
 - 1. Edwards Systems Technology
 - 2. Notifier Fire Systems
 - 3. SimplexGrinnell

2.02 FIRE ALARM SYSTEM:

- A. The equipment shall be standard products of a single manufacturer.
- B. System Operation:
 - 1. The activation of any fire alarm automatic detector circuit shall automatically perform the following functions:
 - a. Illuminate the fire alarm control panel mounted red light emitting diode and audible sonalert and display a description of the device causing the alarm.
 - b. All audible alarm signals shall sound within building of alarm until

silenced by the alarm silence button. If alarm signals are silenced for any reason, they shall automatically resound if another device is tripped.

- c. All visual signals within the building of alarm shall flash until stopped by the system reset button.
 - d. All fire doors held open by door control devices shall release and close.
 - e. Shut down HVAC fans only upon activation of associated duct smoke detectors or per local authority having jurisdiction requirements.
 - f. Gate valve tamper switch shall indicate as a supervisory condition only upon fire alarm control panel.
 - g. Power failure, open circuit or other abnormal conditions in the circuits of a building fire alarm system shall cause the trouble signal to sound and the amber zone trouble light to glow on the fire alarm control panel indicating which circuit is in a disarranged condition. The silencing pushbutton may be selected to silence the audible trouble signal, but the trouble lamp shall not be extinguished until the abnormal condition is rectified.
 - h. The digital dialer shall be tripped causing the Central Monitor Agency to be notified.
 - i. If alarm signals are silenced for any reason, they shall automatically resound if another zone or device is tripped.
 - j. In the event of a commercial power interruption, the system shall automatically transfer to an emergency standby battery source.
 - k. Record the event in the system memory and the system printer if so required.
 - l. Room smoke detectors, when activated, shall sound their local alarm only and annunciate at the control panel and annunciators. If not reset within an adjustable time period building alarm devices
2. The activation of an Elevator Lobby, Machine Room or shaft smoke detector shall return elevator to main exit floor. Actuation of main exit floor elevator smoke detector shall return the elevator to an alternate designated floor.
 3. The activation of an Elevator machine room or shaft smoke detector shall light the elevator cab's "fire hat" signal.
 4. The activation of any heat detector in the Elevator Machine Room or elevator shaft shuts down the elevator power by operating a shunt trip in a circuit breaker feeding the elevator.

2.03 FIRE ALARM CONTROL PANEL:

- A. Fire alarm control panel shall be designed for surface or semi-flush mounting.
- B. Control panel construction shall be modular with solid state, microprocessor based electronics.

- C. Control panel shall display only those primary controls and displays essential to operation during a fire alarm condition.
- D. Keyboards or keypads shall not be required to operate the system during fire alarm conditions.
- E. Scrolling through menu options or lists shall be accomplished in a self-directing manner in which alphanumeric prompting messages shall direct the user.
- F. Control panel shall be standard key lock on door.
- G. Key to match other panels existing on site.
- H. Furnish a dual line digital alarm communicating transmitter (D.A.C.T.).
- I. The control panel shall have a 2 line x 40-character liquid crystal display which shall be backlit for enhanced readability. The display shall support both upper and lower case letters.
- J. The system shall be capable of logging and storing a minimum of 500 events in a history log. Each recorded event shall include the time and date of that event's occurrence.
- K. The system shall be capable of being tested by one person. While in testing mode, the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after logging of the alarm.
- L. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
- M. Should an alarm condition occur from an active point, not in walk test mode, it shall perform its preprogrammed alarm functions.
- N. Should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at preprogrammed time intervals to act as reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable to suit the Owner's application.
- O. There shall be four access levels with level 4 being the highest level. Level 1 actions shall not require a passcode. Passcodes shall consist of up to ten digits. Changes to passcodes shall only be made by authorized personnel in conjunction with Owner.

- P. The control panel shall have an alarm verification feature, field selectable for smoke detector zones, whereby the panel will reset the activated detector and wait for a second alarm activation. The control panel shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this smoke verification tally reach a pre-programmed number, a trouble condition shall occur. Alarm verification zones shall be able to be divided into eight separate groups whereby only verification zones from the same group will confirm the first activation and cause the alarm sequence to occur.
- Q. The control panel shall have the capability for cross-zoning.
- R. Fire alarm control panel shall have the future capability of operating remote CRT's and/or printers; output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate. Each RS-232-C port shall be capable of supporting as many as four remote CRT displays or printers. The fire alarm control panel shall support up to five RS-232-C ports.
- S. The fire alarm control panel shall have the capability to accommodate up to 254 points.
- T. The system must provide communication with initiating and control devices individually. All of these devices will be individually annunciated at the control panel. All addressable devices shall have the capability of being disabled or enabled individually or in groups.
- U. A minimum of 254 addressable devices may be multi-dropped from a single pair of wires.
- V. Systems that require factory reprogramming to add or delete devices are unacceptable.
- W. The communication format must be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. Systems that do not utilize full digital transmission protocol are not acceptable.
- X. Wiring types will be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Class B circuit.
- Y. Furnish and install isolated loop circuit protector devices on all fire alarm initiating device circuit, signaling line circuit, wiring, (including shields), which extends beyond the main building by either aerial, underground or other methods walkways, bridges or other above ground connectors.
 - 1. The ILCP shall be located as close as practicable to the point at which

- the circuits leave or enter a building.
2. The ILCP grounding conductor shall be a No. 12 AWG wire having a maximum length of 28 feet to be run in as straight a line as practicable and connected to the building grounding electrode system (unified ground) per Article 800-31 of the (1999) National Electrical Code.
 3. The ILCP furnished shall have a line to line response time of less than 1 nanosecond capable of accepting greater than 2000 amps at 28 volts. Line to earth response time shall be less than 25 nanoseconds with a maximum current of 2000 amps (35 joules each line) to earth. Shield to earth current shall be 5000 amps maximum.
 4. The ILCP shall be protected by a high dielectric insulating material and be of small enough size to mount in a standard 4" square 2-1/8" deep electrical box.
 5. Spark gap devices or devices incorporated in or installed within the fire alarm control panel in lieu of the specified ILCP are not acceptable.
- Z. Surge protector for 120 VAC power to the fire alarm panel. The surge protector shall be fast acting - 5 nanoseconds or less - and protect line, neutral and ground. It shall be U.L. listed and tested under ANSI/IEEE specifications for Category A locations. The unit shall be provided with an independent, secondary back-up suppression system. In the event the primary transient protection system sacrifices under catastrophic conditions, the secondary stage of protection immediately takes over, keeping the fire alarm panel protected from additional strikes. There shall be two LED indicators on the unit, a green LED to indicate the unit is active and a red LED to indicate that the primary stage of protection has been sacrificed.
- AA. Transient suppressors for RS232 protection. This unit shall have a male and female DB-25 connector for easy installation and utilize Silicon Avalanche Diodes (SAD) technology. The 15 Vpk signal line shall be clamped to 24 Vpk in 5 nanoseconds or less under transient conditions.
- BB. The fire alarm control panel is an existing Gamewell ES3 Series panel by Honeywell

2.04 EQUIPMENT:

- A. Manual stations shall be surface or semi-flush double action addressable. Pull stations will contain electronics that communicate the station's status (alarm, normal) to the fire alarm control over two wires which also provide power to the pull station. The address will be set on the station. The station will be manufactured from high impact red Lexan and with mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. The addressable manual station shall be capable of field programming of its "address" location on an addressable initiating circuit.
1. Honeywell to match existing.

- B. Wall mounted fire alarm signal shall be 24-Volt 80 dBA minimum horn, white finish:
 - 1. Honeywell to match existing.
- C. Wall mounted strobe only, field selectable ADA strobe light (15, 30, 75, 110Cd to meet all applicable codes) white finish:
 - 1. Honeywell to match existing.
- D. Horn/strobe, wall mounted, 24-Volt 80 dBA minimum horn, field selectable ADA strobe light (15, 30, 75, 110Cd to meet all applicable codes), white finish:
 - 1. Honeywell to match existing.
- E. Ceiling smoke detector shall be addressable, photoelectric, (as indicated on drawings) smoke sensor with variable sensitivity, U.L. Listed OAP:
 - 1. Honeywell to match existing.
- F. Ceiling smoke detector shall be addressable, ionization (as indicated on drawings) smoke sensor with variable sensitivity, U.L. Listed OAP:
 - 1. Honeywell to match existing.
- G. Ceiling heat detector shall be addressable (fixed temperature):
 - 1. Honeywell to match existing.
- H. Ceiling heat detector (rate of rise) shall be addressable:
 - 1. Honeywell to match existing.
- I. Duct smoke detectors with sampling tubes and sensor. (Length to be field verified) Unit to contain a programmable relay to control fan shutdown upon activation or upon activation of any other device in programmed zone, U.L. Listed D (I).
 - 1. Honeywell to match existing.
- J. Remote LED indicator, ceiling mounted:
 - 1. Honeywell to match existing.
- K. Required when on drawings, zone adapter module-monitor:
 - 1. Honeywell to match existing.

- L. Required when on drawings, individual addressable modules:
 - 1. Honeywell to match existing.
- M. Required when on drawings, zone adapter module control signal:
 - 1. Honeywell to match existing.
- N. Required when on drawings, control relay, NEMA 1 enclosure:
 - 1. Honeywell to match existing.
- O. Required when visual circuits exceed 60% of main control panel capacity, power booster unit:
 - 1. Honeywell to match existing.
- P. Magnetic door holders, 24VDC, 25 lbs. minimum holding force:
 - 1. Honeywell to match existing.
- Q. Horn/strobe, ceiling mounted, 24 Volt 80 dBA minimum horn, ADA strobe light (15, 30, 75, 110/177Cd to meet all applicable codes), white finish:
 - 1. Gentex GCC24CW.
- R. Strobe only, ceiling mounted, ADA strobe light (15, 30, 75, 110/177Cd to meet all applicable codes), white finish:
 - 1. Gentex GCS24CW.
- U. Remote annunciator, minimum 40 character LCD type display, control pushbutton switches for alarm silence, trouble silence, system reset and manual evaluation switches that duplicate the main control panel, tone alert, system trouble LED and power on LED. Device shall have key "enable" switch to activate or de-activate the control switches. The annunciator shall duplicate the signals occurring at the main control panel. Annunciator to mount into a standard 2-gang or 4" square electrical box.
 - 1. Honeywell to match existing.
- V. Low Frequency Sounder Base that produces a 520Hz +/-10% with a square wave or equivalent.
 - 1. Gamewell B200S-LF.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The power for control panel shall be a dedicated 20 Amp 120-Volt circuit from panelboard with breaker lock. The circuit breaker shall be marked with red identification and the words "FIRE ALARM CIRCUIT" directly adjacent to the circuit breaker. The source power circuit shall be permanently identified on the fire alarm control unit; the identification shall indicate power source panel name, location, and circuit number. Identification tags shall be engraved phenolic name plates with red face and with core.
- B. The Contractor shall furnish and install in accordance with the manufacturer's instructions all wiring, conduit, and outlet boxes for the erection of a complete system as described herein and as shown on the Engineer/Architect's Drawings.
- C. Conductors shall be UL listed for power limited or non-power limited fire protective circuit conductors per NEC Article 760, as required. Color code shall be used and all wires shall be tagged at all junction points and shall test free from ground or crosses between conductors.
- D. Cross-connect to existing system as required, so the new system will annunciate the existing system alarms and the existing system will annunciate the new system. Connections to existing system will be supervised by and coordinated with Owner.
- E. Install conductors parallel with, or at right angles, to the sides and back of the enclosure. Connect conductors that are terminated, spliced or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the wiring diagrams of the system. All connections shall be made with approved crimp-on terminal spade lugs, or pressure-type terminal blocks.
- F. Conductors routed exposed above accessible ceilings may be routed as low voltage open wiring as applicable, refer to Section 26 0523.
- G. Cable Taps: Use numbered pressure plate terminal strips in junction or pull boxes, cabinets or equipment enclosures where any circuit tap is made.
- H. The number of t-taps made on a single addressable loop shall be verified with the equipment manufacturer. Contractor shall limit t-taps to 50 percent of manufacturer's recommendations, unless otherwise approved by the Engineer.
- I. System Wiring: Wire and cable shall be a type listed for its intended use, and shall be installed in accordance with the National Electric Code.
- J. The Contractor shall obtain from the fire alarm system manufacturer, written

instructions regarding the appropriate wire/cable to be used for this installation. (These instructions shall be incorporated into the Owner's manual at the end of the project.) Deviations from these written instructions will not be accepted without written approval by the Engineer, Owner and manufacturer.

- K. All junction boxes and covers shall be painted red and labeled. Label description to be verified at time of installation. Labels shall be engraved as outlined in Section 26 0500 -Electrical General Provisions with red surface, white letters.
- L. The number of devices to be installed on a loop shall be verified with the equipment manufacturer. Contractor shall maintain 30 percent spare capacity on addressable circuit.
- M. Notification Appliance Circuits (NAC) shall be circuited for 70% capacity per each branch circuit.
- N. The contractor shall provide and install additional NAC booster power supplies to accommodate required NAC's and other required 24VDC power. Booster Power supplies shall be located in electrical rooms or at the fire alarm panel location(s). Verify exact location with Engineer prior to installation. Install a smoke detector above all Booster Power supplies. Install dedicated 120V circuit, 20Amp breaker from nearest 120V electrical panel.
- O. Power supply total capacity shall not exceed 70% of rated value.
- P. Voltage drop per circuit shall not exceed 3.4 Volt drop. Contractor shall submit voltage drop calculations with submittals.

LOAD vs. DISTANCE NOTIFICATION APPLIANCE CIRCUIT (3.4 VOLT DROP)	
LOAD CURRENT	MAXIMUM DISTANCE FROM PANEL TO LAST APPLIANCE, IN FEET
0.1A	6,538
0.25A	2,615
0.50A	1,308
0.75A	871
1.0A	654
2.0A	327
3.0A	218
3.5A	186

- Q. Visual and audio device branch circuit conductor size shall be #14 AWG unless

noted otherwise.

- R. Batteries used for secondary (stand-by) power source shall be sized to operate the system for 24-hours under normal conditions, followed by not less than 5-minutes of alarm after 24-hours.
- S. Deleted.
- T. Signal devices that are removed and no new device is installed, provide blank plate and paint to match finish. Remove all conductors from box and conduits.
- U. Install a smoke detector above all fire alarm control panels, annunciators, power supplies, etc.
- V. An equipment manufacturer representative shall attend all meetings, to insure proper installation and to provide assistance in maintaining the operation of the existing system.
- W. Building acceptance is defined as all components being 100% operational and in conformance with current published performance specifications and data sheets. Payment will be contingent on the Owner's acceptance.
- X. The contractor shall install a multi-voltage relay (MR relay) rated for up to 10Amps when using an addressable control relay for controlling 120V loads. Provide 24VDC power as required.
- Y. The equipment supplier shall be responsible for determining the quantity of signal circuits required and candela rating of strobes to conform with AADAG illuminance specifications.
- Z. When multiple strobe lights are visible from one location, those strobe lights shall be synchronized.
- AA. The Contractor shall include 5% (minimum 5) spare notification devices (horn strobes and strobe lights, etc.) to be field located during construction. Any device not installed shall be turned over to the Owner as spare parts.
- BB. The Contractor shall coordinate with the Sprinkler Contractor the exact location and quantity of supervised devices (e.g. flow detectors, gate valves, etc.) prior to rough-in or installation. The Contractor shall install additional monitoring devices and wire complete as required to coordinate with the fire suppression system shop drawings.
- CC. When mechanical units come equipped with their own smoke duct detector, the contractor shall monitor the duct detector's alarm contacts and provide an addressable control relay to reset the duct detector from the fire alarm panel. Unit shutdown and duct detector power shall be by Mechanical Contractor.

- DD. Fire alarm vendor shall verify capacity of existing audio/visual and addressable loop circuits. Contractor shall install additional addressable loop cards, amplifier, power booster supply, control relays, etc. as necessary to provide a complete and fully operational system.
- EE. End of line resistors shall be located in the FAP, a NAC panel or a separate box, painted red, and identified as an EOL location. Separate boxes shall be flush mounted in finished spaces. All end of line resistor locations shall be identified on the "as-built" drawings.
- FF. Fire alarm pull stations installed but not in service shall be covered and legibly labeled "Not in Service".
- HH. Fire alarm devices installed but in service shall be covered for protection until system is in operation.

END OF SECTION 28 3100