PROJECT MANUAL

Douglas County Commissioners

COUNTY COURTHOUSE

Heating, Ventilation & Air Conditioning Improvements

Waterville, Washington

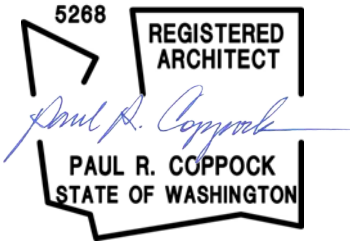
DOH No. 2241

ARCHITECTS & PLANNERS · The DOH Associates, PS · WENATCHEE, WASHINGTON

Douglas County Commissioners
COUNTY COURTHOUSE
Heating, Ventilation & Air Conditioning Improvements
Waterville, Washington

DOH No. 2241

February 15th, 2024



OWNER:

DOUGLAS COUNTY
140 19th Street NW
East Wenatchee, Washington 98802
telephone: (509) 884-7173

Board of Commissioners:

Mr. Dan Sutton, District 1

Mr. Kyle Steinburg, District 2

Mr. Marc Straub, District 3

County Administrator:

Ms. Jordyn Giulio

ARCHITECT:

THE DOH ASSOCIATES, PS
7 N. Wenatchee Avenue, Suite 500
Wenatchee, Washington 98801
telephone: (509) 662-4781

MECHANICAL ENGINEER:

HULTZ BTU
1111 Fawcett Avenue, Suite 100
Tacoma, WA 98402
telephone: (253) 383-3257

END OF SECTION – TABLE OF CONTENTS

SECTION 00 11 16 – INVITATION TO BID.

PART 1 – GENERAL

1.1 NOTICE TO CONTRACTORS

A. Sealed bids will be received by Douglas County at the Office of the Commissioners, 203 S Rainier St, Waterville, Washington for the construction of the Douglas County Courthouse Heating, Ventilation & Air Conditioning Improvements in Waterville, Washington.

B. Time limits for receipt of proposals are as follows:

1. Section 00 41 00 – Price Proposal must be received by 10:00 am, March 26th, 2024.

2. Section 00 41 10 – Subcontractor's Listing, if applicable, must be received not later than one hour after the Price Proposal time limit.

3. Bids received after this time will not be considered.

1.2 SCOPE OF WORK

A. The project is an upgrade of the existing courthouse HVAC system, including but not limited to: Replacement of the existing chiller and chilled water pump; Addition of economizers to the fan coils; Installation and/or replacement of motorized outside air dampers; Revisions to the existing fan coil return air filter locations; Installation of a split system cooling units or fan coil units to select locations; Removal of fan coils and installation of a VRF system; Addition of ventilation air to select locations; Cutting, patching, and painting of interior and exterior components of the building as required to properly integrate and conceal the new work.

1.3 PROJECT WALKTHROUGH

A. Due to the ongoing nature of the Owner's operations, access to the building will be restricted and opportunities to inspect the building will be limited to two scheduled site visits. Access to the non-public areas of this site, other than the guided walkthroughs on the two dates identified below, is prohibited.

1. Orientation Walkthrough

a. The Architect and Engineer will accompany the Owner in a walkthough of the project and will be available to answer questions on the project. The walkthrough will attempt to visit all areas of work in an orderly fashion.

b. The date and time for this walkthrough is scheduled for March 6th, 2024 at 8:00 am

2. Verification Walkthrough

a. The Owner will perform a walkthrough of the project for bidders to look at specific items. Contractors will be given the opportunity to measure,

photograph, and document existing conditions pertinent to the preparation of their bid. The walkthrough will attempt to visit areas of interest expressed by the attendees.

b. The date and time for this walkthrough is scheduled for March 20th, 2024 at 8:00 am

B. Attendance to at least one of the scheduled walkthroughs is **mandatory** for any prime bidder and any mechanical contractor listed as a sub-bidder on the prime bidders Subcontractor Listing.

1.4 BIDDING DOCUMENTS

A. Bidding Documents, including Instructions to Bidders, Form of Agreement, General Requirements, Drawings and Specifications entitled, County Courthouse Heating, Ventilation & Air Conditioning Improvements may be requested from the Architect in Portable Document Format (PDF) and may also be examined at various construction councils and builder association plan centers, a list of which is available from the office of the Architect.

1. Architect: The DOH Associates, PS, 7 N. Wenatchee Avenue, Suite 500, Wenatchee, WA 98801, (509) 662-4781

B. Prime Bidders and Mechanical sub-bidders may obtain up to two sets of printed Bidding Documents from the Architect's office. Electrical sub-bidders may obtain one set from the Architect's office.

C. Other sub-bidders and suppliers may purchase sets or parts of sets, and Prime bidders may purchase additional sets by paying for the cost of reproduction.

D. Prime Bidders, Mechanical and Electrical sub-bidders who are bidding without procuring plans from the Architect are required to send a written request to be included on the bidder's list and shall identify the source of their bid documents.

1.5 PREVAILING WAGE

A. The State of Washington prevailing wage rates are applicable for this public works project located in the Town of Waterville in Douglas County. Bidders are responsible to verify and use the most recent prevailing wage rates. The "Effective Date" for this project is the Bid Proposal due date above. The applicable prevailing wage rates may be found on the Department of Labor and Industries website located at:

1. https://fortress.wa.gov/lni/wagelookup/prvWagelookup.aspx.

B. Upon request, the Architect will mail a hard copy of the applicable prevailing wages for this project. Please contact the DOH Associates at (509) 662-4781.

1.6 TITLE VI STATEMENT

A. Douglas County, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. 2000d to 2000d-4) and Title 49 CFR, Subtitle A, Part 21 Nondiscrimination in Federally-Assisted Programs of the Department of Transportation), hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

1.7 BID OPENING

A. Bids will be opened and read publicly by the Owner's representative immediately following the hour set above.

1. All bidders are welcome to attend this public bid opening.

B. The Owner reserves the right to reject any and all bids and to waive irregularities or informalities, without cause.

1. By Order of: Douglas County Board of Commissioners

1.8 PUBLICATIONS

A. Published as legal advertisement:

1. Wenatchee World	February 22nd and 29th, 2024
2. Daily Journal of Commerce	February 22nd and 29th, 2024
3. Empire Press	February 22nd and 29th, 2024

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 00 11 16

SECTION 00 21 00 – INSTRUCTIONS TO BIDDERS

PROPOSALS, to be entitled to consideration, must be made in accordance with the following instructions:

PART 1 – GENERAL

1.1 EXAMINATION OF DOCUMENTS

A. Before submitting a proposal, a bidder shall:

1. Carefully examine the Drawings and Specifications.

2. Visit the site of the Work, making such observations and measurements as may be required.

a. All visits shall be conducted during the walkthroughs with the Owner as scheduled in the Invitation to Bid.

3. Fully inform himself of existing conditions and limitations.

4. Rely entirely upon his own judgment in preparing his proposal.

5. Include in his bid a sum sufficient to cover all items required by the Contract.

B. Failure to do any of the above shall not relieve the bidder from entering into Contract nor excuse him from performing the Work in strict accordance with the terms of the Contract Documents.

C. Except as specifically provided for hereinafter, a Bidder will not be entitled to additional compensation if he subsequently finds the existing conditions to require methods or equipment that he did not anticipate in arriving at his bid sum(s).

1.2 INTERPRETATIONS

A. Questions regarding Drawings and Specifications should be addressed to the Architect and will be answered by addenda addressed to all bidders.

B. Bidders finding discrepancies, omissions or points of doubtful meaning in the Documents should notify the Architect immediately, and if at all possible at least 36 hours before time set for bid opening.

C. Neither Owner nor Architect will be responsible for oral questions or interpretations. No statement regarding the Work, except as made by bidding documents or addenda thereto, shall be binding upon the Owner.

D. Questions received less than 4 days (96 hours) before time set for bid opening will not be answered.

E. All addenda issued during the bidding period will be incorporated into the Contract. Each bidder must acknowledge each addendum issued, in the space provided therefore on the bid form, in order to have his bid considered.

1.3 FORM OF PROPOSAL

A. Proposals shall be made upon forms provided for that purpose, signed in longhand by the bidder and with his company name and position typed in the spaces provided. If a bidder is a partnership or co-partnership, at least one partner must sign; if a corporation, print name of corporation, State in which incorporated, and follow by signatures of persons authorized to sign, naming the offices they hold in the corporation.

B. Each proposal shall specify a unit or lump sum price, typed or written with ink in both words and figures, for each of the separate items as called for. In case of discrepancy between the written words and figures, the written words shall govern. Any omission of prices for items, including unit costs, shown in the form of proposal or any addition in writing to the form, or any added conditions, limitations or provisions, will be liable to render the proposal informal and cause its rejection.

C. Fill all blank spaces in the bid form whether with a bid figure or with "Not Applicable" or "No Bid".

1.4 SUBSITUTIONS – PRIOR APPROVAL

A. Bids shall be based strictly upon items and materials either specified in the Contract Documents or which have received **written prior approval** as stipulated in DIVISION 1 of the Specifications. By signing the Agreement, the Contractor shall warrant that he has verified availability and delivery in order to properly complete the Work within the stipulated time of completion, and agrees that these are the items and materials to be utilized in the Work.

B. Where a manufacturer and model or type number is specified and other manufacturers are named in connection therewith, such additional named manufacturers may submit quotations on their equivalent products, subject to conformance with the provisions of the Contract Documents, without approval prior to bid opening.

C. Substitutions, other than of manufacturers so named, may be made **ONLY** under the conditions and procedures described in DIVISION 1 of the specifications.

1.5 DELIVERY OF PROPOSAL

A. Bid Proposal and Bid Guarantee shall be enclosed in an opaque sealed envelope, addressed and marked as follows so as to guard against premature opening of any bid:

1. (Name of Bidder Here)

(Owner's name and address here, w/ name of Owner's Representative, if any)

PROPOSAL FOR: Douglas County Commissioners
COUNTY COURTHOUSE
Heating, Ventilation & Air Conditioning Improvements

B. Bids shall be delivered to the Owner's representative appointed to receive bids, as required by the Invitation to Bid.

1.6 MODIFICATION OR WITHDRAWL OF PROPOSALS AFTER DELIVERY

A. A bidder may, without prejudice to himself, withdraw, modify, or correct a proposal after it has been deposited with the Owner, provided the request for such withdrawal, modification or correction is filed with the Owner in writing, hand delivered, or by electronic mail (e-mail) received before the time set for opening proposals. The original proposal, as modified by such written or electronic communication, will be considered as the proposal submitted by the bidder. Modifications will be accepted only if such modification is received prior to the bid opening time and same is confirmed in writing on the official letterhead of the Contractor. E-mail corrections shall be sent to jgiulio@co.douglas.wa.us and copied to info@doharchitects.com and must include the subject line "County Courthouse Bid Modification". It shall be the responsibility of the Bidder to acquire an "email delivered receipt" from the recipient confirming delivery prior to the time of bid.

B. Modification(s) of amounts should only state the amount to be added to, or subtracted from, the original submitted proposal so that the final bid will not be revealed until the sealed proposal is opened.

C. Oral or telephone modifications or withdrawals of bids cannot be considered.

D. No bidder will be permitted to withdraw his proposal between the closing time for receipt of proposals and the actual award of Contract, unless the award is delayed for a period exceeding 30 calendar days.

1.7 OPENING OF BIDS

A. Bids received prior to the time of opening will be securely kept, unopened. The Owner's representative, whose duty it is to open them, will determine when the specified time has arrived, and no bid received thereafter will be considered. No responsibility will be attached to the Owner for the premature opening of an improperly addressed or identified bid.

B. At the time and place fixed for the opening of bids, every bid received within the time fixed for receiving bids will be opened and read publicly, irrespective of irregularities therein, and a tabulation of bids will be furnished to all prime bidders as soon as possible thereafter.

1.8 BID GUARANTEE

A. As a guarantee that if awarded the Contract, the bidder will execute same, each bid shall be accompanied by a certified or bank cashier's check or by a Bid Bond, in the amount not less than five percent (5%) of the total Bid (including alternates, if any) made payable

to Douglas County. Bid Bonds must be furnished by a company licensed to do business as surety in the State of Washington.

B. The successful bidder's bid guarantee will be retained until he has entered into Contract and furnished satisfactory Performance Bond and Certificates of Insurance. The Owner reserves the right to hold the bid guarantees of the 2 next lowest bidders until he has done so, or for a period of 30 days, whichever is the shorter time. Bid guarantees of all other bidders will be returned as soon as practicable after bids are opened.

C. Should a bidder fail to enter into Contract and furnish bond and insurance certification, within 10 days after notice that his proposal has been accepted, his bid guarantee and the proceeds thereof shall be retained by the Owner as liquidated damages, not as penalty.

1.9 EVALUATION OF PROPOSALS – EVIDENCE OF QUALIFICATIONS

A. All proposals will be evaluated in accordance with criteria set forth in Washington State Law, the Requirements of the Contract, and the best interests of the Owner.

B. Numbering of Alternates, if any, does not imply the order in which Alternate Bids may be accepted. The Owner reserves the right to accept, or reject, any Alternate Bid in order to produce whichever combination of Base Bid and Alternates he determines will provide the best value for the Project as a whole. Determination of low bid shall be based upon the aggregate total of Base Bid plus selected Alternate Bids.

C. A bidder whose proposal is under consideration shall, upon request, promptly furnish satisfactory evidence of his financial resources, sub-bidders used in his proposal, his experience, and the organization and equipment he has available for the performance of the Contract.

D. The Owner reserves the right to reject any or all proposals without cause, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with State and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work.

E. Without limiting the generality of the foregoing, the Owner may reject any proposal for any of the following reasons:

1. If the proposal is on a form other than that furnished by the Owner, or if the Owner's form is altered, or if any part of the proposal form is detached.

2. If there are unauthorized additions, conditional or alternate pay items or irregularities of any kind which make the proposal incomplete, indefinite or otherwise ambiguous.

3. If for any reason the Owner determines the proposal to be non-responsive or obscure.

4. If the proposal does not contain a unit price for each pay item or a price for each alternate, if any.

5. If the proposal contains unit prices, if any, that are obviously unbalanced.

6. If the proposal is not accompanied by a proposal guarantee, such as a Bid Bond, or is accompanied by an insufficient or irregular proposal guarantee.

7. Any proposal from a Bidder which has previously failed to perform satisfactorily, or to complete on time, construction of any nature.

1.10 AWARD OF THE CONTRACT

A. The Douglas County Commissioners will, within thirty (30) days of Bid opening, either reject all bids or proceed to award the Contract for the above Work to the lowest qualified bidder with adequate security.

1. A Contract will not be awarded until Douglas County is satisfied that the successful bidder is reasonably familiar with the class of work contemplated and has the necessary capital, tools and experience to satisfactorily perform the work within the time stated. Completion of the work within the time stated is essential and prior commitments of the bidder, failure to complete other work on time, or reasonable doubt as to whether the bidder would procure equipment or complete the project on time would be cause for rejection of any bid. In addition, the Owner may determine any bidder not to be responsible in accordance with RCW 43.13.1911(9) and/or any other legal authority.

B. The acceptance of the Bid shall be a notice in writing titled "Notice of Award" signed by a duly authorized representative of Douglas County, and no other act shall constitute acceptance of the Bid.

C. Formal execution of the Agreement shall be consummated within 10 days of Notice of Award. Time for completion of the Contract shall commence at 12:00 noon on date of Agreement execution.

D. Within seven (7) days of the Notice of Award of Bid, and prior to execution of Agreement, successful bidder shall submit to the Architect for review:

1. Performance and Payment Bonds in the full amount of the Contract Sum, plus WSST.

2. Certificate(s) of Insurance as stipulated in the General Conditions and Supplementary Conditions.

3. Complete list of subcontractors and major materials suppliers to be utilized on the Work.

1.11 FORM OF AGREEMENT

A. The Form of Agreement shall be the AIA "Standard Abbreviated Form of Agreement Between Owner and Contractor" (A104-17), edited to include additional Conditions of the Contract.

1.12 OWNER'S PROTECTIVE BOND(S) and INSURANCE

A. The successful bidder shall furnish to the Owner a corporate surety bond in the full amount of the Contract Sum, **plus Washington State Sales Tax,** conditioned for the faithful performance of the Contract and for the payment of all laborers, mechanics, subcontractors, materialmen, and all persons who shall supply such person or persons, or subcontractors, with provisions and supplies for the carrying on of the work of said Contract. The surety must be authorized to do business in the State of Washington and be of form satisfactory to the Owner.

B. The successful bidder shall furnish Certificates of Insurance complying with the requirements set forth in the General Conditions and Supplementary General Conditions, and in form satisfactory to the Owner.

1.13 DATE OF COMPLETION and LIQUIDATED DAMAGES

A. The Contractor will be required to credit the Owner the amount(s) stipulated in the Supplementary General Conditions, not as a penalty but as liquidated damages, for each calendar day that the Contractor shall be in default beyond the number of days stipulated in the Form of Proposal as constituting the time for completion of the Contract.

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 00 21 00

SECTION 00 41 00 – FORM OF PROPOSAL

PART 1 – GENERAL

1.1 TO:

A. The Douglas County Commissioners

1. 203 S Rainier Street
   Waterville, WA 98858

1.2 FOR:

A. COUNTY COURTHOUSE Heating, Ventilation & Air Conditioning Improvements

1. Contract Documents Dated February 15th, 2024

2. To be constructed in Waterville, Washington

1.3 OFFER:

A. Having carefully examined the Bidding Requirements and Contract Documents for the project, as well as the premises and conditions affecting the Work, the undersigned proposes to furnish all labor and materials and perform all Work for the various parts of the construction in accordance with the above documents for consideration of the following amounts:

1. Combined Work Base Bid

_____ Dollars

($ _____).

2. Combined Work Alternates, the undersigned agrees to perform (or not perform), the following work items of work, as described in the Contract Documents and Schedule of Alternates, for the following additions to (or deductions from), the Base Bid:

1.4 EXTRA WORK

A. The undersigned agrees that, should any extra work be ordered, the following percentages shall be added to material and labor costs to cover overhead and profit:

1. Allowance to General Contractor for overhead and profit for extra work performed by the Contractor's own force:

   a. Fifteen percent (15%)

2. Allowance to General Contractor for overhead and profit for extra work performed by the Subcontractor:

   a. Ten percent (10%)

3. Allowance to each Subcontractor (of any tier) for overhead and profit for extra materials or work performed by the Subcontractor's own force:

   a. Fifteen percent (15%)

4. Allowance to each Subcontractor (of any tier) for overhead and profit for extra materials or work performed by its Subcontractor of any lower tier:

   a. Ten percent (10%)

B. The above percentages shall include **ALL** overhead and incidental costs, including insurance, fees, small tools, project management, superintendence and oversight, etc., except for performance and payment bonds, builder's risk insurance charges, direct labor and equipment rental costs and state sales tax.

1.5 SUBCONTRACTORS

A. The undersigned agrees, if awarded the Contract, to employ the subcontractors listed in Section 00 41 10, SUBCONTRACTOR LISTING, for the trades indicated. The Subcontractor listing in Section 00 41 10 shall be complete and shall include all Subcontractors required to be listed by State law and all additional Subcontractors where specifically requested. The undersigned further agrees that said subcontractors may not be changed without good cause and written consent of the Owner.

1.6 OVERHEAD, PROFIT & SALES TAX

A. **ALL** of the above bid prices include overhead and profit.

B. **NONE** of the above bid prices include Washington State Sales Tax.

1.7 CONTRACT and REQUISITES

A. If the undersigned is notified of the acceptance of this bid within 30 calendar days after the time set for the opening of bids, he agrees to execute an Agreement for the above work, for the compensation computed from the above sums, on the modified AIA Form of Agreement A104-17, included within, and to furnish Performance and Payment Bonds, Certificates of Insurance and Schedules, all as required by the Specifications and Instructions to Bidders.

1.8 BID GUARANTEE

A. The undersigned further agrees that the check or bid bond accompanying this proposal is left in escrow with the Architect, and that its amount is the measure of damages which the Owner will sustain by the failure of the undersigned to execute an Agreement for the Work in the form stipulated in the Bidding Documents, and furnish the required bonds, and that if the undersigned fails to execute said Agreement and deliver said bonds within 10 days after written Notice of Award of the Contract to him has been received, then the check shall become the property of the Owner, or the bid bond shall remain in full effect; but if this bid is not accepted within 30 days after the time set for opening bids, or

if the undersigned delivers said bonds and executes said Agreement, then the check shall be returned to him or the bid bond shall become void.

1.9 TIME OF COMPLETION

A. The undersigned agrees that if awarded the Contract, the Work will be substantially completed by **November 20, 2024**, and fully completed not more than 45 calendar days after Substantial Completion. The undersigned further agrees to provisions for payment of liquidated damages as stipulated in the Supplementary General Conditions.

1.10 ADDENDA

A. The undersigned hereby acknowledges receipt of the following Addenda, all costs, provisions and requirements of which Addenda have been incorporated in the foregoing proposal:

_____

(list each addendum number separately, if none received, enter "none")

1.11 BID FORM SIGNATURES

(Legal name of bidding firm)	Address
Contractor's Registration Number	City State Zip
By (Name and Title)	Phone
Signature	

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 00 41 00

SECTION 00 41 10 – SUBCONTRACTOR LISTING

PART 1 – GENERAL

1.1 TO:

A. The Douglas County Commissioners

1.2 FOR:

A. COUNTY COURTHOUSE Heating, Ventilation & Air Conditioning Improvements

1.3 SUBCONTRACTOR LISTING

A. The undersigned agrees, if awarded the Contract, to employ the following sub-contractors for the trades (or types of work) listed.

B. If the total of Base Bid and all additive Alternates exceeds $1,000,000, list the sub-contractor(s) responsible for the heating, ventilation and air conditioning, and plumbing as described in Chapter 18.106 RCW, and electrical as described in Chapter 19.28 RCW and as required below by the owner. The bidder shall not list more than one sub-contractor for each category of work identified, unless sub-contractors vary with bid alternates, in which case the bidder must indicate which sub-contractor will be used for which alternate(s). If a category of work listed above will not be sub-contracted, the bidder must list itself. Failure to name such sub-contractors or itself shall render the bidder's bid non-responsive.

1. _____

2. _____

3. _____

1.4 SUBMISSION

A. Submission of this form is required only when the contract values exceed the requirements listed above.

1.5 BID FORM SIGNATURES

_____ _____

By (Name and Title) Signature

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 00 41 10

DRAFT

AIA® Document A104™ – 2017

Standard Abbreviated Form of Agreement Between Owner and Contractor

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

« »
« »
« »

The Architect:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

TABLE OF ARTICLES

ARTICLE 1 THE WORK OF THIS CONTRACT

The Contractor shall execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 2 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 2.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 2.2 The Contract Time shall be measured from the date of commencement.

§ 2.3 Substantial Completion

§ 2.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check the appropriate box and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[« »] By the following date: « »

§ 2.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 2.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 2.3, liquidated damages, if any, shall be assessed as set forth in Section 3.5.

ARTICLE 3 CONTRACT SUM

§ 3.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be one of the following:
(Check the appropriate box.)

[« »] Stipulated Sum, in accordance with Section 3.2 below

[« »] Cost of the Work plus the Contractor's Fee, in accordance with Section 3.3 below

[« »] Cost of the Work plus the Contractor's Fee with a Guaranteed Maximum Price, in accordance with Section 3.4 below

(Based on the selection above, complete Section 3.2, 3.3 or 3.4 below.)

§ 3.2 The Stipulated Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 3.2.1 The Stipulated Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 3.2.2 Unit prices, if any:
(Identify the item and state the unit price and the quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 3.2.3 Allowances, if any, included in the stipulated sum:
(Identify each allowance.)

Item	Price

§ 3.3 Liquidated damages, if any, as outlined in Article 14:
(Insert terms and conditions for liquidated damages, if any.)

$500 Dollars per Day
For each calendar day after said time for Substantial Completion that the Work remains not substantially complete, and
$300 Dollars per Day
For each calendar day in excess of 45 days after Substantial Completion that the Final Completion is not attained, as certified by the Architect. »

ARTICLE 4 PAYMENT

§ 4.1 Progress Payments

§ 4.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 4.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 4.1.3 Provided that an Application for Payment is received by the Architect not later than the «fifth» day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the «fifteenth» day of the «following» month. If an Application for Payment is received by the Architect after the date fixed above, payment shall be made by the Owner not later than «forty five» («45») days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 4.1.4 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold retainage from the payment otherwise due as follows:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment and any terms for reduction of retainage during the course of the Work. The amount of retainage may be limited by governing law.)

«5%»

§ 4.1.5 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

«12» % «Twelve Percent»

§ 4.2 Final Payment

§ 4.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 18.2, and to satisfy other requirements, if any, which extend beyond final payment;

.2 the Contractor has submitted a final accounting for the Cost of the Work, where payment is on the basis of the Cost of the Work with or without a Guaranteed Maximum Price; and

.3 a final Certificate for Payment has been issued by the Architect in accordance with Section 15.7.1.

§ 4.2.2 The Owner's final payment to the Contractor shall be made no later than 45 days after the issuance of the Architect's final Certificate for Payment, or as follows:

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ARTICLE 5 DISPUTE RESOLUTION

§ 5. 1 RESOLUTION OF CLAIMS AND DISPUTES

§ 5.1.1 Pursuant to Article 21, All Claims, disputes and other matters in question of the Contractor arising out of, or relating to, the Contract Documents or the breach thereof (i.e., "Claims"), except claims which have been specifically waived under the terms of the Contract Documents, shall be decided exclusively by the following dispute resolution procedure unless the parties mutually agree in writing otherwise.

§ 5.1.2 The Contractor's timely written notice of claim, as provided in 5.1.2 above, shall provide the Owner with the amount of the claim and the extent of any claim for a change in the Contract Time with supporting data prior to the Level I meeting described below, unless the Owner agrees in writing to a continuance of the Level I meeting to ascertain more accurate supporting data. The notice shall be deemed to include a statement that the claim covers all changes in cost and in time (direct, indirect, impact, and consequential) to which the Contractor is entitled. Prior to being obliged to attend the Level II meeting, the Owner or its representatives shall have the right to audit the books and records of the Contractor and of any subcontractor of any tier making a Claim.

§ 5.1.2.1 Level I Within seven days of receipt of the written notice, the senior site representative of the contractor, the project representative of the Architect, and the project representative of the Owner shall meet, confer, and attempt to resolve the claim.

§ 5.1.2.2 Level II If the claim is not resolved within seven days of the close of the Level I meeting, an officer of the Contractor (who did not attend the Level I meeting), a principal of the Architect, and the Owner's senior representative (who did not attend the Level I meeting), shall meet, confer, and attempt to resolve the claim within seven days thereafter.

§ 5.1.2.3 The terms of the resolution of all claims concluded in Level I or II meetings shall be memorialized in writing and signed by each party immediately upon conclusion of the meeting (s).

§ 5.1.2.4 Mediation If, after the above two meetings, the claim is not resolved, the Contractor may bring no claim against the Owner in litigation unless the claim is first subject to non-binding mediation before a single mediator under the Voluntary Construction Mediation Rules of the American Arbitration Association. This requirement cannot be waived except by an explicit written waiver signed by the Owner. An officer of the Contractor and the Senior Representative of the Owner, both having full authority to settle the claim, must attend the mediation session. To the extent there are other parties in interest, such as subcontractors or suppliers, their representatives, with full authority to settle the claim, shall also attend the mediation session. Unless the Owner and the Contractor mutually agree in writing otherwise, all unresolved claims shall be considered at a single mediation session which shall occur prior to Final Acceptance by the Owner.

§ 5.1.2.5 Litigation The Contractor may bring no litigation on claims unless such claims have been properly raised and considered in the procedures of subparagraphs 15.2.1 and 15.2.2.4 above. All unresolved claims shall be waived and released unless the Contractor has strictly complied with the time limits of the Contract Documents, and litigation is served and filed within the earlier of (a) 60 days after Final Acceptance, of (b) 120 days after Substantial Completion. This requirement cannot, and shall not, be waived except by an explicit written waiver signed by the Owner.

§ 5.2.3 The Contractor shall diligently carry on the Work and maintain the Construction Network during any dispute resolution proceedings, unless otherwise agreed by it and the Owner in writing,

§ 5.2.4 The Contractor agrees that the Owner may join the Contractor as a party to any litigation/arbitration involving the Project in any way. All disputes shall be decided by litigation in strict accordance with the time limits prescribed in the Contract.

§ 5.2.5 Notwithstanding the above, the Owner may demand arbitration, before a single arbitrator appointed by the American Arbitration Association under the Expedited Procedure of the Construction Industry Arbitration Rules

within five days of the demand, for the purpose of seeking a declaratory judgment regarding the propriety of the Owner's prospective termination of the contractor. The hearing shall occur within seven days of the appointment of the arbitrator, and the award shall be made within two days of the close of the hearing and shall be final and binding.

ARTICLE 6 ENUMERATION OF CONTRACT DOCUMENTS

§ 6.1 The Contract Documents are defined in Article 7 and, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 6.1.1 The Agreement is this executed AIA Document A104™–2017, Standard Abbreviated Form of Agreement Between Owner and Contractor.

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§ 6.1.2 The Specifications:

(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

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Section	Title	Date	Pages

§ 6.1.3 The Drawings:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

« »

Number	Title	Date

§ 6.1.4 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are enumerated in this Article 6.

§ 6.1.5 Additional documents, if any, forming part of the Contract Documents:

.1 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents.)

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ARTICLE 7 GENERAL PROVISIONS

§ 7.1 The Contract Documents

The Contract Documents are enumerated in Article 6 and consist of this Agreement (including, if applicable, Supplementary and other Conditions of the Contract), Drawings, Specifications, Addenda issued prior to the execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 7.1.1 In case of conflict in the Contract Documents, notify Architect and obtain written instructions before proceeding.

§ 7.1.2 The Contractor shall provide all items shown or described in the Documents and perform all operations required, and shall furnish all labor, materials, equipment, services, required for their completion, including incidental items and services not specifically shown or described but necessary for proper completion of the work shown.

§ 7.1.3 Wherever in the Contract Documents an article, item of work, device, or piece of equipment is referred to in the singular number, such reference shall include as many such items or operations as are indicated on the Drawings or required to complete the installation.

§ 7.1.4 Specification and Drawing notes may include incomplete sentences where words such as "shall", "shall be", "the Contractor shall", and similar phrases shall be supplied by inference.

§ 7.1.5 The terms "approved", "or approved" and "as approved" mean approved by the Architect, and by any governing codes and officials, and by any quality standards specified as applicable to the work in question.

§ 7.1.6 The term "As directed" means as directed by the Architect.

§ 7.1.7 The term "provide" means to furnish and install.

§ 7.1.8 The terms "as required" and/or “as necessary” means as required by applicable codes or standards, and/or as may be required for proper completion of the work.

§ 7.1.9 Divisions and Sections included are listed in the "Table of Contents", together with the number of pages in each Section. The Contractor shall check his copies of the Specifications with the "Table of Contents" to ensure that they are complete.

§ 7.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind between any persons or entities other than the Owner and the Contractor.

§ 7.3 The Work

The term “Work” means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. The Work may constitute the whole or a part of the Project.

§ 7.4 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect’s consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 7.5 Ownership and use of Drawings, Specifications and Other Instruments of Service

§ 7.5.1 The Architect and the Architect’s consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect’s or Architect’s consultants’ reserved rights.

§ 7.5.2 The Contractor, Subcontractors, Sub-subcontractors and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to the protocols established pursuant to Sections 7.6 and 7.7, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect’s consultants.

§ 7.6 Digital Data Use and Transmission

The parties shall agree the transmission and use of Instruments of Service or any other information or documentation in digital form. is provided for the limited purpose of assisting the Contractor, Subcontractors, and Suppliers in the preparation of their shop drawings, cursory material takeoffs and/or site staking. Users acknowledge the electronic media supplied contains work in progress, are subject to change without notice, and may not accurately represent the scope or configuration of work noted, dimensioned, or specified in the contract documents. Contractor shall note that dimensions of the electronic work may not accurately reflect the noted dimensions or placement by shop drawings, notes and accurate adjustments to integrate with other materials and systems.§ 7.7 Digital Data Use and Reliance

Use of the electronic media by the Contractor, Subcontractors, and Suppliers shall be at the Contractor's sole risk and without liability, risk, or legal exposure to the Owner or Architect and the Contractor agrees to release and, to the fullest extent permitted by law, defend, indemnify, and hold harmless the Owner, Architect, Architect's consultants, agents, and fees arising from or relating to any such use by the Contractor or third parties.

§ 7.8 Severability

The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 7.9 Notice

§ 7.9.1 Except as otherwise provided in Section 7.9.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, or by courier, or as otherwise set forth below:

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§ 7.9.2 Notice of Claims shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 7.10 Relationship of the Parties

Where the Contract is based on the Cost of the Work plus the Contractor’s Fee, with or without a Guaranteed Maximum Price, the Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and exercise the Contractor’s skill and judgment in furthering the interests of the Owner; to furnish efficient business administration and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner’s interests. The Owner agrees to furnish and approve, in a timely manner, information required by the Contractor and to make payments to the Contractor in accordance with the requirements of the Contract Documents.

§ 7.10 Common Reference Standards

Reference in the Specifications to known standards such as codes, standard specifications, etc., promulgated by professional or technical Associations, Institutes, Societies are intended to mean the latest edition of each such standard adopted and published as of the date of the Contract for the Work of this Project, except where otherwise specifically indicated. Each such standard referred to shall be considered a part of the Specifications to the same extent as if reproduced therein in full. The following is a representative, though partial, list of such organizations together with the abbreviation by which each is identified.

ACI	American Concrete Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APWA	American Public Works Association (Including State Affiliates)
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASTM	American Society of Testing and Materials
AWI	Architectural Woodwork Institute

AWSC	American Welding Society Code
CSI	Construction Specifications Institute
DOT	Washington State Department of Transportation
IBC	International Building Code, latest edition
IFC	International Fire Code, latest edition
NBFU	National Bureau of Fire Underwriters
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
UBC	Uniform Building Code, reference IBC
WABO	Washington Association of Building Officials
UL	Underwriters' Laboratories, Inc.
WH	Warnock Hersey Fire Laboratories

§ 7.10.1 Refer to individual sections of Specifications for other names and abbreviations of trade associations and standards applicable to specific portions of the Work. In particular, refer to Divisions 22 and 23 for names and abbreviations applicable to the mechanical work, and refer to Division 26 for names and abbreviations applicable to the electrical work.

ARTICLE 8 OWNER

§ 8.1 Information and Services Required of the Owner

§ 8.1.1 Prior to commencement of the Work, at the written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 8.1.1, the Contract Time shall be extended appropriately.

§ 8.1.2 The Owner shall furnish initial survey and a legal description of the site.

§ 8.1.3 The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work. Refer also to Paragraph 16.1.

§ 8.1.4 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 9.6.1, the Owner shall secure and pay for other necessary approvals, easements, assessments, and charges required for the construction, use, or occupancy of permanent structures or for permanent changes in existing facilities.

§ 8.2 Owner's Right to Stop the Work

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents, or repeatedly fails to carry out the Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order is eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 8.3 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 15.4.3, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 21.

ARTICLE 9 CONTRACTOR

§ 9.1 Review of Contract Documents and Field Conditions by Contractor

§ 9.1.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 9.1.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 8.1.2, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies, or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the Contract Documents.

§ 9.1.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 9.2 Supervision and Construction Procedures

§ 9.2.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall be fully and solely responsible for the jobsite safety thereof unless the Contactor gives timely written notice to the Owner and Architect that such means, methods, techniques, sequences or procedures may not be safe.

§ 9.2.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

§ 9.2.2.1 The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work or to make its several parts fit together properly. Cutting and patching work shall be done by skilled workmen experienced in handling the materials being worked.

§ 9.2.2.2 The Contractor shall not structurally damage or endanger any portion of the Work or the work of the Owner or any separate contractors by cutting, patching the existing building(s) or improvements, or otherwise altering any work, or by excavation. The Contractor shall not cut or otherwise alter the work of the Owner or any separate Contractor except with the written consent of the Owner and of such separate Contractor. The Contractor shall not unreasonably withhold from the Owner or any separate Contractor his consent to cutting or otherwise altering the Work.

§ 9.3 Labor and Materials

§ 9.3.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 9.3.2 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

§ 9.3.3 The Contractor may make a substitution only with the consent of the Owner, after evaluation by the Architect and in accordance with a Modification.

§ 9.4 Warranty

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation or normal wear and tear under normal usage. All other warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 15.6.3.

§ 9.4.1 Testing Laboratory Labels:

All materials and equipment for which UL, NBFU or WH standards have been established, and their label service available, shall bear the appropriate UL, NBFU or WH label.

§ 9.4.2 Manufacturers' Trademarks and Names

The Architect reserves the right to review and request the removal of the manufacturers' trademarks on all materials and equipment which will be in plain view of the occupants of the building when placed in final position. Such removal shall be at no expense to the Owner. A decision on the necessity to remove or redesign may be obtained from the Architect in writing prior to bidding. Failure to obtain such approval shall constitute agreement to comply with such decision at a later date.

§ 9.4.3 In addition to the contractual guarantees contained in the General Conditions of the Contract, the Contractor shall obtain and furnish to the Architect written manufacturers'/installers' guarantees for all equipment, fixtures, assemblies and installations provided under the Contract, as called for in the Specifications and customarily available. Furnish with each guarantee: Date guarantee period starts, name, address and telephone number of the guarantor's representative nearest to Project, who, upon request of the Owner, will honor the guarantee during the guarantee period and provide services prescribed in guarantee. Refer to General Conditions and submit in conformance with Section 01 33 00, SUBMITTALS.

§ 9.5 Taxes

The Contractor shall pay sales, consumer, use, and other similar taxes that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 9.6 Permits, Fees, Notices, and Compliance with Laws

§ 9.6.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for permits, fees, licenses, and inspections by government agencies, such as Washington State Labor and Industries, necessary for proper execution and completion of the Work, excluding utility connection charges/fees and/or startup 'use fees', that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 9.6.1.1 Plan Check fees and Building Permit Fees to the Building Department of the governing jurisdiction **SHALL** be paid by the Owner. In additions, charges by serving utilities SHALL be paid by the Owner. It shall be the Contractor's responsibility to determine all additional fees which have, or have not, been paid, and to obtain and pay for all required permits and fees not already paid for or noted to be paid for by the Owner.

§ 9.6.1.2 The Contract Sum, and any agreed variations thereof, shall also include all taxes imposed by law, including business and occupation taxes, except Washington State Sales Tax. State Sales Tax will be paid by the Owner. A proportionate amount of the sales tax will be added to each payment voucher issued to the Contractor.

§ 9.6.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 9.7 Allowances

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. The Owner shall select materials and equipment under allowances with reasonable promptness. Allowance amounts shall include the costs to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts. Contractor's costs for unloading and handling at the site, labor, installation, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowance.

§ 9.8 Contractor's Construction Schedules

§ 9.8.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 9.8.2 The Contractor shall perform the Work in general accordance with the most recent schedule submitted to the Owner and Architect.

§ 9.9 Submittals

§ 9.9.1 The Contractor shall review for compliance with the Contract Documents and submit to the Architect Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents in coordination with the Contractor's construction schedule and in such sequence as to allow the Architect reasonable time for review. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them; (2) determined and verified materials, field measurements, and field construction criteria related thereto, or will do so; and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. The Work shall be in accordance with approved submittals.

§ 9.9.2 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents.

§ 9.10 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 9.11 Cutting and Patching

The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly.

§ 9.12 Cleaning Up

The Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work he shall remove, from and about the Project, any remaining waste materials and rubbish, as well as all his tools, construction equipment, surplus materials, sample panels, etc., and properly dispose of such at his expense. * * Refer also to detailed requirements in Section 01 74 00.

§ 9.12.1 Final clean-up of the Work shall include the following:

1) All floors and interior finished surfaces shall be vacuumed clean and dust free. Apply and buff out one coat approved wax to all resilient floorings (unless non-wax type).

2) Wash and polish all glass inside and outside. This work shall be done by persons experienced, skilled and equipped for such work.

3) Remove foreign matter, marks, stains, splatters of paint, roofing materials, etc., fingerprints, soil and dirt from all finished surfaces, whether interior or exterior, and from all hardware, fixtures and incorporated equipment.

4) Replace all HVAC filters and clean grilles, registers, ducts, blowers and coils if air handling units are operated during construction.

§ 9.12.2 The foregoing provisions shall apply to all areas of new construction, and also to any areas or portions of the existing building(s) and improvements that are in any way affected by the Work of this Contract.

§ 9.12.3 If the Contractor fails to properly clean up upon completion of the Work, the Owner may do so and the cost thereof shall be charged to the Contractor.

§ 9.13 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 9.14 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 9.15 Indemnification

§ 9.15.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 9.15.1.

§ 9.15.2 In claims against any person or entity indemnified under this Section 9.15 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 9.15.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts. After mutual negotiation of the parties, the Contractor waives immunity as to the Owner and Architect only under industrial insurance, Title 51 RCW. IF THE CONTRACTOR DOES NOT AGREE WITH THIS WAIVER, IT MUST PROVIDE A WRITTEN NOTICE TO THE OWNER PRIOR TO THE DATE FOR THE RECEIPT OF BIDS, OR THE CONTRACTOR WILL BE DEEMED TO HAVE WAIVED THIS IMMUNITY.

§ 9.16 The Architect will furnish one clean full size set of Drawings and Specifications to the Contractor to be maintained as Project Record. Record Drawings and Specifications shall be maintained daily not used by the Contractor, shall be kept up-to-date during the entire course of the Work and shall be available on request for examination by the Architect and, when necessary to establish current configurations and clearances for other parts of the Work.

§ 9.16.1 Record Drawings shall be maintained accurately and neatly and as approved by the Architect. The following information shall be clearly shown on the Record Documents:

1) All deviations from sizes, locations, detail or other features of installation as shown in the original Contract Documents. These shall be recorded whether covered by Change Order, Field Order, or effected by Contractor's option.

2) Final, accurate locations of underground and all other concealed items, dimensioned to column lines, walls, fire hydrants, survey monuments or other permanent features. All turns, invert elevations and rates of all piping runs shall be verified and accurately noted or shown.

§ 9.16.2 For work concealed in the building, sufficient information shall be given to allow future location with reasonable accuracy and ease. In some cases this may be by dimension. In others, it may be sufficient to accurately illustrate the Work on the Drawings in relation to parts of the building near which it was installed.

§ 9.16.3 Complete Record Documents, maintained as approved by the hereinbefore described are a necessary and mandatory part of the construction process. The Work shall not be considered complete until they are completed and returned to the Architect, **nor will partial payment for any part of the Work be authorized unless Record Documents applicable to that portion of the Work are current and accurate to date.**

§ 9.17 All operations of the Contractor, his subcontractors and employees, including but not limited to, construction, fabrication, delivery, storage, stockpiling, parking and incidental movement or access, shall be contained within the 'Contract Limits' indicated on the Drawings, if any, or if no such limits are shown, within the boundaries of the Owner's contiguous property.

§ 9.17.1 Contractor shall take all necessary measure to regulate vehicle and pedestrian traffic as necessary, limiting access to designated routes and parking to designated locations.

ARTICLE 10 ARCHITECT

§ 10.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction, until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 10.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld. Nothing contained in this Section or in other portions of the Contract Documents shall be construed as requiring the Architect to direct the method or manner of performing any work under this Contract or to be responsible for the Contractor's performance in any respect.

§ 10.3 The Architect will visit the site at intervals appropriate to the stage of the construction to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general, if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 10.4 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 10.5 Based on the Architect's evaluations of the Work and of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 10.6 The Architect has authority to reject Work that does not conform to the Contract Documents and to require inspection or testing of the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the work.

§ 10.7 The Architect will review and approve or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 10.8 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect will make initial decisions on all claims, disputes, and other matters in question between the Owner and Contractor but will not be liable for results of any interpretations or decisions rendered in good faith.

§ 10.9 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

ARTICLE 11 SUBCONTRACTORS

§ 11.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site.

§ 11.2 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the Subcontractors or suppliers proposed for each of the principal portions of the Work. The Contractor shall not contract with any Subcontractor or supplier to whom the Owner or Architect has made reasonable written objection within ten days after receipt of the Contractor's list of Subcontractors and suppliers. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 11.3 Contracts between the Contractor and Subcontractors shall (1) require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by the Contract Documents, assumes toward the Owner and Architect, and (2) allow the Subcontractor the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contract Documents, has against the Owner.

§ 11.4 Except for those certain rights of information and reasonable objection as stipulated hereinbefore under this Article, the Owner shall have no involvement with, or responsibility for or accruing from, the Contractor's sub-contracts. The (Prime) Contractor is the only party to the agreement with the Owner and is fully responsible to the Owner for the performance of all the work of the Contract. Which portions, if any, of the Work the Contractor chooses to sub-contract to other parties shall be entirely the Contractor's choice, and responsibility, and all consequences of such sub-contracting shall accrue solely to the Contractor.

ARTICLE 12 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 12.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 12.2 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's activities with theirs as required by the Contract Documents.

§ 12.3 The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a Separate Contractor because of delays, improperly timed activities, or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs incurred by the Contractor because of delays, improperly timed activities, damage to the Work, or defective construction of a Separate Contractor.

ARTICLE 13 CHANGES IN THE WORK

§ 13.1 By appropriate Modification, changes in the Work may be accomplished after execution of the Contract. The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract

consisting of additions, deletions, or other revisions, with the Contract Sum and Contract Time being adjusted accordingly. Such changes in the Work shall be authorized by written Change Order signed by the Owner, Contractor, and Architect, or by written Construction Change Directive signed by the Owner and Architect. Upon issuance of the Change Order, Field Order, or Construction Change Directive, the Contractor shall proceed promptly with such changes in the Work, unless otherwise provided in the Change Order, Field Order, or Construction Change Directive.

§ 13.2 Adjustments in the Contract Sum and Contract Time resulting from a change in the Work shall be determined by mutual agreement of the parties or, in the case of a Construction Change Directive signed only by the Owner and Architect, by the Contractor's cost of labor, material, equipment, and reasonable overhead and profit, unless the parties agree on another method for determining the cost or credit. Pending final determination of the total cost of a Construction Change Directive, the Contractor may request payment for Work completed pursuant to the Construction Change Directive. The Architect will make an interim determination of the amount of payment due for purposes of certifying the Contractor's monthly Application for Payment. When the Owner and Contractor agree on adjustments to the Contract Sum and Contract Time arising from a Construction Change Directive, the Architect will prepare a Change Order.

§ 13.3 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work.

§ 13.4 If concealed or unknown physical conditions are encountered at the site that differ materially from those indicated in the Contract Documents or from those conditions ordinarily found to exist, the Contract Sum and Contract Time shall be equitably adjusted as mutually agreed between the Owner and Contractor; provided that the Contractor provides notice to the Owner and Architect promptly and before conditions are disturbed.

§ 13.5 It shall be the responsibility of the Contractor before proceeding with any change to satisfy himself that the change has been properly authorized on behalf of the Owner. No change in the Contract will be allowed unless the change has been authorized in writing by the Owner, and the compensation or method thereof is stated in such written authority.

§ 13.5.1 Claims for extra costs will not be considered unless the claim is based on a written order signed by the Owner and Architect excepting only as provided for work in an emergency affecting the safety of life or the work or of adjoining property.

§ 13.6 Contract Unit Prices, as bid, shall remain valid and in force during the term of the Work, (except as provided for above,) and shall be reconciled with the total construction cost before filing of Notice of Completion.

§ 13.6.1 Unit Prices shall not apply to work which the Contractor may elect to do for his own convenience, nor to work required to correct errors, or unacceptable work of the Contractor.

§ 13.7 Should the Contractor encounter conditions differing substantially from those indicated in the Contract Documents, or unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract, which changed or unusual conditions will be considered by the Contractor as the basis for a claim for extra compensation, the Contractor shall promptly and before any such conditions are disturbed, notify the Owner through the Architect, of the alleged conditions in writing.

§ 13.7.1 If the Owner is not given written notice prior to the conditions being disturbed, the Contractor will be deemed to have waived any claim or claims for extra compensation in any manner arising out of the changed or unusual conditions.

§ 13.7.2 If the Owner shall determine the conditions to be such as to justify a claim for additional compensation, he may provide for additional payment for the particular phase of work in question by a negotiated agreement with the

Contractor based on unit prices if provided for in the Contract, or by any other equitable arrangement mutually agreed upon by the Owner and the Contractor and consented to in writing.

§ 13.7.3 In any event, the Contractor shall proceed with other elements of the Work that are not affected by the alleged changed conditions pending execution of a Change Order if a claim is recognized under the above provisions.

§ 13.8 The Contractor's margin (mark-up) for overhead and profit, added to his actual labor and material, or subcontract cost, of work proposed to be done under change order, shall not exceed the percentages as bid and stipulated in the Agreement, (or if no percentages are so stipulated, shall be reasonable, and comparable to prevailing practice at the time and location of the Work).

§ 13.9.1 "Labor costs" as used herein may include mandatory labor taxes and mandatory benefits. All other costs, including general taxes, fees, increased bond and insurance costs, superintendence, administration, support, etc., shall be covered by the stipulated overhead and profit mark-up.

§ 13.9.2 If additional permits, connection charges, or "use fees" are legally required **due to a change order**, the Owner will reimburse the Contractor for the actual cost of such charges.

§ 13.9.3 Sub-contractors shall be generally bound by the provisions of this Article and their overhead and profit mark-up shall be reasonable and comparable to prevailing practice at the time and location of the Work. If sub-contractors are determined by the Architect to be unreasonable in this regard, the Contractor shall cooperate in obtaining alternative sub-bids for the work proposed.

ARTICLE 14 TIME

§ 14.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing this Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 14.2 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 14.3 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 14.4 The date of Substantial Completion is the date certified by the Architect in accordance with Section 15.6.3.

§ 14.5 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) changes ordered in the Work; (2) by labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions not reasonably anticipatable, unavoidable casualties, or any causes beyond the Contractor’s control; or (3) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine, subject to the provisions of Article 21.

§14.5.1 Except for substantial and unreasonable delays caused by acts or omissions of the Owner, persons acting on behalf of the Owner, or separate contractors employed by the Owner, the Contractor’s sole remedy for delay shall be extension of the Contract Time, and it shall not be entitled to damages or additional compensation for direct, indirect or “impact” costs of any kind due to delays.

§14.5.2 In the event substantial and unreasonable delays caused by the acts or omissions of the Owner, persons acting on behalf of the Owner or separate contractors employed by the Owner, the Contractor may be entitled to damages or equitable compensation therefore, provided:

1) Contractor shall give written notice of claim to the Owner and Architect, in accordance with Article 21, that such delay is pending or has commenced. No damage or adjustments shall be allowed for any day prior to receipt of such notice.

2) Based on the difficulties and disputes commonly attending claims based on delay, the parties specifically agree that the Contractor’s maximum compensation for damages due to delay, including direct, indirect or impact damage of every nature, shall not exceed the same daily sums state herein as liquidated damages du the Owner for Contractor delay during the applicable period (i.e., before substantial completion or after).§ 14.6 It is expressly

understood and agreed by and between the Contractor and the Owner that the time for completion of the Work described herein is reasonable and acceptable taking into account the average yearly climatic conditions at the site of the Work and recognizing the possibility that inclement weather may temporarily stop work.

§ 14.6.1 For purposes of establishing a basis for evaluating the effect of the inclement weather on this Project and its completion date, the Owner and Contractor agree that the construction period stipulated herein allows for 30 lost working days every 12 months due to such inclement weather. For this purpose a lost working day is defined as a regular 8-hour working day during which the total work force on the Project is reduced to less than 25% of the average of the previous 3 days of full force employment when unaffected by weather. For each such lost working day exceeding the stated and expected 30, 1 day of time extension will be added to the Contract completion date. No adjustment in completion date will be made if lost working days total less than 2-1/2 days per month.

§ 14.6.2 Therefore, in the event that the Contract is not completed within the stipulated time or by, or prior to, a date to which the time for completion may have been extended, the Contractor and his surety shall be liable for, and shall pay to the Owner, as liquidated damages but not as a penalty, the sum(s) as outlined in Paragraph 3.5.

§ 14.6.3 Because of the difficulty in computing the actual damages which will result, the amount of Liquidated Damages as set forth above are hereby estimated, agreed upon and determined in advance by the parties hereto as a reasonable forecast of the actual damages which the Owner will suffer by the failure of the Contractor to complete the Work within the stipulated time, or prior to a date to which the period of completion may have extended.

§ 14.6.4 In the event that separately usable parts of the Work are substantially completed by the stipulated date for completion, the liquidated damages may be reduced proportionately, as determined by the Architect.

§ 14.6.5 The Contractor further agrees that any such deduction or payment shall not in any degree release the Contractor from further obligations and liabilities in respect to the fulfillment of the entire Contract.

§ 14.6.6 Liquidated Damages shall not be assessed the Contractor for days for which an extension of time will have been granted, or for delays which are beyond the control of the Contractor, or for delays caused by actions or neglect of the Owner or any of its officers or employees, but no such allowance shall be made unless a claim therefor is presented in writing to the Owner within 5 days after the occurrence of such delay, and the contractual time for completion is duly extended.

ARTICLE 15 PAYMENTS AND COMPLETION

§ 15.1 Schedule of Values

§ 15.1.1 Where the Contract is based on a Stipulated Sum or the Cost of the Work with a Guaranteed Maximum Price pursuant to Section 3.2 or 3.4, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Stipulated Sum or Guaranteed Maximum Price to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy required by the Architect. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 15.1.2 The allocation of the Stipulated Sum or Guaranteed Maximum Price under this Section 15.1 shall not constitute a separate stipulated sum or guaranteed maximum price for each individual line item in the schedule of values.

§ 15.2 Control Estimate

§ 15.2.1 Where the Contract Sum is the Cost of the Work, plus the Contractor's Fee without a Guaranteed Maximum Price pursuant to Section 3.3, the Contractor shall prepare and submit to the Owner a Control Estimate within 14 days of executing this Agreement. The Control Estimate shall include the estimated Cost of the Work plus the Contractor's Fee.

§ 15.2.2 The Control Estimate shall include:

.1 the documents enumerated in Article 6, including all Modifications thereto;

.2 a list of the assumptions made by the Contractor in the preparation of the Control Estimate to supplement the information provided by the Owner and contained in the Contract Documents;

.3 a statement of the estimated Cost of the Work organized by trade categories or systems and the Contractor's Fee;

.4 a project schedule upon which the Control Estimate is based, indicating proposed Subcontractors, activity sequences and durations, milestone dates for receipt and approval of pertinent information, schedule of shop drawings and samples, procurement and delivery of materials or equipment the Owner's occupancy requirements, and the date of Substantial Completion; and

.5 a list of any contingency amounts included in the Control Estimate for further development of design and construction.

§ 15.2.3 When the Control Estimate is acceptable to the Owner and Architect, the Owner shall acknowledge it in writing. The Owner's acceptance of the Control Estimate does not imply that the Control Estimate constitutes a Guaranteed Maximum Price.

§ 15.2.4 The Contractor shall develop and implement a detailed system of cost control that will provide the Owner and Architect with timely information as to the anticipated total Cost of the Work. The cost control system shall compare the Control Estimate with the actual cost for activities in progress and estimates for uncompleted tasks and proposed changes. This information shall be reported to the Owner, in writing, no later than the Contractor's first Application for Payment and shall be revised and submitted with each Application for Payment.

§ 15.2.5 The Owner shall authorize preparation of revisions to the Contract Documents that incorporate the agreed-upon assumptions contained in the Control Estimate. The Owner shall promptly furnish such revised Contract Documents to the Contractor. The Contractor shall notify the Owner and Architect of any inconsistencies between the Control Estimate and the revised Contract Documents.

§ 15.3 Applications for Payment

§ 15.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 15.1, for completed portions of the Work. The application shall be notarized, if required; be supported by all data substantiating the Contractor's right to payment that the Owner or Architect require; shall reflect retainage if provided for in the Contract Documents; and include any revised cost control information required by Section 15.2.4. Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 15.3.2 With each Application for Payment where the Contract Sum is based upon the Cost of the Work, or the Cost of the Work with a Guaranteed Maximum Price, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed progress payments already received by the Contractor plus payrolls for the period covered by the present Application for Payment, less that portion of the progress payments attributable to the Contractor's Fee.

§ 15.3.3 Payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment stored, and protected from damage, off the site at a location agreed upon in writing.

§ 15.3.4 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or other encumbrances adverse to the Owner's interests.

§ 15.4 Certificates for Payment

§ 15.4.1 Prior to submittal of his first Application for Payment, the Contractor shall submit, in form and detail as approved by the Architect, a Schedule of Values allocated to the various portions of the Work. This Schedule, as approved, will serve as the basis for certification of the Contractor's Application for Payment.

§ 15.4.1.2 The Schedule of Values shall allocate, as a line item, a minimum of 2% of the Contract Sum (in addition to stipulated retainage) to "Project Closeout" work including "Completion/Correction List" items, record documents, final cleaning, lien releases, etc.

§ 15.4.1.3 Applications for payment shall be based on the previously approved Schedule of Values, and represent the value of labor and materials incorporated in the Work, and of all stable materials suitably stored at the site, or approved, bonded storage up to and including the last day of the preceding month, less the aggregate total of all previous payments.
Until the Work is complete, the Owner will pay 95% of all amounts due the Contractor on account of progress payments. The remaining 5% being withheld as retainage as provided for under Washington State Law.

§ 15.4.1.4 However, after the Work is 95% complete, the Contractor may request that the total amount of retainage be reduced to 100% of the value of the work remaining on the Project and, if the manner of completion of the Work and its progress are and remain satisfactory to the Architect, and in the absence of other good and sufficient reasons, the Architect may, on presentation by the Contractor of Consent of Surety, certify for, and the Owner make, subsequent payments in such amounts as will adjust the amount of retainage to an amount equal to the portion of the Contract Sum not then certified for payment.

§ 15.4.1.5 Prior to first Application for Payment the Contractor shall exercise in writing to the Owner, one of the following options:

§ 15.4.1.6 Retained percentage will be:

a) Retained in a fund by the Owner until 45 days following the final acceptance of the Work as completed; or

b) Placed in escrow in a mutually selected bank or trust company until 45 days following the final acceptance of the Work completed.

c) Addressed by a Bond, pursuant to RCW 60.28, as acceptable to the Owner and the Washington State Department of Revenue, in the amount of 5% of the total original Contract Sum, plus Washington State Sales Tax, with the provisions for increases and/or decreases in the Contract Sum as the project progresses.

§ 15.4.1.7 If the Contractor, option b), as set forth above, is selected, an escrow account shall be established in a financial institution selected by the Contractor and approved by the Owner, upon commencement of the Work.

§ 15.4.1.8 If the Prime Contractor receives interest on the retainage, then the subcontractors shall receive interest from the Prime Contractor on the amount of retainage withheld from payments due them by the Prime Contractor, subject to the negotiated terms and conditions of the sub-contract.

§ 15.4.1.9 The escrow agreement shall provide that the financial institution will act as escrow agent. Compensation to the escrow agent for establishing and maintaining the escrow account shall be paid from interest accrued in the account.

§ 15.4.1.10 As each progress payment is made, the retainage with respect to that payment shall be deposited by the Owner in the escrow account. When the Work has been fully completed in a satisfactory manner and the owner has approved final payment, the escrow agent shall pay to the Contractor the full amount of funds remaining in the account, including net balance of the interest paid to the account.

§ 15.4.1.11 Payments for materials or equipment items stored on or off the site shall be based on the Contractor's receipted purchase invoice amount (i.e., Contractor's cost).

§ 15.4.1.12 Upon satisfactory submittal of an Application for Payment to the Architect, not later than the third working day of the month, the Owner will make partial payment to the Contractor on the basis of a duly certified approved estimate of the work performed up to the 30th day of the previous month.

§ 15.4.1.13 The Contractor shall include with each Application for Payment, after the first, a notarized affidavit stating that all subcontractors and suppliers have been paid, less earned retainage, as their interest appeared in the last payment received. No Application for Payment will be processed unless accompanied by such notarized affidavit and statement.

§ 15.4.1.14 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor's, the escrow agent shall make payment to the Contractor as may be mutually agreeable to the Owner and Contractor.

§ 15.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluations of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 15.4.3 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 15.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 15.4.1. If the Contractor and the Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 9.2.2, because of

.1 defective Work not remedied;
.2 third-party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 15.4.4 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 15.4.3, in whole or in part, that party may submit a Claim in accordance with Article 21.

§ 15.5 Progress Payments

§ 15.5.1 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to sub-subcontractors in a similar manner.

§ 15.5.2 Neither the Owner nor Architect shall have an obligation to pay or see to the payment of money to a Subcontractor or supplier except as may otherwise be required by law.

§ 15.5.3 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 15.5.4 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If

approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 15.6 Substantial Completion

§ 15.6.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. Substantial Completion will not be awarded earlier the date or days set forth in the Form of Proposal, unless so determined by the Architect on the date Substantial Completion is achieved. No other act by the Owner or Architect shall be construed to authorize issuance of a Certificate of Substantial Completion prior to the date or days set forth in the Form of Proposal.

§ 15.6.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 15.6.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. When the Architect determines that the Work or designated portion thereof is substantially complete, the Architect will issue a Certificate of Substantial Completion which shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 15.6.3.1 When the Architect determines that the Work is fully completed, he will certify for payment based on 100% completion, less retainage.

§ 15.6.3.2 Upon notification by the Contractor that the work of the Contract is substantially complete, the Architect, his Consultants, and the Owner, will conduct a 'pre-final inspection' making note of any apparent, non-conforming, incomplete or unsatisfactory items of Work. These items will be assembled into a 'Completion/Correction List' and attached to the Certificate of Substantial Completion.

§ 15.6.3.3 After proper completion of all Work under the Contract, the Contractor shall submit a letter addressed to Architect stating that the Contractor, or his superintendent in charge of job, has personally made a complete inspection of the job and that all items contained in the 'Completion/Correction List', or not in conformance with Plans and Specifications, have been completed; and that entire Project is ready for final inspection by Architect and Owner. This letter shall be accompanied by a copy of the Architect's 'Completion/Correction List' with each line item initialed and dated by the person responsible for execution of that particular item of work.

§ 15.6.3.4 Upon receipt of written notice that the work is ready for final inspection and acceptance, and upon receipt of a 100% Completion Application for Payment, the Architect (and Owner) will promptly make such inspection. When the Architect determines that the work has been fully and properly completed, he will certify for payment based on 100% completion, less retainage. This Certi-fication for Payment shall also constitute certification by the Architect, to the Owner, that to the best of his knowledge, based on his observations at the site and other information available, the work has been completed in accordance with the terms and conditions of the Contract Documents.

§ 15.6.3.5 If the final inspection reveals any defect in the Work, under the Contract Documents, such defects shall be repaired or unsatisfactory work replaced as the Architect may require, and no extension of the Contract time will be granted because of the time required to remedy such defects.

§ 15.6.3.6 **If the Architect is required to make more than one 'Completion/ Correction List' or conduct additional inspections and/or follow-up administration and monitoring, after the scheduled final inspection in order to determine that all items on the 'Completion/Correction List' have been finally and properly corrected, the cost of his time expended in so doing, including travel, administrative and clerical time, shall be paid for by the Contractor, either directly, or by deduction from the Contract sum with such monies being used instead to compensate the Architect.**

§ 15.6.4 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 15.7 Final Completion and Final Payment

§ 15.7.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions stated in Section 15.7.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 15.7.2 Final payment shall not become due until the Contractor has delivered to the Owner a complete release of all liens and claims arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien and/or claim could be filed, or a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien and/or claim remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including costs and reasonable attorneys' fees. Payment of the retained percentage shall be withheld for a period of 30 days following certification of 100% completion payment by the Architect, and shall be paid the Contractor at the expiration of said 30 days in event no claims, as provided by law, have been filed against such funds and the Contractor has delivered to the Owner a complete release of all claims arising out of this Contract or receipts in full covering all labor, materials and equipment for which a claim could be filed, or a bond satisfactory to the Owner indemnifying him against any such claim; and provided further that releases have been obtained from the State Department of Labor and Industries (including Final Affidavit of Legal Wages paid) and also the Washington State Tax Commission, the State of Washington Employment Security Department, and all other departments and agencies having jurisdiction over the activities of the Contractor. In the event any such claims are filed, the Contractor shall be paid said retained percentages less an amount sufficient to pay any such claims, together with a sum sufficient to pay the costs of legal action, including attorneys' fees.

§ 15.7.2.1 Contractor shall coordinate with the Owner's representative as required to see that required `Notice(s) of Completion of Public Works Project' is filed with the appropriate agencies in a timely manner.

§ 15.7.3 The making of final payment shall constitute a waiver of claims by the Owner except those arising from

.1 liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents;
.3 terms of special warranties required by the Contract Documents; or
.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 15.7.4 Acceptance of final payment by the Contractor, a Subcontractor or supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of the final Application for Payment.

ARTICLE 16 PROTECTION OF PERSONS AND PROPERTY

§ 16.1 Safety Precautions and Programs

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

.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation, or replacement in the course of construction.

The Contractor shall comply with, and give notices required by, applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons and property and their protection from

damage, injury, or loss. The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, a Subcontractor, a sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 16.1.2 and 16.1.3. The Contractor may make a claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 9.15.

§ 16.1.2 The Contractor shall take particular care to protect existing improvements including, but not limited to, underground utilities, landscaping and adjoining property and structures, and to avoid damage thereto. He shall, at his own expense, completely repair any damage thereto caused by his operations.

§ 16.1.3 As a convenience to the Contractor, the Contract Documents attempt to show the approximate location of existing underground utilities and items to the extent that they are known, but neither the Owner nor the Architect can or does purport to know or guarantee that all such utilities and items are shown or that indicated locations are accurate.

§ 16.1.4 Any of the above described damages, if repaired by others, shall be charged to the Contractor.

§ 16.1.5 Work in place that is subject to injury because of operations carried on adjacent thereto shall be covered, boarded up or substantially enclosed with adequate protection. Permanent openings used as thoroughfares for the introduction of work and materials to the structure shall have heads, jambs and sills well blocked and boarded. All forms of protection shall be constructed in such manner that on completion, the entire Work will be delivered to Owner in unblemished conditions.

§ 16.2 Hazardous Materials and Substances

§ 16.2.1 The site of the Work (existing building) and adjunct improvements have not been fully surveyed by a qualified professional to determine what, if any, asbestos-containing materials or PCB's may exist within the limits of the Work. The Owner and Architect are not aware of the existence of any such materials, and are reasonably certain that none do exist within the limits of the Work. However, aforesaid reasonable certainty notwithstanding, it shall be the Contractors' sole responsibility to protect his workers, suppliers, all other properly interested parties, and the General Public, from the possibility of friable asbestos or PCB contamination should such material(s) be encountered.

§ 16.2.2 If materials containing, or reasonably suspect of containing, friable asbestos, PCB's (Polychloronatedbiphenyl), or other material generally recognized as being highly hazardous are encountered, the Contractor shall immediately stop work in the area affected, secure the area, and notify the Owner and the Architect. Sampling and testing of materials will be conducted and, if necessary, a system of work area containment and methods of abatement (removal or encapsulation) will be developed. If agreeable to both parties, a change order may be written to cover the Contractor's additional time and costs, or, the Owner may arrange to have abatement work done under separate contract. In an extreme case, the Owner may at his option, suspend or abandon the Project as provided in Article 12 of this Agreement.

§ 16.2.3 Certain particularly hazardous materials, including friable asbestos (and PCB's or natural gas,) are present in the existing building and/or on the site and (some of) these materials are scheduled to remain on the premises during, and after completion of the work of the Contract.

§ 16.2.3.1 All work shall be conducted in such manner and with all necessary precautions so as not to disturb these materials in any way, and so as to ensure that workers, suppliers and other properly interested parties associated with this Contract, and future occupants of, or visitors to, the premises, shall not be exposed to contamination or hazard as a result of the work of the Contract.

§ 16.2.4 Without limiting the generality of the foregoing, the Contractor is advised that such hazardous materials to remain (under Basic Bid) specifically include, but are not necessarily limited to, asbestos piping insulation, dust and debris in the existing pipe tunnels, crawl space and attic. Workmen of trades such as electrical, mechanical, insulation, etc., that will be doing work in these areas must be adequately and properly cautioned, protected and equipped in accordance with all applicable OSHA and State Department of Labor and Industries regulations and appropriately prudent work practices. (Refer to Section 02 41 00 and 02 80 00.)

§ 16.2.5 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from

performance of the Work in the affected area, if in fact, the material or substance presents the risk of bodily injury or death as described in Section 16.2.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 16.2.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 16.3 The Contract Documents, the Contractor and his operations throughout the joint and several phases of construction shall be governed at all times by applicable provisions of the applicable Federal, State and local laws and ordinances, including but not limited to, the latest amendments of the following:

1) Williams-Steiger Occupation Safety and Health Act of 1970, Public Law 91-956.
2) Part 1910 - Occupational Safety and Health Standards, Chapter 17 of Title 29, Code of Federal Regulations.
3) Part 1518 - Safety and Health Regulations for Construction, Chapter 13 of Title 29, Code of Federal Regulations.
4) Safety Standard for Construction - Washington State Department of Labor and Industries (most current edition).
5) General Safety Standards - Washington State Department of Labor and Industries.

§ 16.3 PROTECTION OF EXISTING TREES AND VEGETATION

Location of existing trees, vegetation and improvements is approximate. Make field adjustments as required and directed by the Architect.

§ 16.3.1 Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavation materials within drip line, excess foot or vehicle traffic, or parking of vehicles within drip line. Contractor shall provide temporary guards to protect trees and vegetation to remain as directed or required.

§ 16.3.2 Contractor shall water and maintain all trees and other vegetation which are to remain within the limits of the Project as required to maintain their health during the course of construction operations.

§ 16.3.3 Contractor shall provide protection for roots over 1" diameter of plants to remain which are cut during construction. Coat the cut faces with an approved emulsified asphalt or other acceptable tree wound coating. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible. Roots of trees shall not be exposed in excavations for more than (1) working day.

§ 16.3.4 Contractor shall repair or replace damaged trees and vegetation as required by the Architect. Trees which cannot be repaired shall be replaced with tree, or plant of type, size and shape similar to the one(s) damaged, as approved.

§ 16.4 DUST AND SMOKE CONTROL

The Contractor shall constantly maintain the entire work area free from dust and smoke which would cause a hazard or nuisance to nearby streets, orchards, crops, residences, businesses, or the operations of other performing work in the area, by sprinkling and other approved methods, as required.

§ 16.4.1 The Contractor is cautioned that dust can be a severe problem in the locality of the Work. No separate payment will be made for dust and smoke control which the Contractor will be required to provide. All costs involved in dust and smoke control shall be included in the Contract Sum.

§ 16.4.2 In the event that the Contractor does not adequately control dust, the Owner reserves the right to contract separately for additional dust control, and deduct the cost involved from the Contract Sum. Further, the Owner will not be responsible for any damage to the Work under the Contract resulting from separate dust control operations made necessary by the Contractor's failure to provide adequate dust control.

ARTICLE 17 INSURANCE AND BONDS

§ 17.1 Contractor's Insurance

§ 17.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in this Section 17.1 or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the insurance required by this Agreement from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 18.4, unless a different duration is stated below:

« »

§ 17.1.2 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than «one million dollars » ($ «1,000,000 ») each occurrence, «two million dollars » ($ «2,000,000 ») general aggregate, and «two million dollars » ($ «2,000,000 ») aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;

.2 personal and advertising injury;

.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;

.4 bodily injury or property damage arising out of completed operations; and

.5 the Contractor's indemnity obligations under Section 9.15.

§ 17.1.3 Automobile Liability covering vehicles owned by the Contractor and non-owned vehicles used by the Contractor, with policy limits of not less than «one million dollars » ($ «1,000,000 ») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance, and use of those motor vehicles along with any other statutorily required automobile coverage.

§ 17.1.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as those required under Section 17.1.2 and 17.1.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ 17.1.5 Workers' Compensation at statutory limits.

§ 17.1.6 Employers' Liability with policy limits not less than «one million dollars » ($ «1,000,000 ») each accident, « one million dollars » ($ «1,000,000 ») each employee, and «two million dollar » ($ «2,000,000 ») policy limit.

§ 17.1.7 The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Section 17.1 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the period required by Section 17.1.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy.

§ 17.1.8 The Contractor shall disclose to the Owner any deductible or self- insured retentions applicable to any insurance required to be provided by the Contractor.

§ 17.1.9 To the fullest extent permitted by law, the Contractor shall cause the commercial liability coverage required by this Section 17.1 to include (1) the Owner, the Architect, and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and

completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's Consultants, CG 20 32 07 04.

§ 17.1.10 Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section 17.1, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 17.1.11 Other Insurance Provided by the Contractor

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ 17.2 Owner's Insurance

§ 17.2.1 Owner's Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 17.2.2 Property Insurance

§ 17.2.2.1 The Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed or materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section 17.2.2.2, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ 17.2.2.1.1 **"Each claim may be subject to a DEDUCTIBLE OF UP TO $5,000.00. Losses up to the deductible amount shall be the responsibility of the Contractor".**

§ 17.2.2.2 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section 17.2.2.1 or, if necessary, replace the insurance policy required under Section 17.2.2.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 18.4.

§ 17.2.2.3 If the insurance required by this Section 17.2.2 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ 17.2.2.4 If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 18.4, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ 17.2.2.5 Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Section 17.2.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by this Section 17.2.2. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ 17.2.2.6 Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section 17.2.2, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the

Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 17.2.2.7 Waiver of Subrogation

§ 17.2.2.7.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by this Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 17.2.2.7 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 17.2.2.7.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 17.2.2.7.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 17.2.2.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements, written where legally required for validity, the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 17.2.2.9 Unless otherwise specifically agreed to in writing between the parties, the Owner's property insurance will not cover materials stored off-site or in transit. If the Contractor wishes to be paid for such materials prior to their being securely stored on-site, he will be required to furnish proof of adequate insurance thereon, at his expense.

§ 17.2.3 Other Insurance Provided by the Owner

(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

§ 17.3 Performance Bond and Payment Bond

§ 17.3.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in the Contract Documents on the date of execution of the Contract.

§ 17.3.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 18 CORRECTION OF WORK

§ 18.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed, or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and

replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense, unless compensable under Section A.1.7.3 in Exhibit A, Determination of the Cost of the Work.

§ 18.1.1 Failure of the Architect, or other Owner's representative to condemn, at any particular time, unsatisfactory material or reject inferior workmanship will in no way release the Contractor from his obligation to properly complete or correct such work, nor shall it be construed to mean the acceptance of such work. No compensation will be made for defective work or materials.

§ 18.1.2 Owner may require partial occupancy of certain portion of the Work during the period when the Work is still in progress and may request that such areas of the building receive concentrated work to allow such occupancy. This shall be done with consideration of the scheduling of the Work by the Contractor.

§ 18.1.2.1 As referred to here, early occupancy of such areas and the moving in of equipment, etc., by the Owner shall not be construed to constitute (Substantial Completion or) acceptance of any of the work performed under this Contract nor shall it be deemed to be the equivalent of the filing of the Notice of Completion of any of the work of this Contract. Provisions for acceptance, under certain circumstances, of portions of the work as being substantially complete are included in Article 9.8 above.

§ 18.1.2.2 Contractor shall be held harmless from any damage done to the Work as the result of early occupancy by the Owner.

§ 18.1.2.3 The Contractor shall make available, in the areas to be so occupied, any utility services, heating and cooling as are in condition to be put into operation at the time of such occupancy. All responsibility for such equipment shall remain with the Contractor while it is so operated prior to final acceptance of the work in these areas. However, an itemized list of each such piece of equipment with the date operation starts shall be prepared by the Contractor's and certified by Architect. This list shall be the basis for the commencement of the guarantee period on the equipment being operated for the benefit of the Owner's occupancy. Owner shall pay for all utility costs which arise out of occupancy by the Owner during construction.

§ 18.1.3 Work of this Contract shall be conducted, scheduled and phased in such a manner that the owner can continue his (business) operations during the course of construction, with minimum possible interruption and discomfort to patrons and employees.

§ 18.1.3.1 The Contractor shall provide temporary barriers, shelters and/or partitions as indicated on the Drawings and as may be required for safety and noise reduction. Barriers shall be sufficient to prevent dust and debris from entering spaces in use by the Owner.

§ 18.1.3.2 Contractor shall cooperate with Owner in providing temporary entrance access and fire egress as may be required for patrons and employees in conformance with code requirements.

§ 18.1.4 The Owner reserves the right to salvage any construction materials such as piping, and other materials, fixtures, etc., of value, as may be encountered. If such rights are exercised, the Owner shall execute such salvage as mutually agreed to with the Contractor, so as not to disrupt the Contractor's schedule or operations. If rights to such materials are (specifically) waived by the Owner, Contractor shall assume possession and/or dispose of them under the Contract. Certain items may be specifically noted for salvage under the Contract and shall be carefully removed by the Contractor and delivered to the Owner as directed.

§ 18.2 In addition to the Contractor's obligations under Section 9.4, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 15.6.3, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty.

§ 18.3 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 8.3.

§ 18.4 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 18.5 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Article 18.

ARTICLE 19 MISCELLANEOUS PROVISIONS

§ 19.1 Assignment of Contract

Neither party to the Contract shall assign the Contract without written consent of the other, except that the Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 19.2 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 21.6.

§ 19.3 Equal Opportunity Employment Policies: The Contractor and all subcontractors shall comply with RCW 49.60 in all respects and shall not discriminate against any employee or applicant for employment on account of race, religion, color, sex or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rate of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

§ 19.3.1 The Contractor and all subcontractors shall, in all solicitations or advertisements for employees placed by them on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

§ 19.4 Eight Hour Law and Payment for Labor: In compliance with RCW 49.28, the Contractor agrees that no laborer, workman, or mechanic in the employ of the Contractor, subcontractor, or other person doing or contracting to do the whole or any part of the work contemplated by this Contract, shall be permitted or required to work more than 8 hours in any one calendar day, provided that, in cases of extraordinary emergency, such as danger to life or property, the hours of work may be extended, but in such cases the rate of pay for time employed in excess of 8 hours of each calendar day shall be not less than 1-1/2 times the rate allowed for this same amount of time during 8 hours service. Any work necessary to be performed after regular working hours or on Sundays or legal holidays shall be performed without additional expense to the Owner.

§ 19.5 Legal Wages on Public Works: Legal wages shall be paid for all labor performed on the Work, as required by RCW 39.12, as amended.

§ 19.5.1 The Contractor shall not commence work until a certified copy of Form F700-029-000 "Statement of Intent to Pay Prevailing Wages on Public Works Contracts" is on file with the Owner, in compliance with the provisions of RCW 39.12, as amended. In addition, certified copies of Form F700-029-000 shall also be on file with the Owner for each subcontractor before the work of said subcontractor commences. Certification of Form F700-029-000 is obtained by filing said form in hard copy or digital form with the Director of Labor and Industries indicating wage to be paid to each classification of laborers, workmen or mechanics employed by the Contractor or subcontractors, which shall not be less than the prevailing rate of wage for an hour's work in the same trade or occupation in the locality of the work as determined by the Industrial Statistician. If the wage rates are correct, the Industrial Statistician will issue a certified acknowledgment of approval to the Contractor.

§ 19.5.2 If any incorrect wage rates are included, the Contractor and/or subcontractor will be notified of the correct rates by the Industrial Statistician and approval will be withheld until a correct statement is received. Upon receipt of

certified copies by the Contractor, he shall distribute them in accordance with the instructions on the form, including submitting a certified copy to the Owner.

§ 19.5.3 For a Contract in excess of ten thousand dollars, a Contractor required to pay the prevailing rate of wage shall post in a location readily visible to workers at the job site:

1) A copy of a Statement of Intent to Pay Prevailing Wages, approved by the Industrial Statistician of the Department of Labor and Industries under RCW 39.12.040; and

2) The address and telephone number of the Industrial Statistician of the Department of Labor and Industries where a complaint or inquiry concerning prevailing wages may be made.

§ 19.5.4 The rules and regulations of the Department of Labor and Industries and the schedule of prevailing wage rates for the locality or localities where this Contract will be performed, as determined by the Industrial Statistician of the Department of Labor and Industries, are by reference made a part of this Contract, as though fully set forth herein.

§ 19.5.5 In case any dispute arises as to what are the prevailing rates of wages for work of a similar nature, and such dispute cannot be adjusted by the parties in interest, including labor and management representative, the matter shall be referred for arbitration to the director of the Department of Labor and Industries of the State and his decision therein shall be final and conclusive and binding on all parties involved in the dispute as provided for by RCW 39.12.060, as amended.

§ 19.5.6 Periodic Requests for Payment shall not be approved unless accompanied by Contractor's statement that prevailing wages have been paid in accordance with the pre-filed Statement of Intent, for the work covered by the request; and likewise, final payment shall not be approved until Final Affidavit of Legal Wages Paid, as certified by State of Washington Department of Labor and Industries' Industrial Statistician, has been received by the Owner.

§ 19.5.7 **The Contractor shall indemnify and hold the Owner harmless from any penalties, claims or other costs, including attorneys fees, resulting from any real or alleged violation of RCW 39.12 by the Contractor or any of its sub-contractors of any tier.**

§ 19.6 The Contractor and all subcontractors of any tier and those persons under their control shall fully comply with all applicable federal and state laws and regulations regarding a drug-free workplace, including the Drug-Free Workplace Act of 1988.

§ 19.6.1 Any person not fit for duty for any reason, including the use of alcohol, controlled substances, or drugs, shall immediately be removed from the Work.

§ 19.7 In accordance with RCW 28A.210.310, **ALL TOBACCO PRODUCTS ARE PROHIBITED** in Publically Owned Buildings. This restriction is in force at all times, regardless of whether occupants are present. In accordance with RCW 70.160, Smoking is prohibited in Public places. This restriction is in force at all times, regardless of whether patrons are present.

§ 19.8 Apprenticeship Utilization Requirements

§ 19.8.1 Contractor shall comply fully with all provisions of RCW 39.04.320 which requires: "For contracts advertised on or after January 1, 2010, for all public works by a school district estimated to cost one million dollars or more, all specifications shall require no less than fifteen percent of the labor hours be performed by apprentices."

§ 19.8.2 Awarding agencies may adjust the requirements of RCW 39.04.320 for a specific project for the following reasons:

.1 The demonstrated lack of availability of apprentices in specific geographic areas;
.2 A disproportionately high ratio of material costs to labor hours, which does not make feasible the required minimum levels of participation;
.3 Participating contractors have demonstrated a good faith effort to comply with the requirements of RCW 39.04.30, 39.04.310 and 39.04.320; or
.4 Other criteria the awarding entity deems appropriate, which are subject to review by the office of the governor.

§ 19.8.3 With each application for payment, contractor shall submit a report which includes the following:

.1 Name of each apprentice and apprentice registration number.
.2 Number of apprentices and labor hours worked by them, categorized by trade or craft.
.3 Number of journey level workers and labor hours worked by them, categorized by trade or craft.
.4 If required, rational for request of exception per paragraph 13.15.2.

§ 19.8.4 A final summary report of information listed in sub-article 13.15.3 shall be submitted with the 100% completion application for payment.

§ 19.9 Tests and Inspections

Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 19.10 The Owner's representative:
(Name, address, email address and other information)

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§ 19.11 The Contractor's representative:
(Name, address, email address and other information)

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§ 19.11 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

ARTICLE 20 TERMINATION OF THE CONTRACT

§ 20.1 Termination by the Contractor

If the Architect fails to certify payment as provided in Section 15.4.1 for a period of 30 days through no fault of the Contractor, or if the Owner fails to make payment as provided in Section 4.1.3 for a period of 30 days, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 20.2 Termination by the Owner for Cause

§ 20.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 20.2.2 When any of the reasons described in Section 20.2.1 exists, the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may, without prejudice to any other remedy the Owner may have and after giving the Contractor seven days' notice, terminate the Contract and take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever reasonable method the Owner may deem expedient. Upon request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 20.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 20.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 20.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

§ 20.3 Termination by the Owner for Convenience

The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. The Owner shall pay the Contractor for Work executed; and costs incurred by reason of such termination, including costs attributable to termination of Subcontracts; and a termination fee, if any, as follows:
(Insert the amount of or method for determining the fee payable to the Contractor by the Owner following a termination for the Owner's convenience, if any.)

« »

ARTICLE 21 CLAIMS AND DISPUTES

§ 21.1 Claims, disputes, and other matters in question arising out of or relating to this Contract, including those alleging an error or omission by the Architect but excluding those arising under Section 16.2, shall be referred initially to the Architect for decision. Such matters, except those waived as provided for in Section 21.11 and Sections 15.7.3 and 15.7.4, may, after initial decision by the Architect or 30 days after submission of the matter to the Architect, be subject to mediation as a condition precedent to binding dispute resolution.

§ 21.2 Notice of Claims

§ 21.2.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 18.2, shall be initiated by notice to the Architect within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 21.2.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 18.2, shall be initiated by notice to the other party.

§ 21.3 Time Limits on Claims

The Owner and Contractor shall commence all claims and causes of action against the other and arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in this Agreement whether in contract, tort, breach of warranty, or otherwise, within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 21.3.

§ 21.4 If a claim, dispute or other matter in question relates to or is the subject of a mechanic's lien, the party asserting such matter may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 21.5 The parties shall endeavor to resolve their disputes by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with their Construction Industry Mediation Procedures in effect on the date of this Agreement. A request for mediation shall be made in writing, delivered to the other party to this Agreement, and filed with the person or entity administering the mediation.

The request may be made concurrently with the binding dispute resolution but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 21.6 If the parties have selected arbitration as the method for binding dispute resolution in this Agreement, any claim, subject to, but not resolved by, mediation mayl be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association, in accordance with the Construction Industry Arbitration Rules in effect on the date of this Agreement. Demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. Any award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 21.7Claims, disputes and other matters in question arising out of or relating to the Contract that are not resolved by mediation, except matters relating to aesthetic effect and except those waived as provided for in Section 21.11 and Sections 15.7.3 and 15.7.4, **MAY**, by agreement of both parties, be decided by arbitration which, unless the parties mutually agree otherwise shall be in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect. The demand for arbitration shall be filed in writing with the other party to this Agreement and with the American Arbitration Association and shall be made within a reasonable time after the dispute has arisen. **ANY** award rendered by the arbitrator or arbitrators shall be final, and judgement may be entered upon it in accordance with applicable law in any court having jurisdiction thereof. Except by written consent of the person or entity sought to or in any other manner, any person or entity not a party to the Agreement under which such arbitration arises, unless it is shown at the time the demand for arbitration is filed that (1) such person or entity is substantially involved in a common question of fact or law, (2) the presence of such person or entity is required if complete relief is to be accorded in the arbitration, (3) the interest or responsibility of such person or entity in the matter is not insubstantial, and (4) such person or entity is not the Architect or any of the Architect's employees or consultants. **ANY** agreement herein among the parties to the Agreement and any other written agreement to arbitrate referred to herein shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 21.8 Except as hereinbefore provided, the provisions of this Article pertaining to arbitration under this Contract, shall also apply to disputes between the Contractor and other prime contractors who may have contracts with the Owner to perform on the work on the site.

§ 21.9 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to this Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 21.10 Continuing Contract Performance

Pending final resolution of a Claim, except as otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 21.11 Waiver of Claims for Consequential Damages

The Contractor and Owner waive claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 20. Nothing contained in this Section 21.11 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	CONTRACTOR *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

SECTION 01 21 13 – CASH ALLOWANCES

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 – GENERAL

1.1 SUMMARY

A. The Contractor shall include in the Contract (Bid) Sum all allowances stated in the following schedule.

1. Items covered by these allowances shall be provided for such amounts and by such persons as the Owner may direct, but the Contractor will not be required to employ persons against whom he makes a reasonable objection

1.2 INCLUDED COST, PAYMENT and ADJUSTMENT

A. Unless specifically stipulated otherwise elsewhere in the Contract Documents, these allowances shall cover the actual net cost to the Contractor of the material and equipment items stipulated under the allowance, delivered to the site, including all applicable taxes and tariffs other than state sales tax.

B. The Contractor's costs or unloading and handling on the site, labor, installation costs, overhead and profit shall be included in the Contract Sum in addition to the allowance.

C. Whenever the actual cost of materials or equipment, as documented by invoice, is more than or less than the applicable allowance, the Contract Sum shall be adjusted accordingly by Change Order.

1.3 SHEDULE OF ALLOWANCES

A. Allowance #1

1. Fire Sprinkler: Fire sprinkler piping and heads may need to be relocated in a number of areas to allow for new work. Include $5,000 allowance in the Contract Sum for this work.

B. Allowance #2

1. Hydronic Piping: Hydronic mains, branch piping, and equipment connections may need to be relocated in a number of areas to allow for new work. Include $5,000 allowance in the Contract Sum for this work.

C. Allowance #3

1. Electrical: Miscellaneous electrical circuits and systems (raceway, conductor, junction boxes, supports, low voltage systems, etc.) may be required to be revised and re-routed to allow for the new work. Include $3,000 allowance in the Contract Sum for this work.

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 21 13

SECTION 01 23 00 – BASE BID and ALTERNATES

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 BASE BID WORK

A. The Base Bid Contract Sum shall include full compensation for all labor, materials, overhead, profit and appurtenant costs for all work shown and/or indicated in the Drawings and Specifications, together with all miscellaneous items of work reasonably required as incidental to proper accomplishment of the work shown, **EXCEPT**:

1. Work (construction or improvements) shown or indicated as 'existing' but not noted for removal, relocation or re-use under the Contract.

2. Work shown or indicated as 'by others' or 'Not in Contract' (N.I.C.), unless a fee or permit is required to be paid (i.e., sewer connection, water meter, etc.), as noted below.

3. Items of work included in the Schedule of Alternate below.

B. Certain items of work, if any, may be done by the serving utility or others but involve a fee or charge which shall be included in the Base Bid Sum where and if required by the Conditions of the Contract.

C. Certain items of work, if any, may require permit fees, inspection fees, or other charges which shall be included in the Base Bid Sum where and if required by the Conditions of the Contract.

1.2 ALTERNATE BIDS

A. No Alternate Bid items are included in the initial issuance for bid. The following shall apply to Alternates added by Addendum.

1. Contractors (Bidders) shall state, in the spaces provided in the Form(s) of Proposal, Alternate Bids for the various parcels of work described below, and as further identified on the Drawings or Addendum. Alternate Bid Sum(s) shall include full compensation for all labor, materials, overhead, profit and appurtenant costs for the work of each Alternate parcel of work, as scheduled and indicated, including all miscellaneous items of work reasonably required as incidental to proper accomplishment of the (alternate) work.

2. **Prime Bidders shall be responsible for coordinating with sub-contract bidders, so as to assure that Base Bid and Alternates include cost of all supporting elements required, and that no matter what combination of Base Bid and Alternates is accepted, the completed work of the Contract shall constitute a complete and properly functioning entity in itself. All work under**

Alternates shall be in strict accordance with all applicable Specification Sections and Addendum items.

3. Numbering of Alternates does not imply the order in which Alternate bids may be accepted. The Owner reserves the right to accept, and/or reject, any Alternate Bids in order to provide whichever combination of Base bid and Alternates he determines will provide the best value for the Project as a whole.

4. The Contractor also shall guarantee his Alternate Bids for the period stipulated in the Form of Proposal, as being fair contract price for which he will accept a Change Order adding the various (alternate) parcels of work to the Contract.

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 23 00

SECTION 01 25 00 – SUBSTITUTIONS and PRODUCT OPTIONS

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 SUMMARY

A. For products specified only by reference standards, select any product meeting standards, by any manufacturer, subject to review by the Architect.

B. For products specified by naming several products or manufacturers, select any product and manufacturer named or submit proposed equivalents for prior approval as defined hereafter.

C. For products specified by naming only one product and manufacturer, there is no option, and no substitution will be allowed except by prior approval as defined hereafter.

1.2 SUBSTITUTIONS

A. During Bidding

1. Architect/Engineer will consider written requests, (on "Substitution Request" form provided hereinafter only) for substitutions, provided such requests are received at least 10 days (240 hours) prior to bid date and hour. Requests received after that time will not be considered.

2. Approvals, if any, of proposed substitutions will be by addenda to all bidders of record.

B. After Contract is Signed

1. The Agreement is based upon the items and materials specified in the Contract Documents. In signing the Agreement, the Contractor warrants that he has verified availability and delivery in order to properly complete the Work within the stipulated time of completion, and agrees that these are the items and materials to be utilized in the Work.

2. During the term of the Contract, substitutions will be allowed in exceptional cases only, and under one or more of the following conditions:

a. Required for compliance with final interpretation of code requirements or insurance regulations.

b. Unavailability of specified products, through no fault of the Contractor.

c. Subsequent information discloses inability of specified products to perform properly or to fit in designated space.

d. Manufacturer/fabricator refusal to certify or guarantee performance of specified product as required.

e. When it is clearly seen, in the judgment of the Architect/ Engineer, a substitution would be substantially to the Owner's best interests, in terms of cost, time or other considerations.

3. The Architect's judgment as to equivalence and acceptability shall be final. Certain non-technical features, such as available color selection, and appearance, may be reason for approval or rejection.

C. Substitution Request

1. The Contractor shall submit 3 copies each of "Substitution Request Form" (included hereafter) which shall include, and or/be accompanied by, the following:

a. Complete data substantiating compliance of proposed substitution with Contract Documents.

1) For products:

a) Product identification, including manufacturer's name and address.

b) Manufacturer's literature.

i. Product description

ii. Performance and test data

iii. Reference standards

c) Samples

d) Name and address of similar projects on which product was used, and date of installation.

2) For construction methods:

a) Detailed description of proposed method.

b) Detail drawings clearly illustrating methods.

b. Itemized comparison of proposed substitution with product or method specified.

c. Data regarding changes in construction schedule and relation to separate contracts.

d. Accurate cost data on proposed substitution in comparison with product or method specified.

e. A self-addressed, stamped, envelope for return of Substitution Request Form. Substitutions may be rejected if self-addressed, stamped envelope does not accompany submittal.

D. In making request for substitution, Bidder/Contractor represents:

1. He has personally investigated proposed product or method, and determined that it is equal or superior in all respects to that specified. He will provide the same guarantee for substitution as for product or method specified. He will coordinate installation of accepted substitution into Work, making such changes as may be required for Work to be complete in all respects.

2. He waives all claims for additional direct and indirect costs related to substitution which consequently becomes apparent.

3. Cost data is complete and includes all related costs under this Contract, but excludes:

a. Costs under separate contracts

b. Architect/Engineer's redesign

E. Substitutions will not be considered if:

1. They are indicated or implied on Shop Drawings or Product Data submittals without request submitted in accordance with this Section and the General Conditions.

2. Acceptance would require substantial revision of Contract Documents.

1.3 PRODUCT LIST

A. Within 30 days date of Contract, submit to Architect/ Engineer 1 electronic copy of a complete list of all products which are proposed for installation.

1. Tabulate list by each Specification Section.

2. For products specified under referenced standards, include with listing of each product:

1) Name and address of manufacturer

2) Trade name

3) Model or catalog designation

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

SUBSTITUTION REQUEST FORM
(SUBMIT 3 COPIES)

TO: _____

PROJECT: _____

We hereby submit for consideration, following product instead of specified item for the above project.

SECTION _____ SPECIFIED ITEM

_____ _____

PROPOSED SUBSTITUION: _____

Attach technical data, including laboratory tests and samples as applicable.

Detailed comparison of the significant qualities (size, weight, durability, performance and similar characteristics, and including visual effect where applicable) for the proposed substitution in comparison with the original requirements.

List completely installation changes and changes to Drawings and Specifications required by proposal.

FILL IN THE BLANKS BELOW:

A. Does substitution require change in Drawing Dimensions? _____

_____

B. What effect does substitution have on other trades? _____

_____

C. Differences between proposed substitution and specified item? _____

_____

D. Manufacturer's guarantees of proposed and specified items are:

_____Same _____Different (Explain on Attachment)

E. Name and address of 3 similar projects on which the product was used.
_____ (Attach) _____

F. Contract completion date is _____Same _____Different (Attach)

Undersigned attests function and quality equivalent or superior to specified item and waives his rights to additional payment and time which may subsequently be necessitated, by failure of the substitution to perform adequately, and for the required work to make corrections thereof. The undersigned will pay for any resulting design changes, including engineering and detailing costs, required to accommodate this substitution and the original design intent.

SUBMITTED:

_____
Signature

_____
Firm

_____
Address

_____

Telephone _____

Date _____

For Use by Architect

_____Accepted _____Accepted as Noted

_____Not Accepted _____Received to Late

By: _____ Date: _____

Remarks: _____

_____

END OF SECTION 01 25 00

SECTION 01 29 73 – SCHEDULE OF VALUES

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 SUMMARY

A. Submit to the Architect a Schedule of Values at least 10 days prior to submitting first Application for Payment.

B. Upon request by Architect, support values given with data that will substantiate their correctness.

C. Use Schedule of Values only as basis for Contractor's Application for Payment.

1.2 FORM OF SUBMITTAL

A. Submit typewritten Schedule of Values on an 'Application and Certification for Payment on Contract' form as provided for the Project by the Architect.

1.3 PREPARING SCHEDULE OF VALUES

A. Use Table of Contents of this Specification as general basis of format in listing costs of work specified under DIVISIONS 2 - 26.

B. Also Refer to Divisions 23 and 26 for further detail of required breakdown of mechanical and electrical work.

C. The Schedule of Values shall also be clearly coordinated with the activities identified in the Construction Network Schedule as specified in Section 01 32 16, and shall allocate, as a line item, a minimum of 2% of the Contract Sum (in addition to stipulated retainage) to "Project Closeout" work between Substantial Completion and Final Completion.

D. Itemize separate line item cost for each of the following general cost items:

1. Performance and Payment Bonds
2. Insurance
3. Building Permit
4. Mobilization
5. Field Supervision (Superintendent) and Layout
6. Temporary Facilities and Controls
7. Project Closeout (2% minimum)

E. Itemize separate line item cost for each section of work. For each line item which has installed value of more than $20,000, break down costs to list major products or operations under each item. If it is intended to bill for material stored on site but not installed at time of billing (i.e., masonry, door frames, hardware, etc.) break line item into materials and labor.

F. Round off figures to nearest 10 dollars. Make sum of total costs of all items listed in Schedule equal to total Contract Sum.

1.4 REVIEW AND RESUBMITTAL

A. After review by Architect, revise and resubmit Schedule of Values as required. Resubmit revised Schedule in same manner.

PART 2 – PRODUCT

(Not used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 29 73

SECTION 01 31 19 – PROJECT MEETINGS

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 SUMMARY

A. Pre-Construction Meeting and Progress Meetings shall be scheduled and held as further detailed below. Person designated herein below shall:

1. Prepare and distribute written notice and agenda of regular and called meetings four days in advance of meeting date.
2. Make physical arrangements for meetings.
3. Preside at meetings.
4. Record minutes; include significant proceedings and decisions.
5. Distribute copies of minutes to attendees within four days of meeting.

1.2 PRE-CONSTRUCTION MEETING

A. Architect will schedule for date within 14 days after date of Notice of Acceptance, and conduct meeting.

B. Required Attendance:

1. Owner
2. Architect/Consultants
3. Contractor (Project Manager) and Superintendent
4. Major Subcontractors

C. Minimum Agenda:

1. Length of Contract and liquidated damages.
2. Performance Bond, Insurance Certificate, Schedule.
3. Sign and distribute Contract(s).
4. Notice to Proceed.
5. Contractor's authorized representatives.
6. Owner's Representatives/Architect/Inspector names and responsibilities.
7. Instruction to Contractor through A/E.
8. Instructions to Contractors in writing.
9. Progress Chart or CPM (Tentative Construction Schedule).
10. Progress Meetings and Reports.
11. Submittals.
12. Delayed start of work in certain areas.
13. Continuation of Owner's operations.
14. Temporary facilities.
15. Contractor's working hours.
16. Contractor's parking, access, storage, etc.
17. Items to be posted in office.

18. Permits status.
19. Coordination with utility companies.
20. Coordination with City (or County).
21. Staking and layout.
22. Quality Control (Special Inspection and Testing).
23. Owner furnished, Contractor installed items.
24. Existing material to be re-used on work.
25. Labor/Material breakdown (Schedule of Values).
26. Monthly payment.
27. Retention (Escrow) Bond.
28. Payments to Subcontractors.
29. Change Orders, time extensions, stop work orders, field orders.
30. Owner occupancy prior to construction completion.
31. Handling disputes.
32. Project Record Documents.
33. O & M Manuals.
34. Contract Closeout.
35. Other Items.

1.3 PROGRESS MEETINGS

A. Contractor shall schedule and conduct regular meetings; minimum of every other week. Exact day and time shall be established at the Pre-Construction Meeting.

B. Hold Called Meetings as exigencies of work dictate.

C. Location of Meetings: Project Site or adjacent location to be determined.

D. Required Attendance:

1. Owner's Representative
2. Architect/Consultants
3. Contractor
4. Subcontractors as pertinent to agenda

E. Minimum Agenda:

1. Review, approve minutes of previous meeting.
2. Review work progress since last meeting.
3. Estimate overall percentage of Work completed.
4. Note field observations, problems and decisions.
5. Identify problems which impede planned progress.
6. Review off-site fabrication problems.
7. Develop corrective measures and procedures to regain planned schedule.
8. Revise Construction Schedule as indicated.
9. Plan progress during next work period.
10. Review submittal schedules, expedite as required to maintain schedule.
11. Maintaining of quality and work standards:
    a. Effect on Construction Schedule
    b. Effect on completion date

12. Complete other current business.

F. Meeting Minutes shall be recorded by the Contractor with copies sent to Owner and Architect within three working days following each meeting.

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 31 19

SECTION 01 32 16 – CONSTRUCTION SCHEDULES

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 CONSTRUCTION NETWORK SCHEDULE

A. Congruent with requirements of the General Conditions of the Contract, the Contractor shall prepare a Network Analysis and Schedule (with review by and in coordination with other Prime Contractors for the Work, if any). The Network Analysis Schedule shall be of the type described in "CPM in Construction" published by the AGC (or other approved system capable of producing the desired planning, scheduling and control information) (such as a horizontal bar chart).

B. The Network Analysis shall include time scale diagrams which show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor, and show how the start of a given activity is dependent on the progress or completion of preceding activities throughout the construction period.

C. Detailed Network activities shall show, in addition to construction activities, the submittal and approval of samples of materials and shop drawings, the procurement of critical materials and equipment and their installation. All activities of the Owner that affect progress shall be shown.

D. Mechanical and electrical subcontractors shall submit Network Analysis Diagrams for their work, to the General Contractor, designed to be integrated into the final Network prepared by the General Contractor.

E. The Contractor may select to shorten (accelerate) the allowed construction period (schedule) at his own discretion and complete the project ahead of the required completion date. However, float time shall be included in the schedule to represent the time allowed for completion of the work. Under no circumstances shall delays to the Contractor's accelerated schedule result in claims for additional cost or time to the Owner.

F. The **approved** Progress Network Analysis shall then be the Schedule to be used by the Contractors and others for planning, organizing and directing the Work and for reporting progress.

G. Diagrams shall be neatly drafted, showing preceding and succeeding event numbers for each activity and activity duration, flowing from left to right. The critical activity sequence (critical path) which controls the total required time to complete each segment and to complete the Project shall be identified on the diagrams. The float time for all activities shall be indicated.

H. The following minimum information shall be provided for each activity:

1. Activity number, description and duration estimate at time of computation.

2. Earliest possible and latest acceptable starting and completion dates.

3. Responsibility for activity (Prime Contractor, subcontractor, supplier, Owner, etc.).

I. **All scheduled activities shall also be clearly coordinated with the Schedule of Values specified in Section 01 29 73.**

J. Revision of the time scaled diagrams shall be required whenever a major change, or a succession of minor changes, occurs in scheduling which influences either the critical path or final completion date of the Project.

K. The schedule shall be updated as of the first day of each month to verify progress and areas needing more attention to complete Project during allotted time frame.

L. Within 7 days of Notice to Proceed (execution of Contract), Contractor shall submit for approval, name of personnel responsible for doing the scheduling and an illustrative example of the type of diagram intended. The Contractor, together with major subcontractors and suppliers, (i.e., mechanical, electrical, etc.,) shall participate with the Architect and Owner in a review and evaluation of the proposed network diagrams as required. The completed Network Analysis shall be submitted within 15 days following completion of review.

M. Initial submittal and all revisions shall be submitted in three copies, signed and dated by the Contractor.

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 32 16

SECTION 01 33 00 – SUBMITTALS

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 SUBMITTALS DEFINED

A. The term 'submittals' as used herein includes all shop drawings, field layouts, samples, color or model selections, material and equipment data and descriptions, certifications, schedules, guarantees, bonds, warranties and other items as called for in the various sections of the Contract Documents.

B. Requirements for Operating Maintenance Manuals and Record Documents are detailed separately in Sections 01 78 23 and 01 78 39, and respective Specification Sections.

1.2 REQUIRED PROCEDURE

A. Submittals not strictly conforming to the requirements of this Section will be returned forthwith for proper resubmittal, resultant delay in approval being the responsibility of the Contractor.

1.3 IDENTIFICATION

A. Completely identify each submittal and resubmittal by showing at least the following information:

1. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.

2. Name of Project as it appears on the Contract Documents.

3. Drawing number and Specification Section number to which the submittal applies.

4. Whether this is an original submittal or resubmittal.

5. Provide 8" x 3" blank space for Contractor and Architect/Engineer's review stamp.

1.4 COORDINATION

A. Prior to submittal for Architect's review, use all means necessary to fully coordinate all material, including the following procedures:

1. Determine and verify all field dimensions and conditions, materials, catalog numbers, and similar data.

2. Coordinate as required with all trades and with all public agencies involved.

3. Secure all necessary approvals from public agencies and others and signify by stamp, or other means, that they have been secured.

4. Clearly indicate all deviations from the Contract Documents.

5. Unless otherwise specifically permitted by the Architect, make all submittals in groups containing all associated items; i.e., all electrical submittals together, all miscellaneous metal fabrications together; etc. The Architect may reject partial submittals as not complying with the provisions of the Contract Documents.

6. All submittals shall be sent to prime Contractor before submission to Architect or Consultants. Upon completion of items 1 thru 5 above, the General Contractor shall then transmit submittals to the Architect.

1.5 TIMING OF SUBMITTALS

A. In general all data and drawing submittals shall be in the Architect's hands within 30 days after execution of Contract. Refer also to various technical sections.

B. In any event, make all submittals far enough in advance of scheduled dates of installation to provide all required time for review, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery in time to maintain Project schedule.

C. In scheduling, allow at least seven full working days for the Architect's review following his receipt of the submittals, and additional time as follows:

1. Submittals of all submittals required under DIVISIONS 22 through 26 require, a **minimum of fourteen full working days for review and return.**

2. Submittals that require a color and/or pattern selection to be made will require a minimum of 21 days for approval, dating from the time that ALL submittals on items requiring color/pattern selections have been received by the Architect.

D. Costs of delays occasioned by tardiness of submittals, including liquidated damages, may be backcharged to sub-contractors and/or suppliers as necessary, but shall not be borne by the Owner.

1.6 NUMBER OF COPIES REQUIRED

A. Submit one electronic copy in portable document format (PDF) to the Architect.

B. Copies required for inclusion in the O & M manuals, under Section 01 78 23 are in addition to the number of submittal required here.

1.7 SHOP DRAWINGS

A. Defined Inclusions: The term 'Shop Drawings' as used herein shall also include job layout and installation drawings as may be required for the work as certain trades (i.e., reinforcing steel, suspended ceilings, casework, etc.), as well as shop fabrication drawings.

B. Format and Content: Make all drawings accurately to a scale sufficiently large to clearly show all pertinent features, method of fabrication, installation, and/or connection to the Work. Indicate size, type, dimension and location of all components, jointing, connections, etc.

C. Make all drawings (copies) with white background. Submittals shall be in the standard sheet sizes of 8 ½ x 11, 11x17, 22x34 or 24x36.

1.8 SAMPLES

A. Furnish all samples called for in the Contract Documents in quantity as required above for other submittals.

B. Unless otherwise specifically directed by the Architect, all samples shall be of the precise article, material or finish proposed to be incorporated into the Work. **Photographic representations**, **links to internet sites,** or other simulations of materials or finishes are **not acceptable**. Refer also to specific requirements in the various technical sections of these Specifications.

C. In certain cases, so noted in the specifications, samples too large for handling as outlined herein, may be prepared and maintained on the job site, and the Architect will waive retention of sample at the time of completion. These samples are also exempted from the quantity requirements stipulated above and may be furnished in single (approved) number, as directed.

1.9 COLORS

A. Unless the precise color and pattern is specifically described in the Contract Documents, whenever a choice of color or pattern is available in a specified product submit accurate color samples and pattern charts to the Architect for his review and selection.

B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited for the installation, completely describe the relative costs and capabilities of each.

C. **All items requiring color (or pattern) selection must be submitted before any selections/approvals can be made. The color scheme must be approved by the Owner as a whole, not piecemeal. ALL color selection submittals should be received as quickly after Contract execution as possible in order to avoid delay in ordering of certain long lead items.**

1.10 CERTIFICATIONS, GUARANTEES, BONDS & WARRANTIES

A. In addition to the Contractual guarantees required by the Agreement, General Conditions and Supplementary Conditions, furnish to the Architect, for forwarding to the Owner, all certifications, guarantees, bonds and warranties specifically called for in the Contract Documents, or ordinarily provided by manufacturers or suppliers of various portions of the Work.

B. Time of Submittal:

1. Certifications, guarantees, etc., or copies thereof of materials or equipment to be incorporated into the Work shall be furnished to the Architect upon delivery to site, and approved before installation.

2. Certifications, guarantees, etc., or copies thereof, of installations, applications or assemblies shall be furnished upon completion of that portion of the Work and prior to Substantial Completion.

1.11 LOG OF SUBMITTALS

A. The Contractor shall maintain a log of all submittals, noting date of issuance, date and status of comments, and subsequent dates of resubmittals and responses.

B. Items for which repeated submittals may be required, but are included here as a reminder for initial and final processing.

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 33 00

SECTION 01 35 00 – SPECIAL CONDITIONS

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 DELAYED START OF WORK, OCCUPANCY and WORK HOURS

A. Due to demands of the Owner's continuing operations, regardless of the date of Contract execution, the existing building's HVAC system cannot be shut down for work prior to September 7th, 2024. Depending upon forecasted weather conditions the Owner and Contractor may mutually agree to an alternative start date. Work to be completed in preparation of the improvements prior to the date the building is available for the shut down of the HVAC system shall be completed in a timely manner immediately prior to that date to minimize the impact on the ongoing operations.

B. Unless mutually agreed upon between the Owner and the Contactor all work within occupied areas of the building, excluding equipment rooms, attics and storage areas, shall be conducted after hours or on weekends. The Owner will work with the Contractor to provide scheduled occupancy of assembly rooms and conference rooms and will consider alternatives to occupancy of offices and other administrative areas to provide flexibility to the Contractor's schedule of work in these areas.

C. All work of this Contract occurring shall be conducted, scheduled and phased in such a manner that the Owner can continue operations during the course of construction, with minimum possible interruption and discomfort to patrons and employees.

1.2 COORDINATION OF FURNISHINGS

A. Any minor furniture adjustments, desk/chairs, shall be allowed to be moved or relocated by the contractor. Contractor is responsible for replacing furniture to its original location.

B. Any major furniture/equipment adjustments, including but not limited to: assembled furniture components (e.g. cubicles); computers; phones; any other electrical or networking equipment, shall be moved and replaced by the **owner**. All major furniture/equipment adjustments shall be scheduled minimum 48 hours in advance as to provide the owner adequate time to relocate equipment and personal.

1.3 HISTORICAL LANDMARK DESIGNATION

A. The contractor understands and acknowledges that the 1901 portion of the Courthouse is a designated historical building and as such no work which alters the visual appearance, whether exterior or interior, shall be performed with exception of the replacement of the louvers specified in the architectural plans.

B. Any unanticipated work that arises with the potential to visually impact this portion of the facility shall be cleared through the Owner prior to any work being undertaken and

may require additional clearance through the Washington State Department of Historical Preservation.

C. Failure of the Contractor to abide by these requirements and any associated remediation shall be the sole responsibility of the Contractor.

1.4 MECHANICAL COMMISSIONING

A. Mechanical commissioning will be performed by the Owner following testing and balancing of the system. The Contractor shall allow full access and make reasonable accommodations for the Owner's commissioning agent.

1.5 TEMPORARY CONSTRUCTION and SERVICES

A. The Contractor shall be permitted to utilize the existing electrical service, water and other utilities currently available on site as necessary for performance of the Work.

1. Use of such services shall not disrupt the Owner's operations. Any modifications to such services for the benefit of the Contractor necessary to maintain the Owner's operations shall be at the expense of the Contractor.

B. The Contractor shall provide any temporary protection for his work and barricades as necessary for protection of persons and property as stipulated in the General Conditions of the Contract and as required by State and Federal regulations.

C. The Contractor shall be responsible for installation, removal and paying all costs incidental thereto for a cellular phone for the site foreman and site superintendent. The site foreman and superintendent shall be accessible by cellular phone while on-site.

D. Contractor may utilize the public restroom facilities on site. It is the Contractor's responsibility to ensure that his employees and sub-contractors are maintaining the restrooms in a responsible manner. Periodic cleaning shall be completed by the Owner, but abuse and irresponsible use of the restrooms by the Contractor's crews shall result in a loss of use of the restrooms, in which case the Contractor shall provide chemical toilets on site for use by the crews.

1.6 TEMPORARY STRUCTURES

A. At the Contractor's discretion, he may site one trailer on site for use by the prime Contractor and the sub-contractors. Any temporary power or other utility connections to the trailer shall be at the Contractor's expense and shall not interrupt the normal operation of the facility.

B. Movable lockboxes, and tool and material storage units shall be located in the building so as not to interfere with the Owner's ongoing operations and not to exceed the structural capacity of the surface of which they are placed.

C. Temporary barricades and/or covered passageways as may be required by Government, State or local, authorities, and as required to adequately protect the public, the Owners employees and patrons, the Contractor's workers, the Work, and existing and adjacent

properties and improvements. Refer also to applicable provisions of the General Conditions and Supplementary General Conditions. Such facilities as are required shall be built by Contractor at no additional cost to the Owner and shall be painted and maintained in an orderly, neat appearance at all times.

D. Scaffolds, Ladders and Runways: Contractor shall furnish, erect and maintain for duration of the Work as required, and remove when the Work permits, all scaffolds, runways, guardrails, plat-forms, barricades and similar construction as may be necessary for the performance of the Work. Such facilities shall be of type and arrangement as required for their specific use; shall be substantially constructed throughout, strongly supported, well secured and shall comply with all applicable rules and regulations of applicable State and local codes.

1.7 PARKING

A. The Contractor and sub-contractors shall utilize off street parking for all parking needs and shall make every effort to preserve public parking at the entry to the building. Exceptions to loading and unloading activities, and refuse removal are permitted to the degree that they do not prohibit the normal use of the building by employees and patrons.

1.8 SIGNAGE

A. No onsite signage shall be erected on the project grounds or building surfaces, except for directional signage, signs warning of hazards, etc. Signs advertising the Contractor's or sub-contractor's company and discipline shall only be permitted on temporary structures sited by the Contractor.

1.9 NO ON-SITE BURNING ALLOWED

A. The Contractor shall not, under the work of this Contract, conduct any burning of slash, debris, scraps, wastage, etc., at the site, or on any property of the Owner's. The Contractor shall legally and appropriately dispose of all such material off-site. Should the Contractor choose to arrange for disposal burning at a remote site, of other ownership, he shall assume all related costs, risks and responsibilities, and shall hold the Owner harmless from any problems, complaints, challenges, losses or damages, whether legal, financial or otherwise, arising out of such burning operations.

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 35 00

SECTION 01 73 29 – CUTTING and PATCHING

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching. Refer to specific sections related to the work shown on the drawings for integration of other elements.

1. Cutting shall entail removal of in-place construction necessary to permit installation or performance of other work.

2. Patching shall require fitting and repair of work required to restore surfaces to original conditions after installation of other Work.

1.2 SUBMITTALS

A. Submit a written request in advance of cutting or alteration which affects the structural integrity of any element of the project, compromises the integrity of any surface exposed to the weather or moisture related elements, disturbs the efficiency, maintenance, or safety of any operational element, changes the visual qualities of site exposed elements, or modifies the work of the Owner or the Owner's Contractor.

1. Written requests should identify the project and specifics regarding the location, method and timing of the work. Details and engineering calculations shall be provided for any modifications to the structural elements of the building.

1.3 QUALITY ASSURANCE

A. Unless specifically authorized in advance, the Contractor shall not make modifications to essential building items.

1. Structural elements shall not be cut or patched in a manner that could change their load-carrying capacity.

2. Existing building improvements to remain which are affected by demolition or construction activities shall be shored, supported, etc. as required to maintain their integrity and facilitate integration into the new work.

3. Operational equipment such as fire-suppression systems, mechanical, electrical, access controls, etc. (or other miscellaneous elements) shall not be modified in a manner that reduces their capacity to perform as intended or results in increased maintenance or decreased operational life, or safety.

4. No cutting and patching shall be done in a manner that results in the visual evidence of the work. Do not cut and patch construction exposed on the exterior or in

occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Before proceeding meet at the project site with all parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 JOB CONDITIONS

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

B. Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

C. Provide temporary support of Work to be cut.

D. Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

E. Avoid interference with use of adjoining areas or interruption of free passage to adjoining area.

F. Existing Utility Services and Mechanical/Electrical Systems:

1. Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize/prevent interruption to occupied areas.

PART 2 – PRODUCT

2.1 IN-PLACE MATERIALS

A. Use materials identical to the in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 – EXECUTION

3.1 PERFORMANCE

A. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cutting:

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

2. Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

    a. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

    b. Cut or drill from exposed or finished side into concealed surfaces.

    c. Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

3. For mechanical and electrical services, cut off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

4. Proceed with patching after construction operations requiring cutting are complete.

B. Patching:

1. Patch by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

    a. Surface shall have all irregularities such as nail or screw pops, holes, gouges, paint drips, debris under or on surface, cracks, sealant joints, corner and edge beads, etc. corrected for a uniform and smooth finish. Where texturing occurs, retexture to match existing surface.

2. Inspect and test patched areas after completion to demonstrate integrity of installation where feasible.

3. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

    b. Restore any damaged pipe covering to its original condition.

4. Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

    b. At penetrations of fire rated walls, partitions, ceilings or floor construction, completely seal void with fire rated materials to full thickness of the penetrated element.

5. Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

    a. It is anticipated that certain rooms will have extensive demolition of a suspended ceiling for removal and installation of HVAC systems. Carefully remove and reuse existing materials. Employ contractors skilled at ceiling installation and familiar with the required seismic bracing. Where materials are damaged replace with like materials.

    b. It shall be the contractor's responsibility to schedule walkthrough with the Owner's representative prior to demolition to identify any damage prior to work.

6. Patch exterior building enclosure components in a manner that restores enclosure to a weather tight condition.

7. Salvage

    a. Carefully remove windows and other historic materials where required by the work. Preserve and protect and deliver to the owner.

3.2 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty and similar materials.

END OF SECTION 01 73 29

SECTION 01 74 00 – CLEANING

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 SUMMARY

A. Maintain premises and public properties free from unnecessary accumulations of waste, debris, and rubbish caused by operations, through-out the course of the work.

B. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and thoroughly clean all areas and surfaces; leave Project clean and ready for occupancy.

1.2 MANUFACTURER'S TRADEMARKS and NAMES

A. The Architect reserves the right to review and request the removal of the manufacturer's trademarks on all materials and equipment which will be in plain view of the occupants of the building when placed in final position. Such removal shall be at no expense to the Owner. A decision on the necessity to remove or redesign may be obtained from the Architect in writing prior to bidding. Failure to obtain such approval shall constitute agreement to comply with such decision at a later date.

1.3 SAFETY REQUIREMENTS

A. Maintain Project in accordance with local City, County, or State applicable Standards and Regulations.

B. Store volatile waste in covered metal containers, and remove from premises daily. Prevent accumulation of waste which create hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not bury rubbish and waste materials on Project site.

2. Do not dispose of volatile waste such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

3. Do not dispose of waste into streams or waterways.

PART 2 – PRODUCT

2.1 GENERAL

A. Use only cleaning materials recommended by the manufacturer or surface to be cleaned. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 – EXECUTION

3.1 DURING CONSTRUCTION

A. Maintain building, grounds, and public properties free from accumulations of waste materials and rubbish. Provide on-site containers for collection of waste materials, debris, and rubbish.

B. In addition to dust control provisions specified elsewhere herein, Contractor shall take appropriate steps to prevent airborne dust and debris from soiling or otherwise affecting the work of the Contract and the adjacent occupied spaces. Utilize covered containers when moving demolition debris and other waste within the finished spaces.

C. Wet down dry materials and rubbish to allay dust. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

D. At reasonable intervals during progress of work, remove waste materials, debris, and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

E. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted or uncured surfaces.

F. Cleaning operations shall be scheduled in occupied spaces at the end of each work session and before they are to be occupied by the County for schedule workdays.

3.2 FINAL CLEANING

A. Employ appropriately experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for Substantial Completion or occupancy, conduct inspection of all interior and exterior surfaces, and of concealed spaces, in order to determine scope of required cleaning and properly direct cleaning personnel.

C. At areas of work, remove grease, dust, dirt, stains, labels, fingerprints, paint splatters, and other foreign materials produced during construction from all visible interior and exterior finished surfaces.

D. Repair, patch, and touch up marred surfaces to match specified finish(s).

E. In areas of work, immediately after completion of the work in the area, thoroughly vacuum all carpeting and mop/wash all hard surface floors.

F. At areas of work where soiled by construction activities, broom clean exterior paved surfaces; rake clean other surfaces of grounds.

G. Replace HVAC filters and vacuum, clean registers, grilles, ducts, blowers and coils and vacuum if air handling units were operated during construction.

H. Maintain premises in clean condition until Project, or portion thereof, is occupied by Owner.

END OF SECTION 01 74 00

SECTION 01 78 23 – OPERATING and MAINTENANCE DATA

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 SUMMARY

A. The Contractor shall assemble and provide to the Owner, manuals as described below, containing all normally available technical information on proper operation and/or maintenance of **all** equipment, systems, materials, installations and assemblies that are a part of the Work of this Contract, as well as certain custom drafted instructions/ recommendations where specified in the technical sections of the specifications.

B. The fact that certain items are specifically noted for inclusion in the O & M Manual(s) in the various technical sections of the Specifications shall not be construed as reason for exclusion of customarily available information from the manual(s). **If instructions or recommendations exist, they shall be included.**

1.2 REQUIRED PROCEDURE

A. Submittals of O & M Manuals not strictly conforming to the requirements of this Section will be returned forthwith for proper resubmittal, resultant delay in approval being the responsibility of the Contractor.

1. Prior to request for Pre-Final inspection, submit preliminary draft copy to Architect for approval before making up final copies. Upon approval and **prior to Owner Instruction Session(s)**, submit 1 final printed copy (of each manual) and 1 electronic copy to Architect for transmittal to Owner.

1.3 FORMAT

A. The printed copy of the manual shall be made up in 8-1/2" x 11", (nominal) standard 3-ring binders of good quality, labeled **on the spine** with title, job name and date. All contents shall be 8-1/2" x 11" sheets, except that drawings may be neatly accordion folded to 8-1/2" x 11" size and punched for insertion, with drawing identification clearly visible in lower righthand corner of top side of fold. All data in manuals must be clean, neat, clearly readable, and organized by Specification Division, or other logical sequence, with heavy manila tabbed dividers.

B. An electronic copy of the manual shall also be submitted using the same organization, material and indexing as the hard copies.

1.4 CONTENTS

A. Manuals shall include at least the following:

1. Neatly typewritten index near the front of the manual, furnishing immediate information as to location in the manual of all emergency data regarding the installation. (i.e., phone number of emergency service, etc.).

2. Complete **custom drafted** instructions for proper operation and maintenance of jobsite integrated systems of configuration unique to this project, as called for in the various technical sections of the specifications.

3. Complete instructions regarding operation and/or maintenance of all items of equipment, devices, assemblies, manufactured systems, materials and finishes incorporated into the Work.

    a. Include all assembly instructions and other related packing materials shipped with individual equipment and fixtures and used for installation of the product.

4. Complete nomenclature of all replaceable parts of all equipment, devices or assemblies, their part numbers, current cost, and name and address of nearest vendor of parts.

5. Copies of all guarantees and warranties called for and issued. These copies are in addition to those initially required for approval. Each guarantee, or attachment thereto, shall clearly state the date the guarantee warranty) starts and the name, address and telephone number of the guarantor's representative nearest the Project who will, upon request from the Owner, honor the guarantee (warranty) and provide services prescribed therein.

6. Copies of the related **approved** Shop Drawings (Layout Drawings, etc.) with all data concerning changes made during construction, as applicable, for all items in the manual.

7. All packing instructions for installation, parts, and operation that are shipped with pieces of equipment, fixtures, etc.

B. Where manufacturer's catalog pages are included in the manual(s), clearly indicate the precise items included in this installation and delete, or otherwise clearly indicate, all data with which this installation is not concerned.

1.4 OWNER INSTRUCTION SESSION

A. Upon completion of the Work of Contract, delivery of O & M manuals, and **prior to certification of Substantial Completion,** the Contractor and/or authorized subcontractors shall, **using the O & M manuals as a reference**, thoroughly instruct the Owner, or his authorized representative, in the proper operation and maintenance of all, systems, equipment, assemblies, materials and finishes installed under this Contract.

B. Liability for damage to equipment, systems, or materials caused by improper operation and/or maintenance by the Owner due to lack of proper information and instruction from the Contractor, shall accrue to the Contractor.

C. Time and date of Instruction Session(s) shall be as mutually agreeable to the Owner and the Contractor.

D. Separate sessions may be held for General, Mechanical, and Electrical portions of the Work, **but all components of each of these three categories shall be covered in a single integrated session** (i.e., HVAC controls shall not be discussed separately from basic HVAC system operation, etc.).

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 78 23

SECTION 01 78 39 – PROJECT RECORD DOCUMENTS

In Addition to the Basic Provisions included in the CONDITIONS OF THE CONTRACT, the following requirements shall be strictly observed.

PART 1 – GENERAL

1.1 SUMMARY

A. Complete Record Documents, maintained and submitted as herein described are a mandatory part of the construction process under this Contract. The Architect will review the Record Documents each month prior to certifying the Contractor's Request for Payment, and **no partial payment for any part of the Work will be authorized unless record documentation applicable to that portion of the Work is current and accurate to date.** Likewise, the Work will not be considered complete until the final submittal copies of the Record Documents, as hereinafter described, are properly completed, returned to the Architect, and accepted as complete.

B. In addition to the basic provisions of the General Conditions, the following requirements shall be strictly reserved

1.2 MAINTENANCE OF JOBSITE DOCUMENTS

A. Maintain in current state, at the job site, 1 copy of the following:

1. Contract Documents
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Other Modifications to the Contract
7. Field Test Reports
8. Progress Reports
9. Updated Construction Schedule

B. Label each Document “Project Record” in 2 inch high printed lettering.

C. Record Documents shall be kept up-to-date daily during the entire course of the Work and shall be available on request for examination by the Architect, and when necessary, to establish clearances for other parts of the Work.

D. Use colored pencils for marking, conforming to the following color code:

1. Red for architectural work
2. Dark Green for structural work
3. Dark Blue for plumbing work

4. Purple for heating, ventilating, and air conditioning work
5. Orange for electrical work

E. Store documents in temporary field office, apart from documents used for construction. Maintain documents in clean, dry, legible condition. Do not use Project Record Documents for construction purposes. Documents shall be available at all times for inspection by Architect/Engineer and Owner.

F. The following information shall be maintained on the Record Drawings:

1. All changes or deviation from sizes, locations, details, items, or other features of installation as shown in the original Contract Documents shall be recorded whether covered by Change Order, Field Order, or affected by Contractor's option.

2. In addition, it shall be possible, using these drawings, to correctly and easily locate, identify and establish sizes of utilities, all piping, ductwork and the like, as well as all other features of work **which will be concealed**, either underground and/or in enclosed spaces.

3. Locations of underground work shall be established by dimensions to permanent monuments, control points, or improvements, and by properly referenced centerlines or invert elevations and rates of fall. Show all changes in direction or slope, points of intercept, access, boxes, cleanouts, etc.

4. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. Ordinarily, this shall be by exact scale, or dimension.

G. The following information shall be maintained in the Record Specifications and Addenda:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes or approvals of specified items, standards or procedures made by Change Order.

3. Other incorporated items, standards or procedures not originally specified.

1.3 FINAL SUBMITTAL COPIES

A. As the Work nears completion, the Architect will provide, (1) complete set of the original (Bidding) Drawings on paper, (1) paper copy of any change order, revision or clarification drawings larger than 8-1/2 x 11 issued during the course of the Work, and (1) complete set each of Specifications, Addenda and 8-1/2 x 11 change order, revision or clarification drawings.

B. Working from the jobsite Record Documents, and any other supporting data required, and utilizing a competent scribe, the Contractor shall carefully and neatly record, throughout each of the Documents described in the foregoing paragraph, all changes,

notations and other information stipulated hereinbefore to be recorded. Drawings shall then be scanned, bound and provided in both hard copy and electronic portable document format (PDF) form back to the Owner and shall be as approved by the Architect.

C. Changes/deviations in locations or dimension illustrated on the electronic drawings shall be by means of marking out original dimensions and drafting new dimensions in their place. The Contractor may provide additional drawings for clarification if required, however, no drawing size shall exceed the typical sheet size of the original (Bidding) Drawings. Specifications shall also have all changes hand noted.

D. Prior to request for Final Acceptance Inspection, submit the complete set of Record Documents to Architect for review and comment. Upon receipt of Architect's comments and prior to submitting request for final payment, resubmit (finally corrected) documents, including the electronic set plus 1 set of Drawings and the marked copies of all other Documents.

E. This Final Record Contract Documents submittal shall be accompanied by a transmittal letter which contains:

1. Date of submittal
2. Project title and number
3. Contractor's name and address
4. Title and number of each Record Document
5. Statement of certification that each document as submitted is complete and accurate
6. Signature of Contractor, (authorized representative).

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION 01 78 39

SECTION 02 41 00 - DEMOLITION

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 – GENERAL

1.1 CONTRACT CONDITIONS

A. Drawing indications of existing conditions are cursory, and for Contractor's general reference only. Contractor shall carefully examine existing conditions and accept existing construction and site improvements on an "as is" basis.

B. Prior to starting demolition, Contractor and Architect shall make a complete inspection of conditions of adjacent parts of the building and property, including visible defects close to, or adjoining spaces to be altered. When deemed necessary to facilitate Contractor's work, portions of building, or other improvements, may be removed and replaced in "as-is" condition, at Contractor's expense.

C. Refer to Section 01 35 00 SPECIAL CONDITIONS for requirements for delayed start of demolition work in certain areas.

D. The term "General Demolition" as used herein refers to all demolition other than abatement of asbestos, PCBs and other hazardous materials.

1.2 SCOPE OF WORK

A. Demolish and/or remove all existing construction components, site improvements, systems, items and equipment so indicated on the Drawings **and as further required to properly implement the new work of the Contract.**

B. **Demolition Drawings (if any) are schematic and general in nature and do not attempt to show the exact scope or detail of all required demolition.**

C. Also, at all visible finished areas within the Limits of Work, including the building exterior, remove any miscellaneous unused or abandoned items, such as old brackets, bolts, pipes, phone lines, TV cables, accessories, etc.

1.3 QUALITY ASSURANCE

A. Coordination

1. The Contractor shall fully coordinate **ALL** demolition work, as may be executed by various trades, etc., including mechanical and electrical demolition.

B. Protections

1. All demolition work shall proceed in an orderly and careful manner with due consideration for any existing structures, including any portions of the surrounding structure, which are to remain. Cover as necessary, allowing no leaks of water (or dust particles), even temporary, in existing building.

2. If Owner is using a portion of the building, cooperate with him for continuous operation of his business. Interruptions of any utility service shall be scheduled so as not to interfere with the Owner's business operation, and as stipulated in Section 01 35 00 SPECIAL CONDITIONS.

3. Provide protection of persons and property required by CONDITIONS of the CONTRACT and protection of Historic Components as noted in Section 01 35 00. Provide protection to neighboring property, occupants of said property, customers, visitors, and passers-by, from damage, injury or discomfort caused by dust or any other nuisance. Periodically sprinkle to allay dust as required and/or directed.

4. Avoid any encroachment on adjacent properties unless prior written permission is obtained by Owners. Repair and make good any damage to adjoining properties or improvements caused by operations under this Contract.

1.4 JOB CONDITIONS

A. Disposition of Removed Material

1. All material removed under this Contract, which is not to be salvaged or reused, shall become the property of the Contractor and be promptly removed from the site. General building materials may be reused on the Work if Architect specifically judges them equal to new in all critical respects. Certain items may be scheduled for reuse; (see Drawings for information.) Contractor shall store items to be reused on site as directed or in a bonded warehouse with approval of the Architect.

a. Contractor shall provide all testing and documentation required by the local landfill or governing authority to dispose of building materials and debris. If hazardous materials are identified the Contractor shall proceed as required by the General Conditions of the Contract, Article 16.2.

1.5 Salvage of Materials

A. The Owner reserves the right to salvage certain construction materials, fixtures, or other existing items of value (as may be encountered). Items selected by the Owner for salvage under the Contract shall be removed with particular care and delivered to storage on the premises as directed by the Owner. Materials not claimed by the Owner for salvage, scheduled to be reused or to remain in the Work, shall become the property of the Contractor, and shall be removed promptly from the site.

1. Materials which shall be carefully removed by the Contractor and delivered to the Owner:

a. Windows and sash of any windows removed for installation of window louvers.

b. Any historically significant elements of the building.

2. Items to be carefully removed, cleaned, stored and re-used on the work as specified and shown:

a. Acoustical ceiling tile and grid.

PART 2 – PRODUCT

(Not Used)

PART 3 – EXECUTION

3.1 DEMOLITION

A. Execute all required demolition in an orderly and careful manner.

1. Provide necessary support, shoring, etc. to existing improvements to remain as necessary to prevent damage.

B. All debris and rubble shall be removed from the premises promptly and disposed of at Contractor's expense. Use only covered debris boxes to convey demolished materials through the finished spaces of the existing building. Salvage items shall be wiped reasonably clean and delivered into Contract or Owner's storage, as scheduled, immediately upon removal.

C. Particular care shall be taken at boundaries of demolition work to provide for smooth and properly finished merging of new work with existing to remain. This shall include the removal of existing items (such as corner beads, j-molds, etc.) as required to create a smooth surface or straight corner.

D. All holes, cracks, voids, broken edges, etc., in existing surfaces or other building components to remain, resulting from demolition work, shall be filled, patched, or refinished as required for proper completion and appearance of the finished Work. Specific patching and finishing procedures for various materials may be further addressed in the various sections of these Specifications.

E. Before removal of structural supporting members, provide shoring as required and in a manner suitable to the Work sequences.

F. Where support of existing portions of the Work to remain is to be transferred to new construction, do not remove any other existing load carrying members until adequate temporary shoring, or new supporting structure, having attained full strength, is in proper place.

3.2 CLEAN UP and PATCHING

A. Repair of Damage

1. Repair or replace entirely, as required by Architect, any portion of existing property, building, or other improvements to remain, damaged in the course of demolition, or removed/modified to provide access to new work.

B. Clean Up

1. On completion of demolition work, leave the area of the Work and all adjacent areas clean and in satisfactory condition.

END OF SECTION 02 41 00

SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Sprinkler System Design

B. Piping

C. Sprinkler Heads

1.3 QUALITY ASSURANCE

A. General: Comply with 23 05 00 requirements.

B. Listing: All materials and equipment shall be UL listed and FM approved for the application.

C. Latest Design: Products shall be of the manufacturer's latest design.

D. Code and AHJ Compliance: Products and installation shall comply with code and Authority Having Jurisdiction (AHJ) requirements. Contractor is responsible to review and be familiar with applicable codes, specific AHJ requirements, and to contact the AHJ prior to bidding to confirm requirements. Products submitted are represented by the Contractor as complying with code and AHJ requirements.

1.4 SUBMITTALS

A. General: Comply with Section 23 05 00.

C. Product Data: Submit information on all products to be used; include evidence of product UL listing and FM approval.

1.5 GENERAL REQUIREMENTS

A. Experience: Project's fire sprinkler systems are bidder designed. All design shall be performed by a Contractor and individuals thoroughly familiar with and knowledgeable of NFPA 13, local AHJ requirements, and fire sprinkler system design and installation. By virtue of submitting a bid, the Contractor is acknowledging that he does in fact have such knowledge; that specific requirements

have been confirmed with the AHJ, and all work provided will fully comply with all the requirements of these specifications. The fire sprinkler Contractor shall be qualified, as required by the AHJ to design and install all parts of the fire sprinkler system.

B. Professional Stamp: All fire sprinkler design drawings and calculations shall be prepared by and stamped by a licensed fire sprinkler professional as required by the AHJ.

C. Design: System shall be Contractor designed and approval by both the Fire Marshal and Architect/Engineer. System design shall comply with Contract Documents regarding particular system configuration as may be specified or noted (i.e. routing of mains, head locations, etc.).

D. System Description: Revise existing system as needed to accommodate project work. See drawings for allowance to include in bid and work required.

1.6 REFERENCES

A. FM-AG: FM Global Approval Guide.

B. NFPA 13: Standard for the Installation of Sprinkler Systems.

C. UL-FPD: Underwriters Laboratories Fire Protection Equipment Directory.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: All products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic manufacturer's only.

C. Sprinkler System Components: Reliable, Viking, Potter-Roemer, Gem, Star, Victaulic, Tyco.

2.2 PIPE AND PIPE FITTINGS

A. Pipe and Fittings: Pipe shall be steel or copper; in accordance with NFPA 13. Fittings shall be suitable for 175 psi working pressure, and shall be cast iron or malleable iron screwed, grooved, welded, or soldered; in accordance with NFPA 13. Pipe and fittings shall have a CRR of 1.0 or better. Pipe and fittings ran outside and exposed to the outdoors shall be galvanized type. Flexible braided steel piping serving individual heads may be used where acceptable to the AHJ, and such piping is FM approved and UL listed for the application.

2.3 SPRINKLER HEADS

A. Wet Type - Finished Areas:

1. Pendant: Shall be low profile, glass bulb type, with temperature rating to suit application and factory chrome plated finish. Where installed through ceiling, provide with escutcheons, two piece adjustable recessed type, with factory chrome plated finish to match sprinkler heads. Quick response type.

2. Upright: Shall be glass bulb type, with temperature rating to suit application, and factory chrome plated finish. Quick response type.

3. Sidewall: Shall be glass bulb or fusible solder type, with temperature rating to suit application, and factory chrome plated finish. Quick response type.

B. Wet Type - Unfinished Areas: Link/lever type or glass-bulb type, with natural bronze or chrome plated finish, temperature rating to suit application. Quick response type.

C. Dry Type:

1. General: Provide where system may be exposed to freezing temperatures with finish, length and temperature rating to suit application. Quick response type.

2. Finished Areas: Polished chrome finish type with flush type chrome plated escutcheon where installed through ceilings, soffits, and similar elements.

3. Unfinished Areas: Natural bronze finish with flush or deep type brass finish escutcheon where installed through a floor, ceiling, or similar element.

D. Configuration: Sprinkler heads shall be upright, pendant or sidewall type as required to suit application.

E. Extended Coverage Heads: Provide as necessary to allow complete coverage of all areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Installation of all equipment shall be performed by a Contractor specializing in this work and subject to Owner and AHJ approval. Install all items in accordance with code, manufacturers' recommendations, and best construction practices. Provide all system design, system features, fire sprinkler coverage, system support/anchorage, and documentation as specified herein and required by the AHJ.

B. Pipe Routing:

1. Select pipe routing that maintains full personnel access to building equipment and systems, without requiring stepping over or bending down to cross

sprinkler piping. Follow specific pipe routing requirements of the Contract Documents as indicated. Piping shall run parallel to building structure in a neat, workmanlike manner.

2. All piping shall be run concealed in ceiling space, attic space, pipe shafts, soffits, etc. where possible. Piping may only be exposed with Engineers approval and shall be painted as directed by the Architect/Engineer. Where piping must run exposed, it shall be ran in as unobtrusive fashion as possible, in lines parallel to major building features, as high as possible, and as directed by the Architect/Engineer.

3. Provide all necessary drilling of beams, trusses, etc; reference Section 23 05 00 for cutting requirements; structural Engineers approval is required prior to any such cutting or drilling.

C. Escutcheons: Provide chrome plated escutcheon plates at exposed pipe penetrations of all ceilings, floors and walls.

D. Conflict Resolution: Review all building and system plans carefully and reuse the fire sprinkler work to avoid interferences and conflicts with other trades. Discuss and coordinate proposed sprinkler routing with other trades. The fire sprinkler system has the lowest priority of all building systems and is required to accommodate the space requirements of other systems.

E. System Drainage: Special care shall be taken to ensure that entire sprinkler system is drainable in accordance with code. Provide drain valves as required (with labels) to allow for drainage; valves shall be concealed (with access doors) where possible; provide valves with provisions (male pipe nipple) for attaching temporary drain lines (where needed).

F. Sprinkler Heads: Location of heads shall be no closer than 6 inches to any ceiling T-bar and shall (to the greatest extent possible) be centered in the ceiling panels but shall line up on at least the centerline of one side of the panels.

G. Hangers and Supports: Shall comply with NFPA 13 and Section 23 05 29. See also structural drawings for added limitations/requirements of supports and attachments to structure.

3.2 TESTING

A. Testing: Revised portions of the system shall be hydrostatically and operationally tested in accordance with the requirements of NFPA 13 and the AHJ.

END OF SECTION 21 10 00

SECTION 23 02 00 – OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Operation and Maintenance Manual.

1.3 SUBMITTALS

A. General: Comply with Section 23 05 00 and Division 01.

B. Preliminary O&M: Submit preliminary review O&M manual for review.

C. Final O&M: Submit Final O&M manuals per Division 01.

PART 2 - PRODUCTS

2.1 GENERAL

A. General Contents: A maintenance manual shall be compiled containing maintenance and operating information and maintenance schedules for all project mechanical systems. See Division 01 for quantities, organization, format, and other requirements; meet additional requirements as specified herein.

2.2 SUBMITTAL DATA AND TECHNICAL O&M DATA

A. Submittal Data:

1. General: Provide a copy the submittal data (clearly identified and marked to suit each item). Note: The submittals are not retained by the Owner and a copy is therefore required in the O&M.

2. Product Data: Manufacturer's technical product data, with manufacturer's model number, description of the equipment, equipment capacities, equipment options, electrical power voltage/phase, special features, and accessories. Label data sheets with same designation as used on contract documents. Provide for all items requiring maintenance and for items that may require replacement over a 30-year period or be revised due to an Owner building improvement.

3. Shop Drawings: Provide copy of final shop drawings as approved for each area where shop drawings were required to be submitted.

B. Technical O&M Data: Provide for each equipment or item requiring maintenance. Label O&M data to clearly indicate which equipment on the project it applies to (use same designation as used in the Contract Documents). Data to include:

1. Manufacturer's operating and maintenance manuals and instructions.

2. Itemized list of maintenance activities and their scheduled frequency.

3. Maintenance instructions for each maintenance activity.

4. Manufacturer's parts list.

5. Manufacturer's recommended lubricants.

6. Size, quantity and type of filters required (as applicable).

7. Size, quantity and type each belts unit requires (as applicable).

8. Size, quantity and type of fuses (as applicable).

9. Control devices calibration information.

10. System wiring diagrams and schematics.

11. Control sequence descriptions with setpoints and range of adjustments.

C. Sources: Provide names, addresses, and phone numbers for local manufacturer's representative, service companies, and parts sources for mechanical system components.

D. Start-Up Reports: Include copies of all equipment and system start-up reports.

E. Balancing Report: Include a full copy of the balancing report under a dividing tab for the specification section (or building system) where this work is specified. Where balancing is provided by others, obtain from the balancer a copy of the report to insert in the O&M's.

2.3 MAINTENANCE SCHEDULES

A. General: Provide Maintenance schedules with an itemized list of maintenance activities and their scheduled frequency (i.e., weekly, monthly, semi-annually, etc.) for item requiring maintenance.

B. Special Maintenance: List any critical maintenance items or areas requiring special attention.

C. Start-Up/Shut-Down: Provide normal start-up, operating, and shut-down procedures; emergency shut-down procedures; and (where applicable) seasonal shut-

down procedures.

PART 3 – EXECUTION – NOT USED

END OF SECTION 23 02 00

SECTION 23 05 00 – COMMON WORK RESULTS FOR MECHANICAL

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Division 21 - Fire Suppression.

C. Division 23 - Heating, Ventilation, and Air Conditioning (HVAC) Systems.

D. Division 25 - Integrated Automation.

1.2 WORK INCLUDED

A. General Mechanical System Requirements.

B. Mechanical System Motors.

C. Identification and Labeling.

1.3 DEFINITIONS

A. Abbreviations, Terms and Symbols: Where not defined elsewhere in the Contract Documents, shall be as defined in RS Means Illustrated Construction Dictionary, Fourth Addition and in the ASHRAE Handbook of Fundamentals, latest edition.

B. "As required" means "as necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all codes."

C. "Concealed" means "hidden from view" as determined when areas are in their final finished condition, from the point of view of a person located in the finished area. Items located in areas above suspended ceilings, in plumbing chases, and in similar areas are considered "concealed." Items located in cabinet spaces (e.g. below sinks) are not considered concealed.

D. "Coordinate" means "to accomplish the work with all others that are involved in the work by: directly discussing the work with them, arranging and participating in special meetings with them to discuss and plan the work being done by each, obtaining and completing any necessary forms and documentation required for the work to proceed, reaching agreement on how parts of the work performed by each trade will be installed relative to each other both in physical location and in time sequence, exchanging all necessary information so as to allow the work to be accomplished with a united effort in accordance with the project requirements".

E. "Finished Areas" means "areas receiving a finish coat of paint on one or more wall surface."

F. “Mechanical”, where applied to the scope of work, includes all project fire suppression systems, plumbing systems, HVAC systems, and controls for these systems and all work covered by specification Divisions 20, 21, 23, and 25. Such work is shown on multiple drawings and is not limited to a particular set of sheets, or sheets prefaced with a particular letter.

G. The term "related documents" (as used at the beginning of each specification section), and the Specification Divisions and Sections listed with it, is only an indication of some of the specification sections which the work of that section may be strongly related to. Since all items of work relate to one another and require full coordination, all specification sections, as listed in the Table of Contents, shall be considered as being "related documents", and shall be considered (by this reference) in the same manner as if they had all been listed under the term "related documents" in each specification section.

H. "Work included" (as used at the beginning of each specification section), and the items listed with it, is only an indication of some of the items specified in that Section and is in no way limiting the work of that Section. See complete drawings and specifications for all required work.

I. "Verify" means "Contractor shall obtain, by methods independent of the project Architect/Engineer and Owner, the information noted and the information needed to properly perform the work". Where used as "verify existing" the reference is to all existing items related to the work (i.e. piping systems, duct systems, electrical power, controls, structural conditions, space available, building construction type, etc.); the "verify" definition shall include "Confirm by means independent of any existing field labeling and independent of the Architect/ Engineer and Owner what the existing piping (or duct) system contains, sizes, what the flow direction is, what normal pressures/temperatures are, what other systems and areas the piping (or duct) is interconnected to; what the existing control voltages/signal types are by direct measurement; what the existing electrical power voltages and phases are by direct measurement; and additional field verification and coordination to ensure that compatible products are provided, correct connections made, and all work performed to allow for fully functioning systems." “Means independent of existing field labeling” shall include methods such as: the use of exterior pressurized sources to pressurize piping system lines, use of flow tests with dyes, physical tracing of piping and all connections to, electronic detection methods, electronic/electric line tracing, electrical measurements, physical disassembling of system, excavation or uncovering of concealed systems, use of insertion cameras and similar efforts.

J. “Substitution”: As applied to equipment means “equipment that is different than the ‘Basis of Design’ equipment scheduled on the drawings (or otherwise indicated in the contract documents)”.

1.4 GENERAL REQUIREMENTS

A. Scope: Furnish all labor, materials, tools, equipment, and services for all mechanical work. This section applies to all Division 20, 21, 23, 25 specifications and to all project mechanical work.

B. General: All work shall comply with Division 00, General Conditions, Supplementary Conditions, Division 01, and all other provisions of the Contract Documents.

C. Code:

1. Compliance: All work shall be done in accordance with all applicable codes and ordinances. Throughout the Project Documents, items are shown or specified in excess of code requirements; in all such cases, the work shall be done so that code requirements are exceeded as indicated. Comply with code accessibility requirements.

2. Documentation: Maintain documentation of all permits and code inspections for the mechanical work; submit documentation showing systems have satisfactorily passed all AHJ inspections and requirements.

3. Code Knowledge: Contractor and workers assigned to this project shall be familiar and knowledgeable of all applicable codes and ordinances. Code requirements are typically not repeated in the Contract Documents. By submitting a bid, the Contractor is acknowledging that the Contractor and workers to be utilized on this project have such knowledge.

4. Proof of Code Compliance: Prior to final completion, satisfactory evidence shall be furnished to show that all work has been installed in accordance with all codes and that all inspections required have been successfully passed. Satisfactory evidence includes signed inspections by the local code authority, test lab results, qualified and witnessed field tests, and related acceptance certificates by local code authorities, and field notes by the Contractor as to when all inspections and tests occurred.

D. Complete Systems: Furnish and install all materials, appurtenances, devices, and miscellaneous items not specifically mentioned herein or noted on the drawings, but which are necessary to make a complete working installation of all mechanical systems. Not all accessories or devices are shown or specified that are necessary to form complete and functional systems.

E. Review and Coordination:

1. General: To eliminate all possible errors and interferences, thoroughly examine all the Drawings and Specifications before work is started, and consult and coordinate with each of the various trades regarding the work. Such coordination shall begin prior to any work starting, and continue throughout the project.

2. Suppliers: Suppliers of products shall review the documents to confirm that their products are suitable for the application and that all manufacturers

requirements and recommendations have been satisfactorily addressed in the Contract Documents. Where not addressed the supplier shall notify bidders and the Engineer prior to bidding to resolve any issue or include in their bid an adequate amount to resolve the issue.

F. Conflicts and Discrepancies: Notify the Architect/Engineer of any discrepancies or conflicts before proceeding with any work or the purchasing of any materials for the area(s) of conflict until requesting and obtaining written instructions from the Architect/Engineer on how to proceed. Where conflicts occur, the most expensive and stringent requirement (as judged by the Architect/Engineer) shall prevail. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Architect/Engineer's instructions on how to proceed shall be done at the Contractor's expense.

G. Drawings and Specifications: Drawings and specifications are complementary and what is called for in either is binding as if called for in both. The drawings are diagrammatic and show the general arrangement of the construction and therefore do not show all offsets, fittings and accessories which are required to form a complete and operating installation. Mechanical work is shown on multiple drawings and is not limited to a particular set of sheets, or sheets prefaced with a particular letter.

H. Offsets/Fittings:

1. Piping Systems: Include in bid all necessary fittings and offset to completely connect up all systems, maintain clear access paths to equipment, and comply with all project requirements. Offsets are required to route piping around building structural elements, roof slopes, mechanical systems, electrical systems, and numerous other items. Due to the schematic nature of the plans such offsets are typically not shown. Contractor is responsible to determine the quantity of offsets and fittings required, and the labor involved. No added payment or "extras" will be granted for the Contractor's failure to correctly estimate the number of offsets and fittings and labor required. Contractor is advised that equipment connections may require more than 20 elbows per coil per pipe line.

2. Duct Systems: Include in bid all necessary fittings, offsets, and transitions to completely connect all systems, maintain clear access paths, and comply with all project requirements. Offsets are required to route ducts around building structural elements, roof slopes, mechanical systems, electrical systems, and numerous other items. Due to the schematic nature of the plans such offsets are typically not shown. Contractor is responsible to determine the quantity of offsets and fittings required, and the labor involved. No added payments or "extras" will be granted for the Contractor's failure to correctly estimate number of offsets, fittings, transitions and labor required. Contractor is advised that transitions are required at connections to all equipment, to all air inlets/outlets, crossing of beam lines, at crossing with piping, and similar locations.

I. Design: The level of design presented in the documents represents the extent of the design being furnished to the Contractor; any additional design needed shall be provided by the Contractor. All design by the Contractor shall be performed by individuals skilled and experienced in such work, and where required by local code (or elsewhere in the documents) shall be performed by engineers licensed in the State where the project is located. Include in bid the costs of all such project design; including engineering, drafting, coordination, and all related activities and work. Such designs services are required for many building systems; including but not limited to ductwork at equipment, piping at fixtures and equipment, hanger/support systems, temporary duct/piping systems, mechanical offsets/adjustments to suit other system, seismic anchors, and for methods/means of accomplishing the work. Where design or performance criteria to be met is not stated (or is unclear), develop proposed criteria (based on code, similar projects, and related data) and submit the proposed criteria for review prior to performing full design work.

J. Special Tools: Furnish to the Owner one complete set of any and all special tools such as odd size wrenches, keys, etc. (allen wrenches are considered odd), which are necessary to gain access to, service, or adjust any piece of equipment installed under this contract. Each tool shall be marked or tagged to identify its use. Submit a written record listing the special tools provided, date, and signed by the Owner's representative receiving the tools.

K. Standards and References: Shall be latest edition unless a specific edition, year, or version is cited, or is enforced by the AHJ.

L. Warranties:

1. General: Products and workmanship shall be warranted to be free from all defects, capable of providing satisfactory system operation, and conforming to the requirements of the Contract Documents. Include in the project bid all costs associated with project warranties to ensure that the warranty extends for the required period; possible project delays and failure by others to complete their work may cause the start of the warranty period to be delayed. The Contractor shall be responsible for increasing the warranty dates by corresponding amounts to provide the required warranty periods.

2. Basic Project Warranty: As described in the General Conditions, Supplementary Conditions, and Division 01. See individual specification sections for specific warranty requirements. Start date and duration are as indicated in General Conditions, Supplementary Conditions, and Division 01. Where not indicated otherwise, the basic project warranty shall start at project substantial completion and be for one year.

3. Special Warranties: See individual specification sections for special warranty requirements and extended warranty periods beyond the basic project warranty.

M. Permits and Fees:

1. Obtain and pay for all permits, licenses, fees and inspections as required by the Code and as specified herein (unless noted otherwise).

2. Pay all charges made by any utility company or municipality for material, labor or services incident to the connection of service (unless noted otherwise).

1.5 SUBSTITUTIONS

A. General: See Division 00 and 01 for information and requirements regarding substitutions. Manufacturers not scheduled on the plans or listed as "Acceptable Manufacturers" require prior approval and shall submit a substitution request form (see Division 01 for requirements and limitations). See Paragraph 2.01 this specification section regarding "Acceptable Manufacturers".

B. Redesign:

1. The Contract Documents show design configurations based on particular manufacturers. Use of other manufacturers' products (i.e. substitutions) from what is shown (or specified) may require redesign of mechanical, plumbing, controls, fire protection, electrical, structural, and general building construction to accommodate the substitution.

2. Review the installation requirements for substitutions and provide redesign of all affected construction. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance, utility connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns.

3. Redesign shall be done by the Contractor and shall meet the requirements and have the approval of the Architect/Engineer prior to beginning work. Apply for and obtain all permits and regulatory approvals.

C. Construction Modifications: Provide all required construction modifications to accommodate the substituted products; this includes all mechanical, plumbing, controls, fire protection, electrical, structural, and general building construction. Construction modification shall comply with code, specifications, and be equal to designed construction.

D. Costs: Cost of redesign, construction costs, and all additional costs incurred to accommodate substituted equipment shall be borne by the Contractor.

E. Submittals: In addition to other required submittals, submit shop drawings showing the redesign for substituted equipment; submittal shall include installation plans and sections, connecting services (i.e. ducts, piping, electrical) locations and routing, required service clearances, and related installation details. Submit data required by other disciplines to allow review of the impact of the substitution (i.e. weights, electrical).

1.6 QUALITY ASSURANCE

A. Experience: All work shall be performed by individuals experienced and knowledgeable in the work they are performing, and experienced with the same type of systems and building type as this project. By virtue of submitting a bid, the Contractor is acknowledging that workers to be utilized on this project have such experience and knowledge. Upon request of the Engineer, submit resumes showing the work history, training, and types of projects worked on, for individuals assigned to this project.

B. Code: Utilize workers experienced and knowledgeable with codes pertaining to their work; verify code compliance through-out the project.

C. ASME: All pressure vessels, pressure vessel safety devices, and pressure vessel appurtenances shall comply with the standards of, and bear the stamp of ASME.

D. Quality Assurance Checks: Prior to ordering products and making submittals, confirm the following for each:

1. General: Product is suitable for the intended purpose and complies with the Contract Documents.

2. Manufacturer: Product's manufacturer is listed as an acceptable manufacturer in the Contract Document's or a substitution request (where allowed) has been submitted and the manufacturer has been listed as acceptable.

3. Electrical (for products requiring electrical power):

   a. Product is for use with the voltage/phase as indicated on the electrical plans (or for the electrical circuit the item will be connected to).

   b. Product's ampacity requirements (MCA) do not exceed that indicated on the electrical plans (or for the electrical circuit the item will be connected to).

   c. Where product is a replacement for an existing product, and is to be re-connected to an existing circuit, the existing voltage/phase has been field verified and product matches voltage/phase available.

4. Weight: Product's weight is no greater than that indicated.

5. Space Verification: Product will fit in the space available, and along the path available to install the item, will have adequate service clearances, and will not impede on any clearances required for other items in the space the item will be located.

6. Installation: A suitable method for installing the product has been selected which meets the project schedule and other requirements.

7. Anchorage/Support: The manufacturers recommended method of anchorage and support is consistent with the method indicated in the Contract Documents, and the item has provisions suitable for such anchorage/support.

8. Lead Time: The product's fabrication, shipping, and delivery period meets the project schedule requirements.

9. Substituted Equipment: Where equipment is not the basis of design confirm all requirements for substituted equipment have been met and shop drawings of construction revisions have been (or are being) prepared.

10. Controls: Item is compatible with the controls it will be connected to and has been coordinated with the firm providing the project control work to provide the specified (or required) sequence of operation.

11. Listing: Item is Listed when required to be as such. And if the item is to be installed as part of a Listed system or assembly, it is compliant with the Listing of the overall system or assembly.

12. Existing Buildings/Systems: Product size, weight, connecting services (i.e. electrical, controls, power, plumbing, etc.) are configured and suitable for existing items they connect to or interface with.

E. Check-Out: The Contractor shall be responsible to verify that proper installation and proper connections have been provided for all mechanical work. Contractor shall provide installation checkout, start-up services, and perform a thorough check of all mechanical systems to verify proper installation and operation. Contractor shall operate all items multiple times under varying conditions to confirm proper operation. Contractor shall submit a checklist listing all equipment, fixtures, and similar items furnished on this project, with a date and initials indicating when the item was checked, a list of what was checked, and by whom. Such check shall, as a minimum utilize documents provided by the equipment manufacturer. Such a check-out is in addition to any commissioning activities specified (unless noted otherwise).

1.7 SUBMITTALS

A. General:

1. See Division 00 and 01 for submittal requirements.

2. By making a submittal (of shop drawings or product data) the Contractor represents that they have reviewed them for compliance with the Contract Documents, including detailed connection and installation features and requirements, and that the submitted item is their proposed method of compliance with the Contract Documents.

3. Perform no portion of the work for which the Contract Documents require a submittal until the respective submittal has been made, the review completed by the Architect/Engineer, and all issues resolved.

4. The Owner and Architect/Engineer are depending on the submittal process as a final review and confirmation of materials and various aspects of the work, and may make changes in the project due to information contained in the submittals and with the understanding that the opportunity to make changes exist until submittals are made and the review is completed. The Contractor is responsible for added costs which may be incurred if work is performed which limits the Owner the opportunity to make such changes (e.g. work done prior to a submittal being made or the submittal review being completed).

5. Submittals shall be logically organized, neat and legible. Submittals to include:

   a. Name of project.

   b. Owner's name.

   c. Specification section reference and paragraph (or drawing number or detail) submittal is for.

   d. Contractor name and contact information.

   e. Subcontractor name and contact information.

   f. Date of submittal.

6. Electronic Files: Submittals that are sent electronically shall have a separate .pdf file corresponding to the each specification section. Files shall be named with the specification number and title.

B. Quality Assurance: By submitting an item for review, the Contractor is claiming that all "Quality Assurance Checks" (see paragraph 1.06 this specification Section) have been performed and satisfactorily passed and no further comment from the submittal reviewer is required for the "Quality Assurance Checks".

C. Variations: Only variations that are specifically identified as described herein will be considered. Provide with the submittal (in addition to other information required): description of the proposed variation, entity who is proposing the variation, why the variation is being proposed, any cost changes associated with the variation, and any other pertinent data to allow for review. Failure to submit information on the variation as described will result in the submittal review being conducted without considering the variation.

D. Product Submittals - Information Required:

1. Manufacturer's professionally developed documents, containing product description, model number, and illustrations. Mark clearly to identify pertinent information and exact model and configuration being submitted.

2. List of accessories and options provided with product.

3. Product dimensions and clearances required.

4. Product weight.

5. Submittal identified with product name and symbol (as shown on the drawings or written in the specifications) and specification Section and paragraph reference.

6. Performance capacity and characteristics showing compliance with the Contract Documents.

7. Manufacturer's and local manufacturer's representative names, addresses, and phone numbers.

8. For equipment requiring piping or duct connections:

    a. Type of connections required.

    b. Size and locations of connections.

9. For electrically operated equipment:

    a. Number and locations of electrical service connections required.

    b. Voltage required.

    c. Fuse or circuit breaker protection requirements.

    d. Motor starter requirements; if motor starter is furnished with the equipment, submit product information on motor starter.

10. For equipment requiring control connections:

    a. Type of control signals required.

    b. Control communication protocol.

    c. Information on control devices furnished with equipment.

    d. Location of control connections.

11. Manufacturer's installation instructions.

12. See each specification Section for additional submittal requirements.

13. Edited Content: Submittals shall indicate the equipment and options that are to be provided. Copies of an unedited catalog will be rejected. Pages/items that are not applicable shall be deleted prior to submittal to the Engineer.

E. Shop Drawing Submittals:

1. Shop drawings shall be professionally drafted using AutoCAD, Revit, or an equivalent compatible program (hand sketches are not acceptable). Shop drawings shall be independently developed by the Contractor and not be a copy of the Contract Drawings.

2. Submit electronic files in original drafting format (i.e. *.dwg) and pdf format with as-built documentation.

3. Provide shop drawings for the following systems:

a. VRF system refrigerant piping.

b. HVAC control systems.

c. For any parts of any system which are to be installed differently than as shown on the drawings.

d. Construction revisions to accommodate Substituted Equipment.

e. Other areas/work as noted in the Contract Documents.

f. For those systems requiring shop drawings, reference system's specification Section for additional requirements.

F. Re-Submittals: If submittals are marked 'Rejected' or 'Revise and Resubmit', the Contractor shall revise the submittal to satisfy the comments or conform to project requirements, and submit to the Engineer for review. Only those items that were rejected or required a resubmittal will be reviewed by the Engineer; All other items will not be reviewed. All re-submittals shall be at least one of the following:

1. Provide a 'Re-Submittal Summary Sheet' which indicates how each comment was addressed (it is acceptable to add the responses to a copy of the original submittal review comments).

2. Cloud (or otherwise clearly identify) the revised portions to indicate what is different from the original submittal.

1.8 RECORD DOCUMENTS

A. Field Record Drawings: Maintain a set of full size contract plans at the project site upon which all changes from the as-bid plans are noted. Plans shall be maintained clean, dry and legible; with information recorded concurrent with construction progress. These plans shall also include actual locations (with dimensions) of all underground and concealed mechanical systems. Connection points to outside

utilities shall be located by field measurements and so noted on these record drawings. All addenda, change order, field orders, design clarifications, request for information, and all other clarifications and revisions to the plans shall also be made a part of these record drawings. Plans shall be available for weekly review by the Architect/Engineer. Label drawing "As-Builts" with date, name of Contractor, and name of individual overseeing the work.

B. Final Field Record Drawings Submittal: Deliver to the Architect/Engineer the original Field Record drawings and one full size copy (may be scanned, and submitted in PDF format).

1.9 PRODUCT HANDLING, PROTECTION AND MAINTENANCE

A. Protection:

1. Protect all products from contamination, becoming unclean, and from damage of any kind and whatever cause; when being handled, in storage, and while installed, until final project acceptance.

2. Completely cover fixtures, motors, control panels, equipment, and similar items to protect from becoming unclean and damage of any kind.

3. Protect premises and work of other trades from damage due to Mechanical work.

B. Openings: Cap all openings in pipe, ductwork and equipment to protect against entry of foreign matter until all work that could cause unclean conditions or damage is complete (including work that has dust or fumes associated with it). Caps shall be of sufficient strength and seal integrity to prevent entry of water or fumes for the most extreme conditions they may be exposed to (i.e. high velocity water spray, high winds, concrete splash, etc.)

C. Storage: Provide properly conditioned and sheltered storage facilities for products to prevent damage of any kind and to maintain new condition. Provide adequate venting arrangements to avoid condensation damage.

D. Operation and Maintenance:

1. General: Inspect products periodically to confirm conditions and maintenance needs. Keep records of inspections and (upon request) forward to the Architect/Engineer prior to project final acceptance. Operation and Maintenance shall be in accordance with manufacturer's written procedures and recognized best maintenance practices. Keep records of maintenance and (upon request) forward to the Architect/Engineer prior to project final acceptance.

2. Stored Products: Provide maintenance (i.e. equipment rotation, lubrication, flush, cleaning, etc.) and inspection on products while stored to maintain new condition.

3. Installed Products: Provide maintenance and inspection of products and operate mechanical systems until substantial completion or specified Owner Instruction has been provided (whichever is later). Maintenance shall include all labor and materials and all manufacturers' recommended maintenance (i.e. strainer cleaning, filter changes, bearing lubrication, belt tensioning, etc.). In addition to scheduled maintenance, review all equipment periodically to allow detection of improper operation or any special maintenance needs; review shall be consistent with best practices for the product but in no case less than a site visit every two weeks. Document all maintenance activities.

E. Damaged Products: Damaged products shall be replaced with new. Where damage is limited to paint (or similar finish), the product may remain if the finish is restored to a new condition (as judged by the Architect/Engineer).

1.10 JOB CONDITIONS

A. Special Requirements:

1. Maintain emergency and service entrance usable to pedestrian and vehicle traffic at all times. Where trenches are cut, provide adequate bridging for traffic.

2. Coordinate startup and shutdown of all mechanical systems and utilities with related trades and the Owner's representative.

3. Coordinate all construction activities with the Owner's Representative and cooperate fully so as to minimize conflicts and to facilitate Owner usage of the premises during construction.

4. Provide temporary services to occupied areas to accommodate Owner's use during construction. All temporary work shall comply with same specifications as for new work and be of same quality.

B. Downtime Restrictions:

1. Contractor shall notify the Owner at least 72 hours in advance of any intended shut-down of any building services or systems and obtain Owner approval prior to proceeding.

2. Electrical power to the building shall not be interrupted at any one time for more than 15 minutes.

C. Schedule of Work: Arrange work to comply with schedule of construction, and so as not to violate any downtime restrictions, and to accommodate the Owner's scheduled use of the premises during construction.

1.11 ENGINEER FIELD REVIEWS AND TEST WITNESSING

A. General: Arrange construction schedule and notifications to the Engineer to accommodate Engineer's schedule and the possibility of review times occurring up

to 14 days after notification, and for the possible failure to satisfactorily pass Engineer's reviews requiring revisions and re-reviews.

B. Notification: Notify Engineer at least 7 days in advance of readiness for reviews; arrange mutually agreed upon times for the reviews to occur.

C. Access: Provide ladders, any special tools and safety equipment to allow Engineer's access to areas and equipment. Remove and reinstall ceiling tiles, access panels, and similar items where requested to allow for reviews.

D. Review of Systems with Equipment:

1. Prior to Engineer's review, system's equipment shall have received specified start-up and be substantiated by a written report.

2. Prior to Engineer's review, systems shall have been operating properly for at least five consecutive days prior to the scheduled review date.

3. Personnel shall be present to operate the system's equipment and controls, and to vary system settings as directed by the Engineer to allow for a review of operation over a range of settings.

E. Re-Review Fees: The project budget allows for one review by the Engineer for specified reviews and witnessing. See Division 00 and 01 for compensation to the Owner to in turn allow for compensation to the Engineer for required re-reviews.

1.12 REFERENCES

A. ASME A13.1: Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Any reference in the Specifications or on the Drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, model number, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The manufacturers listed as Acceptable Manufacturers may bid the project for the items indicated without submitting a substitution request; however that does not relieve the products from having to comply with the Contract Documents.

B. Substitutions: Products by manufacturers listed as "Acceptable Manufacturers" (other than those listed as the "Basis of Design") are considered substitutions and shall comply with the requirements for substitutions. See Paragraph titled "Substitutions" in Part 1 of this specification section.

C. Considerations: In reviewing a manufacturer for acceptance, factors considered (as compared to the specified item) include: engineering data showing item's capacity,

performance, proper local representation of manufacturer, likelihood of manufacturer's future local support of product, service availability, previous installations, previous use by Owner/Engineer/Architect, product quality, availability/quality of maintenance and operation data, electrical requirements, capacity/performance, acoustics, physical dimensions, weight, items geometry and access requirements, utility needs, and similar concerns.

D. Limitations of the Term "Acceptable Manufacturer": The listing of a manufacturer as an Acceptable Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which have represented themselves as being capable of manufacturing, or have in the past manufactured, items equal to those specified. The burden to review products to confirm equivalency with the specified products is on the Contractor. The Architect/Engineer shall be the final judge as to whether an item is equal to that specified.

E. Quality: Products provided by Acceptable Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the Contract Documents. The Architect/Engineer shall be the judge as to whether an item meets these requirements or not.

F. Manufacturer: To be considered as being made by a particular manufacturer, the product must be made directly by the manufacturer and have the manufacturer's name (or nameplate with name) affixed to the product (or on the product container where direct labeling is not possible). Example: manufacture "A" is listed as an acceptable manufacture; manufacturer "B" is not listed as an acceptable manufacturer; manufacturer "A" owns "B"; products from "B" do not qualify as being made by an acceptable manufacturer by virtue of ownership.

2.2 PRODUCTS - GENERAL

A. Standard Products: Products shall be standard products of a manufacturer regularly engaged in the manufacture of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The two year's experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Except that equipment changes made solely to satisfy code requirements, to improve unit efficiency, or to comply with unique project requirements are not required to have two year prior operation.

B. Latest Design: Products shall be the latest design and version available from the manufacturer, including software. Discontinued products shall not be used.

C. Service Support: Qualified permanent service organizations for support of the equipment shall be located reasonably convenient to the equipment installation and

able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

D. Manufacturer's Nameplate: Equipment shall have a manufacturer's nameplate bearing the manufacturer's name, address, model number, serial number, and additional information as required by code. Nameplate shall be securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable. Nameplate shall be of durable construction, easily read, with lettering minimum size 12 font.

E. Compatibility: All components and materials used shall be compatible to the conditions and materials the items will be exposed to. All items exposed to the weather shall be galvanized, or be of stainless steel or similar corrosion resistant material.

F. Sizes: Sizes indicated for products manufactured to standardized sizes (e.g. pipe, pipe fittings, valves, material gauges, etc.) are minimums. During bidding confirm that the sizes are available and meet project requirements. Where indicated sizes are not available provide the next larger available size; confirm this larger size will suit the construction and meet Contract Document requirements prior to ordering. Such size revisions are subject to Engineer's review; indicate size revisions on the product submittal and why the size is being revised.

G. Non-Specified Items: Materials shown on the drawings but not specified shall be provided as shown and as required to suit the application illustrated and intended and shall be of commercial quality, consistent with the quality of similar type items provided on the project. Not all items shown on the drawings necessarily have a corresponding specification; such items shall be provided per this paragraph and so as to provide complete, finished, fully functioning mechanical systems.

H. Weights: Do not exceed the weights shown unless added structural supports are provided. Such supports shall meet the requirements of the project Structural Engineer. The Contractor shall bear all costs for all redesign and added supports to accommodate heavier equipment. The Contractor shall reimburse the Engineer for all time associated with all review and analyses regarding the use of equipment heavier than that indicated.

I. Temperature/Pressure Rating: All materials and components furnished shall be suitable for the temperature and pressures they will be exposed to. Contractor shall consider possible operating modes to ensure proper material ratings.

J. Standardization: All products of the same type shall be by the same manufacturer and have the same characteristics and features to allow for Owner's standardization.

K. Model Numbers: Any reference to a manufacturer's "model number" is a reference to a manufacturer's series number or type of product, and is not a complete "model number" in having all the necessary numbers/letters to convey all of the features, accessories, and options that are required. These series numbers are only meant to convey a type of product that may meet the project requirements. Where conflicts

or discrepancies occur regarding a listed manufacturer's series or "model" number and specified capacities or features, the more stringent and expensive shall prevail.

L. Application and Suitability: Products shall be designed and intended for: institutional application, for the use indicated, and be suitable for the operating conditions they will be exposed to. Firms supplying the products shall review the documents and related site and environmental data to confirm compliance. By making product submittals and using products they are being represented as appropriate for the project and application shown.

2.3 ELECTRICAL

A. General: All electrical devices, wiring, products, and work shall comply with the Division 26 specifications and code. See drawings for building occupancy type, types of construction, and areas which may require special wiring methods or other electrical work. Electrical disconnects shall be accessible as required by code, and shall not require removal of screens, equipment, or other items to access.

B. Equipment: All equipment requiring power shall be factory wired to an equipment mounted junction box (or an accessible compartment with power terminals or electrical device) arranged to allow for connection of electrical power.

C. Overcurrent protection: Circuit breakers, circuit breaker disconnects, fuses, and other current limiting devices indicated to be provided, shall be rated to suit the maximum overcurrent rating of the item served, and have other ratings, as required by code. Circuit breakers for HVAC and refrigeration unit equipment shall be UL listed by HACR type.

D. Short Circuit Current Rating (SCCR): All equipment (or components) requiring the use of electrical power shall have a SCCR value to comply with code. The minimum rating shall be 5,000 Amps RMS Symmetrical unless a lower value is indicated on the plans or allowed by code. Where the Contractor wishes to utilize equipment having a lower rating, the Contractor shall be responsible to provide calculations substantiating that a lower SCCR is acceptable (and complies with code), or make revisions to the electrical system to accommodate the proposed equipment (or components).

E. Product Certification (Listing): Products which require connection to electrical power shall be certified (i.e. listed) by a Nationally Recognized Testing Laboratory (NRTL) and be labeled (in a conspicuous place) with such certification (or certification mark). Certification shall comply with code, OSHA Standards, and Authority Having Jurisdiction (AHJ) requirements. NRTL's shall be recognized as such by OSHA and the AHJ. Certification shall be for the complete assembly (approval of individual components is not acceptable). Field evaluations to obtain certification shall be performed by accredited product testing laboratories acceptable to the AHJ and Engineer, be performed in accordance with code, NFPA 791, recognized practices, and be labeled to identify the certification. Certification is not required where the AHJ does not require it.

F. Power Restart: All equipment, components and systems shall be configured to automatically restart upon restoration of power after a power failure (i.e. either generator power, UPS power, or utility power); unless specifically noted otherwise or required for safety reason to require manual restart. Provide staged restart as required by the control sequences or for proper generator operation or system operation.

2.4 MOTORS

A. General: Where a piece of equipment specified includes an electric motor, the motor shall be factory installed and mounted. Motor starters and motor electrical disconnect switches shall be provided by the Contractor doing the work of the Section where the item was specified, unless specifically shown to be provided by Division 26 (or another Division). Wiring from the motor to motor starters and to electrical disconnects shall be by the Contractor doing the work of the Section where the item was specified, unless specifically shown to be provided by Division 26.

B. Acceptable Manufacturers: General Electric, TECO-Westinghouse, Reliance, Gould, Century, Baldor, U.S. Motors, Marathon, and acceptable manufacturers for the equipment (see individual specification sections).

C. Type: Motor type shall comply with code and applicable standard requirements and be configured to suit the application. Motors located indoors shall be open frame, drip-proof type, unless indicated otherwise. Motors located outdoors exposed to weather shall have corrosion resistant finish and shall be totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) type, unless indicated otherwise.

D. Listing: All motors shall be UL listed.

E. Efficiency: Motor efficiencies shall comply with code. Fractional horsepower motors shall be the electronically commutated (EC) type with speed control where noted and where non-EC motors are not available which comply with code efficiency requirements. Motor power factor shall comply with code, local utility requirements, and as indicated. Provide added power factor correction devices as necessary to comply.

F. Sizing: Motors shall not be smaller than indicated and of adequate size to start and drive the respective equipment when handling the quantities specified without exceeding the nameplate full load current at the conditions indicated and for the expected operating conditions. If it becomes evident that a motor furnished is too small to meet these requirements as a result of the Contractor using substituted equipment or having revised the system arrangement, the Contractor shall replace it with a motor of adequate size at no additional cost to the Owner. Contractor shall also arrange with the Electrical Contractor to increase the size of the wiring, motor starter and other accessories as required to serve the larger motor at no additional cost to the Owner.

G. Service Factor: Minimum 1.15.

H. Variable Frequency Drive (VFD) Applications: Motors used with Variable Frequency Drives (VFD's) shall be rated for such use per IEEE standards and have shaft grounding protection.

I. EC Motors (ECM):

1. General: Electronically commutated type with integral inverter to convert AC power (of voltage/phase indicated) to DC power, and solid state circuitry to vary output power and speed of motor. Motor shall have permanently lubricated bearings with an L10 life of 100,000 hours at expected operating conditions. Motor shall have rotor position and rotation detection as required for operation.

2. Speed Range: Motor speed shall be controllable down to 25% of full speed.

3. Manual Speed Control: Provide with manual speed adjustment dial for motor speed control. Dial shall be motor mounted unless indicated otherwise, operable by a screwdriver or by hand. Motor mounted controls shall be factory wired. Remote mount dials shall be hand operable (i.e. no tools required), shall be for mounting on a standard 2 x 4 electrical junction box, and be able to be located up to 100 feet remote from the motor. Motor control wiring for remote mount dials shall be factory wired from the motor to an equipment mounted junction box (with field supplied wiring from this J-box to the remote dial).

4. EMCS Control: Motor speed shall be adjustable via a remote 0-10V input signal (unless noted otherwise) from the building EMCS. Control wiring shall be factory wired from the motor to an equipment mounted junction box. EMCS control is not required where not indicated to be provided or where not utilized as part of the control sequence.

5. Control Power: Provide with integral transformer, factory wired, as needed to power motor controls. Locate transformer at motor or equipment.

2.5 IDENTIFICATION AND LABELS

A. General: Mechanical equipment shall be labeled. Labels in concealed accessible spaces shall be reviewed and verified by Architect/Engineer prior to being concealed.

B. Piping:

1. Type: Self-sticking colored identification markers, lettered to identify the pipe contents, and banded at each end with arrow tape indicating the direction of flow. Markers shall be similar and equal to Brady "System 1" and Seton "Opti-Code" markers. Spray painted stencil labeling is not acceptable. Some labels may be special order.

2. Identification Colors: Comply with ASME A13.1, and as follows:

Conveyed Material/System	Background	Letters
Hydronic Systems	Yellow	Black
Refrigeration	Black	White

3. Lettering: Lettering shall identify the material conveyed in each pipe and shall match the designation used on the plans, but without abbreviations. Systems which have supply and return piping shall have piping labeled as such (i.e. heating water return, heating water supply, etc.). Systems that have different pressures shall be labeled to indicate such (i.e. Steam-Low Pressure, Steam- Medium Pressure, Natural Gas-Low Pressure, Natural Gas-Medium Pressure, etc.).

4. Size: Size of letters and color field shall comply with ASME A13.1, repeated here for convenience:

Outside Diameter of Pipe or Covering	Length of Color Field	Size of Letters
3/4 to 1-1/4 Inches	8 Inches	1/2 Inches
1-1/2 to 2 Inches	8 Inches	3/4 Inches
2-1/2 to 6 Inches	12 Inches	1-1/4 Inches
8 to 10 Inches	24 Inches	2-1/2 Inches
Over 10 Inches	32 Inches	3-1/2 Inches

5. Applications: Install on all exposed piping adjacent to each shut-off valve, at branches to indicate changes of direction, where pipes pass through walls and floors, on 20 foot centers or at least one in each room on each pipe. Markers shall be installed on all concealed accessible piping (i.e., piping above suspended ceilings, behind access doors, in accessible chases, etc.) near the point of access. For piping above suspended ceilings, markers shall be installed the same as if the piping was exposed (i.e., same as if the suspended ceiling was not in place). Markers shall be installed so as to be easily read by a person standing on the floor. Provide additional flow arrows at each pipe connection at valves having more than 2 ports (i.e. 3-way control valves).

6. Other Requirements: See other specification Sections for additional requirements.

C. Valves:

1. Labels: Laminated plastic or phenolic material, at least 1/16-inch thick, with black surface layer and white (unless other color indicated) sub-layer for letter engraving to expose sub-layer. Labels shall not be less than 3" x 1" in size. Label shall be pre-drilled at one end for attachment to valve. Attach to valve with No. 6 polished nickel-steel jack chain of sufficient length to allow label to hang free.

2. Lettering: Engrave label with valve size, name of system served (cold water, heating water supply, chilled water supply, etc.) and purpose of valve. Lettering size 3/16-inch, except where needed to be smaller to fit label size.

3. Application: Labels shall be installed on all valves except valves at hydronic system coils and equipment where the valve purpose is readily obvious.

D. Equipment:

1. Labels: Laminated plastic (or phenolic) material, 1/16-inch thick, with black surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Minimum 2-inch high (unless indicated otherwise or required due to equipment size) with length to contain required lettering. Label shall be pre-drilled and be mechanically fastened to the equipment. Prior to making labels, submit a list of all proposed labels.

2. Lettering: All caps, engraved on label, with equipment designation (same designation as used on Contract Drawings; e.g. HVAC-101, EF-22, CP-1A). Air handling equipment (i.e. VAV terminal units, fans, etc.) labels shall include the room names and numbers or area of building served (use final installed room designations). Where systems serve portions of the building (i.e. wings or floors), include on label the area served. Lettering shall be in multiple rows, with equipment label on top row. Equipment lettering to be 5/8-inch high; area served lettering to be 3/8-inch high (except that smaller lettering may be used if necessary to fit label size).

3. Application: All scheduled mechanical equipment shall be labeled. The label shall be located on a side of the equipment so as to be easily read, with the marking visible to a person standing at the access level near the equipment (assuming any necessary access to a concealed unit has been made).

E. Electrical Devices:

1. Labels: Minimum 1/4-inch high (unless indicated otherwise) lettering, all caps, engraved on laminated plastic or phenolic material, at least 1/16-inch thick. Laminated plastic (or phenolic) shall have black surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Label shall be pre-drilled and be mechanically fastened to the item; where mechanical fastening is not possible use 3M VHB double sided specialty tape No. 4945. Prior to making labels, submit a list of all proposed labels.

2. Lettering: Label shall identify the item served (using the same designation as indicated on the Contract Drawings), the source of power (by panel and circuit breaker), and comply with code.

3. Application: Variable frequency drives, motor starters, disconnects, contactors, relays and similar items which control power to equipment and system components shall be labeled. The label shall be located so as to be easily read. See Division 25 for labeling of low voltage control components.

F. Duct Access Doors:

1. Labels: Minimum 1-inch high (unless indicated otherwise) lettering, engraved on laminated plastic or phenolic material, at least 1/16th inch thick. Laminated plastic (or phenolic) shall have red surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Label shall be pre-drilled and be mechanically fastened to the duct access door.

2. Lettering: Label shall comply with code, and indicate the item being accessed (i.e. Fire/Smoke Damper, Fire Damper, CO2 Sensor, etc.).

3. Application: All duct access doors serving fire dampers, fire/smoke dampers, smoke dampers, control dampers, items required by code, and control devices shall be labeled. The label shall be located so as to be easily read, with the marking visible to a person standing at the access level near the access door (assuming any necessary access to a concealed label has been made).

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship: Furnish and install products to provide complete and functioning systems with a neat and finished appearance. If, in the judgment of the Architect/Engineer, any portion of the work has not been installed in accordance with the Contract Documents and in a neat workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall be required to revise the work so that it complies with the Contract Documents, at no increase in cost to the Owner.

B. Coordination: Coordinate the work with all trades that may be affected by the work to avoid conflicts, allow proper maintenance access, provide required clearances, and to allow for an organized and efficient installation of all systems.

C. Submittals: Perform no portion of the work for which the Contract Documents require a submittal until the respective submittal has been made, the review completed by the Architect/Engineer, and all issues resolved.

D. Examination and Preparation: Examine installation conditions and verify they are proper and ready for the work to proceed. Verify compatibility of materials in contact with other materials, and suitability for conditions they will be exposed to. Do not proceed with the work until unsatisfactory conditions have been corrected. Prepare area to accept the work and prepare products for the installation.

E. Field Conditions: Check field conditions and verify all measurements and relationships indicated on the drawings before proceeding with any work. In verifying existing conditions, the Contractor shall verify by direct physical inspection, complete tracing out of systems, by applying test pressures, by excavation and inspection, use of pipeline cameras, and other suitable absolute certain methods to confirm the actual physical conditions that exist.

F. Openings and Cutting and Patching in Existing Construction:

1. Openings--General: Provide all openings and cutting as needed to accommodate all work. Provide patching to restore all damaged and disturbed areas to pre-construction conditions (or better). The Contractor or subcontractor requiring the opening shall be responsible for making that opening. The opening shall be made by skilled labor experienced in providing openings in the material being penetrated.

2. Areas To Be Cut and Patched: Wherever floors, walls, ceilings, plates, firestops and framing members are cut, these openings shall be substantially reinforced and sealed so as to maintain the strength and sealing ability of the element equal to that as if it had not been cut. All reinforcement/sealing shall satisfy the Architect/Engineer and comply with the governing codes. Such cut areas shall be patched and restored to a finished condition, equal to adjacent final finished areas that have not been cut.

3. Cutting of Structural Features: Make no cuts or alterations to any structural framing members without explicit consent of the Engineer, and then only under his direction. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. All required cutting to install material shall be accomplished with the use of saw cutting equipment.

4. Patching Materials: Patching shall be with materials of like kind and quality of the adjoining surface by skilled labor experienced in that particular trade.

G. Cleaning: Clean all products (whether exposed to view or not) of all construction debris, and other materials; grease and oil spots shall be removed with appropriate cleaning agents and surfaces carefully wiped clean. Where cleaning cannot restore items to new conditions, the item shall be replaced with new.

3.2 INSTALLATION

A. General: Work shall be in accordance with manufacturer's written installation instructions, code, applicable standards, and best construction practices.

B. Space Verification: Prior to ordering materials verify that adequate space exists to accept the products, along the installation path, and to allow for proper maintenance access. Select products that will fit the space available; some optional materials (i.e. valve types, fitting types, substitutes manufacturer's etc.) may not be suitable. Verification shall be by direct field measurement of the actual space available and use of manufacturer's final submittal dimensions. Where the project involves new construction and long lead items and a time schedule not allowing for such direct field measurements, confirm in writing with all trades associated with building the space that adequate room is available. Review maintenance and service access space required and confirm requirements will be met. No submittals shall be made until such space verification work has been performed, and confirmed that adequate space

is available. By virtue of making a submittal that Contractor affirms he has completed this verification.

C. Installation Locations:

1. General: Unless dimensioned locations for items are shown, select the precise location of the item in accordance with the Contract Documents, coordinated with other trades and item connection locations, and subject to the Architect/Engineer's review. No allowances will be granted for failure to obtain the Architect/Engineer's review, failure to coordinate the work, and failure to comply with Contract Document requirements.

2. Manually Operated Components: Valves, damper operators, on/off switches, keypads, controls, and other devices which are manually adjustable or operated shall be located so as to be easily accessible by a person standing on the floor adjacent to the item. Any such items which are not in the open shall be made accessible through access doors in the building construction. See individual specification sections for additional requirements.

3. Monitoring Components: Gauges, thermometers, instrumentation, and other components which display visual information (i.e. operating conditions, alarms, etc.), shall be located and oriented so as to be easily read by a person standing on the floor. Provide necessary brackets, hangers, remote read devices and accessories as needed. Equipment control panels and graphic displays furnished with equipment (or integral to equipment) shall be located to be easily accessible by a person standing on the floor adjacent to the equipment, and be located between 4-feet and 6-feet above the finished floor.

4. Installation Issues: If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Architect/Engineer before installing the item in a location that will result in poor access.

5. ADA Accessibility: Locate items which are required to be ADA accessible in accordance with code (including but not limited to IBC, ICC A117.1 and local amendments) for accessibility; verify accessibility requirements with the AHJ.

D. Replacement and Maintenance: Install mechanical equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance (e.g. coils, heat exchanger bundles, sheaves, filters, bearings, etc.) can be removed. Relocate items which interfere with access or revise item installation location, orientation, or means of access.

E. Building Access Doors:

1. Access doors are typically not shown on the drawings; provide where indicated and where needed to provide access to valves, drains, duct access doors, equipment, control devices, dampers, and similar items requiring

service or access that would otherwise be inaccessible. Provide access doors to allow for the future removal of items that would require the removal of permanent building construction (i.e. GWB ceilings, GWB walls, concrete construction, etc.)

2. Select size, quantity, and locations of access doors. Review all drawings, construction materials, and work of other trades in determining access door requirements.

3. Developed dimensioned locations where needed for use by other trades or for coordination purposes.

4. Coordinate access door locations, size, and details with other trades.

F. Rotating Parts: Belts, pulleys, couplings, projecting setscrews, keys and other rotating parts which may pose a danger to personnel shall be fully enclosed or guarded in accordance with Code, and so as not to present a safety hazard.

G. Equipment Pads:

1. Outdoors At Grade:

a. General: All ground mounted mechanical equipment shall be installed on a concrete pad (unless indicated otherwise). Pad shall be minimum 6-inch thick, minimum 4" wider than the equipment all around. Set pad on minimum 6-inch gravel base, compacted to 95% density. Concrete shall be same as used for building footings (unless noted otherwise) and be placed in accordance with ACI standards.

b. Where the largest dimension for any pad exceeds 4 feet or the equipment exceeds 300 lbs, provide pad with welded wire fabric (6-inch x 6-inch, No. 6), centered in pad.

c. Where the largest dimension for the pad exceeds 6 feet or exceeds 400 lbs, provide 8" thick concrete pad with #4 rebar centered in pad 12-inch on center each way, and set pad on 8-inch deep gravel base (compacted to 95% density). Pad shall be minimum 6-inches larger than equipment all around.

d. Freeze Protection: Where project location is subject to freezing water below the bottom of the pad depth, provide thickened perimeter edge to frost depth (unless written direction from a structural engineer or the soils report does not require such depth). Provide #4 re-bar 6" on center horizontal and vertical in thickened edge and both ways horizontally in main pad field (in lieu of welded wire fabric).

H. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil plastic tape wrapped at point of contact or plastic centering inserts.

I. Electrical Offsets: Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below electrical panels to structure, and clearance of 3.5 feet directly in front of panel, except where indicated otherwise or required by code to be more. Such required offsets are typically not shown on the plans but are to be provided per this paragraph. Include in bid offsets for all systems near electrical panels.

J. Piping Through Framing: Piping through framing shall be installed in the approximate center of the member. Where located such that nails or screws are likely to damage the pipe, a steel plate at least 1/16-inch thick shall be installed to provide protection. At metal framing, wrap piping to prevent contact of dissimilar metals. At metal and wood framing, provide plastic pipe insulators at piping penetrations through framing nearest each equipment connection and on at least 32-inch centers.

K. Safety Protection: All ductwork, piping and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and reflective red/white self-sticking safety tape. All sharp corners on supports and other installed items shall be ground smooth.

L. Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the location of pipe and duct routings and in coordinating all work so that equipment access and a clear maintenance pathway to equipment is maintained. Poor maintenance access will not be accepted. Contractor shall note that in essentially all areas piping and ducts need to run with slopes parallel to the roof (or floor above), in necessitating elbows/fittings/transitions at crosses of ducts/pipes and at all connections to mains and branches; and requiring added fittings to maintain a clear walking path

M. Pressure Tests: Maintain documentation of all pressure (and leakage) tests performed on systems and submit with project closeout documents. Records shall contain (as a minimum): date of test, system name, description portion of system being tested, method of test, initial and final test pressures (or of measured leakage rates, as applicable), indication of test pass or fail, name and signature of individual performing (or documenting) the test, initials of independent witness of test.

3.3 PENETRATION PROTECTION

A. Exterior and Watertight Penetrations: Where any work pierces the building exterior (or construction intended to be watertight) the penetration shall be made watertight and weatherproof. Provide all necessary products (e.g. caulking, flashing, screens, gaskets, backing materials, siding, roofing, trim, etc.). Where not detailed or indicated how to install submit shop drawings of the proposed methods. Flashing arrangements shall be per SMACNA Architectural Sheet Metal Manual unless noted otherwise. Caulking alone is not an acceptable means of sealing penetrations.

B. Equipment: Equipment or products located outdoors shall be watertight (except for provisions designed to intentionally accept water and having drain provisions) and

shall be designed and intended by the manufacturer to be used outdoors at the project location. Where any work pierces the unit casing exposed to the outdoors the penetration shall be made watertight and weatherproof; provide all necessary products (e.g. caulking, flashing, gaskets, backing materials, etc.).

3.4 START-UP

A. General: Provide inspections, start-up and operational checks of all mechanical systems and equipment. Maintain documentation of all start-up work and submit with project closeout documents. See individual specification Sections for additional requirements.

B. Personnel: Inspection and start-up services shall be done by individuals trained in the operation, and knowledgeable with, the systems being started-up. Equipment start-up shall be by the manufacturer's authorized service representative where indicated (see individual specification Sections).

C. Scheduling and Agenda: Submit a proposed detailed start-up schedule with proposed dates and times at least 30 days prior to the earliest proposed system start-up. Revise dates and times as mutually agreed upon with trades involved, and witnesses, before submitting a final start-up schedule.

D. Witnessing: Start-up may be witnessed by the Engineer and Owner's representative (at their option). Notify the Engineer and Owner 7 days prior to the proposed start-up time.

3.5 OWNER INSTRUCTION

A. General: Provide instruction to the Owner on the operation and maintenance of all installed mechanical systems.

B. Personnel: Instruction on the operation and maintenance of products shall be by individuals trained and experienced in the installation, operation and maintenance of these products. Instruction shall be by the product manufacturer's authorized service representative where indicated (see individual specification Sections).

C. Scheduling and Agenda: Submit a proposed instruction schedule (with proposed dates and times) and an instruction agenda at least 30 days prior to the earliest proposed instruction period. Coordinate Owner and Architect/Engineer review and arrange mutually agreed upon instruction schedule and the instruction agenda, and submit a final instruction schedule and agenda. Organize instruction by sub-systems corresponding to the project specifications (or similar logical grouping).

D. Instruction: Demonstrate and explain normal start-up, normal shut-down, normal operation, normal settings, adjustments, signs of abnormal operation, emergency shut-down, safety concerns, and related information. Demonstrate and explain system maintenance requirements with references to the O&M Manual. Show how maintenance is performed, including how items are accessed, maintenance procedures, tools and parts required, and related information. Review typical repairs and explain how performed.

END OF SECTION 23 05 00

SECTION 23 05 03 – EXISTING SYSTEMS WORK FOR MECHANICAL

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Protection of Items from Damage.

B. Maintaining Utilities and Building Services.

C. Cleaning.

D. Temporary Systems.

E. Review of Existing Conditions.

F. Cutting and Patching.

G. Deactivation and Cap-off of Systems.

H. Mechanical Demolition and Disposal.

1.3 DEFINITIONS

A. “Remove”, "demo", and "demolish" mean "Remove and legally dispose of item and item accessories; except where indicated to be reinstalled, salvaged, or some other required work is indicated."

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials: All materials used for capping, temporary piping, repairs, reconnecting, reinstalling, and related work shall be same as specified for new systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Protection: Existing items not being demolished shall be protected against damage. Where necessary to prevent damage or necessary to accomplish other work, items shall be disconnected and moved to a suitable protective storage location during the project and then reinstalled to their original location.

B. Utilities and Building Systems: Maintain existing utilities and building systems in service (unless indicated otherwise) and protect from damage during project. Where utilities or building systems must be shut-off to accomplish the work, see drawing notes, Section 23 05 00, and Division 01 for downtime limitations and Owner coordination and notification requirements; coordinate interruptions with other trades.

C. Cleaning: All existing items that remain during construction and were affected by the construction shall be cleaned to a like new condition.

D. Equipment and System Contents: Equipment and systems contain fluids that are typical for such items (e.g. HVAC units contain refrigerant, oils; hydronic systems contain ethylene glycol, corrosion control chemicals, etc.) and require special removal methods and disposal.

E. Existing Items:

1. Information and Field Verification: Routing, locations, and identification of existing items on plans are approximate and are limited. The relative location of systems shown on plans has not been verified, and is schematic only. Field verify locations, contents, and flow direction of all piping and ducts prior to performing any work associated with such systems (see also Section 23 05 00). Do not rely on existing labeling of systems; such labeling shall be considered wrong until verified by other physical evidence.

2. Work Around: Existing building cavities (ceiling spaces, walls, etc.) contain a multitude of systems (e.g. conduit, wiring, fire suppression, light fixtures, low voltage system components, piping, ducts, etc.) typical for buildings of the type of this project. Added effort is required to identify and locate these systems, to work around such systems, and to temporarily disconnect and reconnect (and possibly remove and store) various building components to accommodate the work. Existing building elements will also require the work to be installed in smaller sections (i.e. shorter pipe or duct lengths) than normally possible, and to make system connections in awkward or cramped locations.

3. Revisions: Revise existing systems as needed to accommodate project work and new finishes. Work shall include adjusting locations of items to suit new ceiling heights, revisions to building element locations, revisions to finishes, and other changes.

4. Electrical: Verify voltage, phase, horsepower, panel circuits, and other electrical parameters of existing items prior to beginning work and ordering replacement products. Electrical data listed on the drawings for such items

has not been field verified.

5. Hydronic Systems: Unless noted otherwise, work on hydronic systems will require complete system drain down and re-filling to accomplish the work. Re-filling shall restore the system to pre-construction chemical concentration conditions, as indicated by the latest Owner's chemical test results. Systems that contain glycol may have the glycol salvaged and reused in refilling the system provided the fluid to be reused is filtered through a 20 mesh strainer.

6. Controls: Verify existing communication protocol, existing component manufacturers, and model numbers, LAN type(s), software, location of devices, quantity of system points, methods used in terminating communication wiring, overall system performance, and sequences.

F. Cutting: Provide all cutting and openings as necessary to accomplish the work indicated. No structural members shall be cut unless Structural Engineer's approval is obtained first. Assume all building members are "structural" unless clearly evident otherwise. See Section 23 05 00 and Division 01 for additional requirements.

G. Patching: Patch all wall/floor/ceiling/roof openings left by removal of existing items where wall/floor/ceiling/roof is to remain. Patch with materials and workmanship so as to match finish of adjacent undisturbed area, and to provide conditions equivalent to the original new construction.

H. Owner's Salvage: Owner has first right to all items shown to be demolished. All items not wanted by Owner, and not indicated to be salvaged for reuse, shall be removed by the Contractor.

3.2 REVIEW OF EXISTING CONDITIONS

A. General: Provide field investigation of all systems and existing conditions to confirm extent of demolition, routing of existing systems, existing building materials of construction, mechanical system types and materials involved, areas where cutting and patching is required, site access, sizes of existing system components, and all other aspects of existing building and systems and their relationship to the Work.

B. Review Timing: Review existing conditions prior to bidding, again prior to commencing any work or ordering materials, and continually throughout the project.

C. Review for Space and Routing:

1. Review existing conditions (including dimensions) where equipment must be moved through to confirm adequate space and path.

2. Review existing conditions (including dimensions and locations of existing systems) where work will occur to determine impact on the locations and routing of new systems; include time to develop shop drawings and revisions to routing shown on the design drawings to accommodate existing conditions.

D. Existing Record Drawings: Existing record drawings located at the Engineers office are available for review.

3.3 EXISTING CONSTRUCTION

A. Hydronic Systems: Volume of each existing hydronic systems shall be assumed to be 1 gallon per building square foot (unless noted otherwise).

B. Floor Slabs: All upper floors shall be assumed to be 8" thick with #4 rebar 24" O.C. each way (except where existing drawings indicate otherwise).

C. Ceiling Construction: All ceiling construction shall be assumed to be two layers of 5/8" type X GWB installed over 2 x 6 20 gauge steel stud framing on 16" centers (unless noted otherwise).

D. Wall Construction: All walls shall be assumed to be constructed of 8 x 16 solid grouted CMU or 8-inch thick concrete (unless noted otherwise).

3.4 DEMOLITION

A. General: Review site conditions and identify all demolition work; include in bid all costs for demolition and disposal. Coordinate all demolition work with other trades. Confirm items to be salvaged or reused, and overall demolition scope.

B. Scope: Not all items to be demolished are necessarily shown on the drawings, but are covered by notes and specifications. In addition to demolishing items indicated, demolish all associated items (unless indicated otherwise); this includes such items as supports, insulation, piping, drains, control wiring/conduit, power wiring/conduit, unions, valves, and similar accessories. Demolish all utilities serving demolished items completely or back to active mains where mains are to remain active; assume such utilities extend at least forty feet from the demolished items (unless indicated otherwise). Demolish all mechanical items located in building elements which are being demolished (i.e. located in walls, chases, roof assemblies, etc.). Demolish items as required to accomplish the work.

C. Prevent Damage: Where existing building systems are to be reused to serve new items, carefully execute the demolition work to prevent damage to items to be reused and to prevent the demolition of items that are intended for reuse.

D. Depth: Abandoned items, anchors, inserts, and other projections embedded in existing construction and not being concealed by new construction shall be removed to 1" below the adjacent finished surface, and the disturbed area patched.

E. Cap-Offs and Terminations:

1. Permanent: Provide cap-off of all existing utilities and systems that are cut or served demolished items. All cap-offs shall occur in concealed locations (unless indicated otherwise). Cap-off's shall be of equivalent material as the item being capped and be insulated where the connected system was

insulated or where doing so will reduce energy consumption or prevent condensation.

2. Temporary: Provide temporary cap-off of all existing utilities and systems to allow continued use of all systems until the final system components are installed and connected.

3. Wiring Terminations: Terminate all control wiring and electrical power connections in a manner that complies with code and allows remaining items to function as intended.

F. Disposal: Dispose of all demolished items and all waste materials off site in accordance with code and legal requirements. See Division 01 for waste management requirements.

G. Refrigerants: Shall be recovered by a licensed competent person and disposed of in accordance with code and legal requirements. Provide license certificate and disposal records to Owner.

END OF SECTION 23 05 03

SECTION 23 05 19 – PIPING SPECIALTIES FOR MECHANICAL

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Thermometers.

B. Pressure Gauges.

C. Strainers.

D. Unions.

E. Flexible Connectors.

F. Test Ports.

G. Access Doors.

1.3 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Product Data: Submit product information data for all items to be used.

1.4 REFERENCES

A. ANSI Z21.24: Connectors for Gas Appliances.

B. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.39: Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300.

D. ASME B40.3 - Bimetallic Activated Thermometers.

E. ASME B40.100 - Pressure Gauges and Gauge Attachments.

F. IFGC: International Fuel Gas Code.

G. IMC: International Mechanical Code.

H. UPC: Uniform Plumbing Code.

1.5 GENERAL REQUIREMENTS

A. Domestic (Potable) Water Systems: All items in contact with potable water shall be lead free in accordance with ANSI/NSF 61. Plastic piping system components shall comply with ANSI/NSF 14.

B. System Requirements: Products shall comply with additional requirements cited for the specific systems the products are being installed in; see specific system specification sections.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Thermometers: Trerice, Weiss, Winters.

C. Pressure Gauges: Trerice, Weiss, Winters.

D. Strainers: Watts, Keckley, Mueller, Sarco, Taco, Paco, Bell & Gossett, Armstrong, Wilkins.

E. Unions: Anvil, Nibco, Watts, Epco, Victaulic, Ward, Jefferson Union.

F. Dielectric Connecters: Victaulic Precision Plumbing Products, Elster Perfection.

G. Flexible Connectors: Universal, Mason, Dormont, OPW, Unisource, Twin City Hose.

H. Test Ports: Autoflow, Flowset, Peterson Equipment.

I. Access Doors: J. R. Smith, Zurn, Josam, Acudor, Elmdoor, Kees, J.C. Industries.

J. Escutcheons: Selected by Contractor.

2.2 THERMOMETERS - INDUSTRIAL

A. Type: 7 inch scale, adjustable angle, red reading mercury, industrial thermometer.

B. Construction: Aluminum or polyester case, acrylic plastic or heavy glass window, aluminum face, stem of brass or aluminum construction, with separate brass socket (i.e. thermowell). Bulb chambers tapered to match taper in thermowell to give metal to metal contact. Scale case adjustable over a minimum 180° range, with locking fastener.

C. Stem Length: Stem insertion length approximately one-half of pipe diameter. Where installed on tanks, minimum insertion length is 5". Where installed on insulated piping systems, provide a longer stem thermometer and extended neck socket (thermowell) to extend thermometer base past the insulation.

D. Display: White background with bold black numerals and Fahrenheit degree markings, red or blue reading spirit.

E. Accuracy: Plus or minus 1% of full scale.

F. Ranges: Plus or minus 50% of systems normal operating temperature (at point of measurement), with figure intervals approximately 1/20th of range. For systems with multiple operating temperatures wider ranges may be used to allow the same thermometer type through-out the system.

2.3 PRESSURE GAUGES

A. General: 4-1/2" round dial, stem mounting, black impact resistant phenolic (or fiberglass reinforced polypropylene) flangeless case, white face with black numerals, phosphor bronze bourdon tube rated to minimum 250 psi, brass socket, acrylic window, and 1/4" npt (or 1/2" npt) bottom connection. Shut off cock not allowed (use ball valve). Rated for use with the system pressures and temperatures to be exposed to, but be rated for no less than 250° F. Accuracy shall be 0.5% per ASME B40, 100 Grade 2A.

B. Liquid Fill: Gauges used on pumps and where vibration or pulsation are present shall be liquid filled and be provided with a snubber. Liquid fill shall be suitable for ambient temperatures from 0 to 150° F, and for system temperatures to be encountered.

C. Pressure Gauge Ranges: 0 to 1.5 times systems normal operating pressure (at point of measurement), with numeral figures on 5 psig for gauges reading to 100 psi, and 10 psig on gauges reading to higher values.

D. Syphons: Gauges used on steam or steam condensate piping shall have syphons; rated for minimum 500 psi and 400° F.

2.4 STRAINERS

A. Water Systems:

1. Copper Piping Systems 2-1/2" and Smaller: Bronze body, "Y" type, screwed or solder type end connections, 125 lb class (rated 125 psi steam working pressure at 350 deg F minimum) and 400 psi (WOG) rated working pressures at 210 deg F, stainless steel 20 mesh wire screen, and gasketed retainer cap. Reinforce wire mesh with perforated stainless steel sheet for sizes 2" and 2-1/2". Ratio of net free area of screen to pipe free area greater than 3.5. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping system specification section.

2. Copper Piping Systems 3" and Larger: Bronze or ductile iron body, "Y" type, flanged end connections, 150 lb class (rated 150 psi steam working pressure at 400 deg F minimum), brass or stainless steel screen with 3/64" perforations for 3" and 3/32" perforations for larger sizes; with gasketed threaded retainer cap. Ratio of net free area of screen to pipe free area greater than 3. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping specification section.

3. Steel Piping Systems: Ductile iron, cast iron, or carbon steel construction, "Y" type, 250 lb class (rated 250 psi steam working pressure at 450°F minimum), with stainless steel screen. Screen shall be 20 mesh for strainers up to 2" in size, and have 3/32" perforations on larger sizes. Sizes 2-1/2 inch and less shall have threaded end connections; larger sizes shall have flanged end connections. Provide with bolted and gasketed strainer cap on flanged strainers; provide threaded gasketed retainer cap on threaded strainers. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping system specification section.

2.5 UNIONS

A. Dielectric Unions: Shall not be used. Provide "dielectric connector" with standard union where union is required at connection point of dissimilar materials.

B. Unions on Copper Pipe:

1. General: Pressure and temperature ratings to match (or exceed) piping system being installed in; minimum Class 125.

2. 2-Inch Pipe and Smaller: Wrought copper solder joint copper to copper union, complying with ASTM B16.18.

3. 2-1/2-Inch Pipe and Larger: Brass flange unions.

C. Unions on Steel Pipe:

1. General: Pressure and temperature ratings to match (or exceed) piping system being installed in; minimum Class 150.

2. Threaded: Malleable iron union, threaded connections, with ground joints, complying with ASME B16.39. Provide with brass-to-iron seat (except provide iron-to-iron seat where the conveyed material is detrimental to brass).

3. Welded and Flanged: Flange unions; see individual system specification sections.

D. Dielectric Connector: Schedule 40 steel pipe nipple, zinc electroplated, with internal thermoplastic lining which is NSF/FDA listed and meeting all code requirements for

potable water applications. Suitable for continuous use up to 225 deg F and 300 psi. "Clearflow" dielectric waterway (or approved). For systems operating at temperatures greater than 225 deg F provide flanged connections with insulating gaskets.

2.6 FLEXIBLE CONNECTORS

A. Pump Flexible Connectors: Twin sphere type, constructed of peroxide cured EPDM with Kevlar tie cords, multilayered. Embedded solid steel rings shall be used at raised face flanged ends. Shall have an external ductile iron reinforcement ring between spheres. Rated minimum 225 psi at 230°F. Control rods shall be used as recommended by the manufacturer for the application; rods shall have 1/2-inch thick neoprene bushings, washers and accessories sized to accommodate system loads and conditions. Same size as pipe installed end, with end connections to suit connecting piping. Mason Industries "SafeFlex" SFDEJ Series, and SFDCR Series.

B. Piping Flexible Connectors: Corrugated hose type with outer braided wire sheath covering. Corrugations shall be close pitch annular type. Minimum working pressure of 250 psig, minimum length of 12 inches (or 12 times the connector's nominal diameter, whichever is more), and screwed or flanged end connections. Metal for hose shall be bronze or stainless steel; braided sheath shall be stainless steel, any type of ASTM 300 series.

2.7 TEST PORTS

A. Temperature/Pressure Type: Test port for installation in tee in piping allowing insertion of probe for measurement of pressure and/or temperature. Valve shall be of brass construction, have 1/4-inch or 1/2-inch NPT male connection, with dual valves to prevent leakage and gasketed cap with attachment to test port. Rated for minimum 500 psi and 275 deg F. Provide extended length on insulated piping systems so that insulation does not cover the test port.

2.8 ACCESS DOORS

A. Hinged lockable steel access door, for mounting on face of wall, with minimum 16 gauge frame and 16 gauge door, concealed hinge, cam and cylinder lock, and anchor straps or anchor frame with mounting holes. Provide Type 304 stainless steel construction with No. 4 finish where used in restrooms, locker rooms, kitchens, and similar "wet" areas. Provide steel construction with prime coated finish in other areas. Door shall have rounded corners, and concealed pivoting rod hinge. Size shall be 12" x 12" (unless indicated otherwise) but shall be large enough to allow necessary access to item being served and sized to allow removal of the item (where access door is the only means of removal without disturbing fixed construction).

B. Fire Rating: Door shall maintain fire rating of element installed in; reference drawings for required rating.

C. Access doors shall all be keyed alike. Provide two (2) keys for each door.

2.9 ESCUTCHEONS

A. Type: Circular metal collar to seal pipe penetrations at building elements (i.e. walls, floors, cabinets, and ceilings); one piece type except that split hinge type may be used for applications on existing piping.

B. Construction: Constructed of chrome plated brass or polished stainless steel, sized to tightly fit pipe exterior surface (or pipe insulation where insulated) and to fully cover the building element penetration.

C. Projection: Shallow face type with maximum projection from wall not to exceed 1.2 times inner diameter of escutcheon.

D. Special Applications: For sprinkler heads and similar special applications see items' specification Section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Thermometers: Install thermometers and thermal wells in piping at locations indicated, and so as to be easily read.

B. Pressure Gauges: Install pressure gauges at inlet and outlets of all pumps; at each side of pressure reducing valves; and as indicated. Provide with ball-type isolation valves.

C. Strainers: Install strainers ahead of each control valve, and as indicated. Provide valve in blow-off connection on strainers, valve shall be same size as blow-off tapping.

D. Suction Diffusers: Install suction diffusers on all base mounted pumps and where indicated.

E. Unions: Install unions in pipe connections to control valves, coils, regulators, reducers, all equipment, and where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise. Dielectric unions shall not be used.

F. Dielectric Connectors: Install connectors between all connections of copper and steel piping (or equipment), and other dissimilar metals. Where flanged connections occur use insulating type flanges. Dielectric unions shall no be used.

G. Flexible Connectors:

1. General: Install in pipe connections to equipment with rotating elements, at building expansion joints, at equipment with vibration isolators, as needed to allow for movement in a seismic event, and where indicated. Install in a manner to allow for expected movement.

2. Size: Match connecting pipe size shown on plan, with transition after the flexible connector to match the equipment connection size.

H. Test Ports: Install at locations shown on drawings and where needed by Balancer to allow measurements for flow adjustments.

I. Access Doors: Provide access doors where indicated on the drawings and where needed to provide access to trap primers, water hammer arresters, cleanouts, valves, coils, controls, mechanical spaces, and similar items requiring service or access that would otherwise be inaccessible. Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation. Access doors are typically not shown in the plans. Review ceiling and wall types and locations of items requiring access to determine quantity and sizes of access doors required.

J. Escutcheons: Provide at all pipe penetrations through building elements, except where penetration is concealed (unless specifically noted otherwise). Items located in accessible cabinet spaces (e.g. below sinks) are not considered concealed.

END OF SECTION 23 05 19

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR MECHANICAL

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Pipe Hangers and Supports.

B. Duct Hangers and Supports.

C. Mechanical Equipment Anchors and Supports.

1.3 QUALITY ASSURANCE

A. Pipe Hanger Standards: Manufacturers Standardization Society (MSS) Standards SP-58, SP-89, SP-69, and SP-90.

B. General: All methods, materials and workmanship shall comply with Code; including IBC, IMC, UPC, NFPA Standards, and ASME standards.

1.4 SUBMITTALS

A. General: Submittals shall comply with Section 23 05 00.

B. Product Data: Submit product data for all hangers, supports, and anchors. Data to include finish, load rating, dimensions, and applicable agency listings. Indicate application for all items by system type, size, and other criteria as appropriate to project.

C. Shop Drawings:

1. General: Shop drawings shall clearly indicate dimensions, anchor and support type, anchor and support size, anchor and support spacing, finish, configuration, and systems/equipment to be applied to.

2. Fabricated Supports: Submit shop drawings for all fabricated supports.

3. Finished Areas: Submit shop drawings for all supports that will be exposed in finished areas.

1.5 GENERAL REQUIREMENTS

A. Design and Manufacture: All pipe hangers and supports shall be designed and manufactured in accordance with MSS-SP 58.

1.6 REFERENCES

A. ADC: Air Duct Council - Flexible Duct Performance and Installation Standard, 5th Edition.

B. ASHRAE-F: American Society of Heating, Refrigeration, and Air Conditioning Engineers, Handbook of Fundamentals.

C. ASME B31.1: Power Piping.

D. ASME B31.9: Building Services Piping.

E. ASTM A36: Standard Specification for Carbon Structural Steel.

F. ASTM A108: Standard Specification for Steel Bar, Carbon and Alloy, Cold - Finished.

G. ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

H. ASTM A153: Standard specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

I. ASTM A653: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

J. ASTM A907: Standard Specification for Steel, Wire, Epoxy - Coated.

K. ASTM A924: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.

L. IBC: International Building Code.

M. IMC: International Mechanical Code.

N. Mason SRG: Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, Electrical Systems and Floor Mounted Equipment, 6th Edition.

O. MSS SP-58: Pipe and Hangers and Supports - Materials, Design and Manufacture.

P. MSS SP-69: Pipe and Hangers and Supports - Selection and Application.

Q. MSS SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices.

R. MSS SP-90: Guidelines on Terminology for Pipe Hangers and Supports.

S. SMACNA-DCS: HVAC Duct Construction Standards, 3rd Edition.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Hangers and Supports: Grinnell, B-Line Systems, Unistrut, Erico, PHD, Basic-PSA, Pate, Caddy, Unisource, Metraflex, American Insulation Sales, Thermal Pipe Shields, Miro Industries.

C. Anchors: Rawplug, Phillips, Hilti, Michigan, Simpson, Fastenal, Red Head, Grinnell, B-Line Systems, Unistrut, PHD, Basic-PSA, Metraflex.

2.2 GENERAL

A. Finish:

1. Indoor Applications: Electro-plated zinc in accordance with ASTM B 633, or hot-dip galvanized after fabrication in accordance with ASTM A 123; except that hanger straps may be formed from pre-galvanized steel.

2. Outdoor Applications: Hot-dip galvanized after fabrication in accordance with ASTM A 123, ASTM A 153, or ASTM A 653 (as applicable to item).

B. Identification: Steel pipe hangers and supports shall be stamped with the manufacturer's name, part number, and size.

C. Hanger Rods: Threaded hot rolled steel. Hanger rods shall be sized so that the total load imposed (including pipe or duct, insulation, hangers, and fluid) does not exceed the following:

Nominal Rod Diameter	Maximum Load
1/4 Inch	240 Pounds
5/16 Inch	440 Pounds
3/8 Inch	610 Pounds
1/2 Inch	1130 Pounds
5/8 Inch	1810 Pounds
3/4 Inch	2710 Pounds
7/8 Inch	3770 Pounds
1 Inch	4960 Pounds

D. Hanger Straps: Galvanized steel, minimum 1" x 22 gauge (except where required by Code to be heavier or noted otherwise), of lock-forming grade conforming to ASTM A924, G90 (minimum) galvanized coating conforming to ASTM A 653. Minimum yield strength of 30,000 psi. Straps shall be sized so that the total load imposed does not exceed the following:

Strap Size	Maximum Load
1" x 22 Gauge	230 Pounds

1” x 20 Gauge	290 Pounds
1" x 18 Gauge	380 Pounds
1" x 16 Gauge	630 Pounds
1-1/2" x 16 Gauge	990 Pounds

E. Beam Attachments: Constructed of malleable iron or steel, MSS standard types designed for clamping to building structural support beam. “C” clamp type shall have cup point set screws with locknuts and retaining straps. Center loaded type beam clamps shall have horizontally adjustable clamping bolt (or rod with nuts).

F. Concrete Anchors: Wedge type expansion anchors, with hex nut and washer, and stainless steel split expansion rings. Tested to ASTM E 488 criteria, UL listed, with exposed anchor head stamped with code to identify anchor length.

G. General Anchors (Screws, Nuts, Bolts, Fasteners):

1. General: Constructed of materials suitable for the conditions exposed to and materials being joined, with minimum 50 year service life. Stainless steel construction where exposed to corrosive conditions. Configuration, size and grade to suit application, accommodate expected forces, and provide anchoring to structural element (or allow for proper fastening of items). Minimum safety factor of 2.5 (or as required by code, whichever is greater). Comply with ASTM A307, SAE J429, SAE J78, or ASTM A 563; bolts and nuts shall have unified inch screw threads (course, UNC).

2. Test Reports: Provide independent test report indicating fastener strength (pullout and shear) as installed in the materials and applications of this project (when required by the Engineer or AHJ).

3. Finish: In finished areas, the portion of fastener exposed to view shall match the exposed finish of item being fastened.

H. Manufactured Strut Systems:

1. Channels: Minimum 12 gauge, 1-5/8 x 1-5/8" (unless noted otherwise), with slots/holes to suit application.

2. Accessories: Channel nuts press formed, machined and hardened with gripping slot, fabricated from steel conforming to ASTM A 108 or ASTM A 36. Fittings fabricated from steel in accordance with ASTM A 907.

3. End Caps: Vinyl cap, capable of withstanding high temperatures without degradation, manufactured specifically for use with manufactured strut. Unistrut Series P2859 or P2860 (or approved).

I. Steel: Structural steel per ASTM A 36.

J. Wood: Only allowed to be used where building structural elements are of wood construction same type, grade used for building structural members. Where located

outdoors shall be the pressure treated type; with all cut portions of wood painted with wood preservative.

K. Field Galvanizing Compound: Brush or spray applied galvanizing treatment; consisting of a premixed ready to apply liquid organic zinc compound, with 95% metallic zinc content by weight in dry film. ZRC worldwide "ZRC Cold Galvanizing Compound".

L. Ground Pipe Supports: Designed for rooftop support of piping to distribute load evenly over roof surface; factory fabricated. Shall be constructed of thermoplastic, polycarbonate, or polyethylene material, with attached strut support for anchoring of pipe, pipe attachment hardware, and sized to suit piping used with and so that pressure on roof does not exceed 150 pounds per square foot. Provide style with height to match pie height requirements above the roof. Strut and hardware shall be hot-dipped galvanized or have electro-galvanized finish. Plastic materials shall have UV stabilizers to resist UV deterioration. For piping systems subject expansion and contraction, provide roller type support allowing pipe movement, having a foam bottom to minimize roof abrasion. Caddy "Pyramid ST", Pyramid 50", "Pyramid 150", Pyramid RL".

2.3 DUCT HANGERS AND SUPPORTS

A. Hangers: As shown in SMACNA-DCS except that wire shall not be used and all materials used shall comply with these specifications.

B. Vertical Duct Supports at Floor: 1-1/2" x 1-1/2" x 1/8" (minimum) galvanized steel angle and to support ducts, maximum 12 foot on center, and as shown in SMACNA-DCS. For ducts over 30 inches wide provide riser reinforcing with hanger rods between the riser support and riser reinforcing.

C. Vertical Duct Supports at Wall: 1-1/2" x 1/8" (minimum) strap or 1-1/2" x 1-1/2" x 1/8" (minimum) angle bracket and as shown in SMACNA-DCS.

D. Hanger Attachments to Structure: As shown in SMACNA-DCS to suit building construction and as allowed on structural drawings. Provide washers at all fasteners through hanger straps (regardless of SMACNA-DCS allowances). Where C-clamps are provided, retainer clips shall be used. Friction beam clamps shall not be used.

E. Hanger Attachments to Ducts: As shown in SMACNA-DCS except that wire shall not be used as any form of support or attachment for ducts.

F. Flexible Duct Strap: Woven polypropylene hanging strap, minimum tensile strength of 400 lbs, minimum 1.75-inches wide, designed and intended for flexible duct support.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. General: Provide all necessary bolts, nuts, washers, fasteners, turnbuckles, hanger rods, rod connectors, stanchions, wall/roof/floor backing and attachments, bridging between structural members, and any other miscellaneous accessories required for the support and anchoring of all pipes, ducts, and mechanical equipment. All supports, whether from floor, walls, or hung from structure, are Contractor's responsibility. Anchors and supports shall be adequate to accommodate forces equipment will be exposed to. Any field cut pieces of galvanized materials shall be hot-dip galvanized after cutting; or be solvent and wire brushed clean and receive field applied galvanizing treatment. This field applied galvanizing (only allowed with prior permission for minor localized cuts) shall use multiple coats to provide as near equal protection as possible to factory (or hot-dip) applied coatings.

B. Backing: Install steel or wood backing in walls (anchored to studs) and in ceiling (anchored to joists or trusses), as required to provide support for items.

C. Installation: Install all inserts, anchors, and supports in accordance with manufacturer's instructions, code requirements, and best professional practices. The most restrictive criteria governs.

D. Welded Assembly Finish: All welded steel support assemblies shall have a power wire brush and primer paint finish where installed indoors and be have factory applied hot-dip galvanized finish where installed outdoors (or subject to moisture); unless another finish is specified.

E. Attachments: Attach to anchoring element (i.e. building structure, concrete pads, etc.) as shown on drawings (reference structural drawings). Where not detailed on the drawings, the Contractor shall design and submit shop drawings of proposed attachment methods to the Engineer for review.

F. Application:

1. Where not detailed on the drawings (or otherwise indicated), the selection and design of supports is the Contractor’s responsibility, in compliance with code and Contract Document requirements; subject to submittal review and acceptance by the Engineer.

2. Exposed supports in finished areas shall be arranged to minimize their visibility; be free of dents, scratches and labels, and be configured in a manner to match the decorum and finish of the room they are installed in. Exposed supports in finished areas shall be cleaned to allow for field painting (unless a chrome, stainless steel, or similar finish has been indicated).

3. HVAC Support wire and flexible duct strap shall only be used for support of ceiling air inlets and outlets, or at flexible duct supports.

G. Manufactured Strut (“Unistrut”): Provide end caps on all strut ends at the following locations:

1. Where exposed to view in finished areas.

2. Where near maintenance access paths.

3. Where personnel injury could occur if the ends were not covered.

3.2 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. General: Aboveground pipe shall be anchored to the structure to prevent sagging, to keep pipe in alignment, and to resist the forces the pipe will be exposed to; piping shall be supported independent of equipment so that no loads bear on the equipment.

B. Adjustment: All pipe supports shall be provided with a means of adjustment for the aligning and leveling of the pipe after installation.

C. Applications: Selection, sizing, and installation of pipe supports and accessories shall be in accordance with the manufacturers recommendations, standards MSS SP-89 and MSS SP-69, UPC, and IMC. Refrigerant piping and similar piping subject to vibration (i.e. high pressure tubing) shall be installed with cushion clamps.

D. Support Spacing: Provide piping support spacing according to the most restrictive of the following: UPC, IMC, ASME B31.1, B31.9, local codes, manufacturers recommendations or Contract Documents specific requirements. Provide supports at each change in direction of piping and at each side of concentrated loads (such as in-line pumps, valves greater than size 5", and similar items).

E. Trapeze Hangers: Multiple parallel pipes may be supported on trapeze hangers provided the slopes of such pipes allow use of common trapeze. Suspend trapeze hanger from the building structure using hanger rods; attach to the building structure using concrete inserts, beam clamps, or other approved methods. Where trapeze width exceeds 30 inches, and where building attachment restrictions require more anchor points, provide three (or more) hanger rod supports. Provide pipe anchors to secure piping to trapeze on minimum 20 foot spacing; size and install pipe anchor to allow longitudinal movement of pipe (unless noted otherwise) with minimal vertical and transverse movement; where pipe is subject to expansion/contraction provide anchoring and alignment guides per paragraph titled "Thermal Expansion/Contraction".

F. Vertical Piping Supports: Support piping at each floor line with pipe clamps and at intermediate points as required so that hanger spacing does not exceed allowable spacing and as required to prevent excessive pipe movement and so as to comply with the maximum spacings cited above. Support all pipe stacks at their bases with a concrete pier or suitable support. For vertical pipe drops which occur away from a wall or similar anchoring surface, provide angled bracing from nearest structure on two sides of drop to provide rigid anchoring of pipe drop.

G. Insulated Pipe Supports:

1. Insulation Inserts and Shield Required: Protect all insulated pipe at point of support with pre-insulated pipe supports. Such supports shall be in place at time of installing pipe.

2. Shield Only Required: Provide shield under insulated pipe at support points.

3.3 INSTALLATION OF DUCT HANGERS AND SUPPORTS

A. General: Provide anchors and supports for all ductwork. Supports and hangers shall comply with SMACNA-DCS, except that hanger spacing and hanger maximum loads shall be governed by whichever is more restrictive between these specifications or SMACNA-DCS.

B. Hanger Spacing -- Rectangular Duct:

Duct Area	Maximum Spacing
Up to 4 Square Feet	8 Feet
4.1 to 10 Square Feet	6 Feet
10 Square Feet and Up	4 Feet

C. Hanger Spacing -- Round Duct:

Duct Area	Maximum Spacing
Up to 24 Inch Diameter	8 Feet
25 Inch to 48 Inch Diameter	6 Feet
49 Inch Diameter and Up	4 Feet

D. Hanger Spacing - Flexible Duct: 4 feet, and at changes of direction as needed to maintain duct elevation and smooth airflow.

E. Vertical Ducts: Support at each floor level, but in no case less than on 12 foot intervals.

F. Flexible Duct: Support with methods shown in ADC. Metal strap in contact with the flexible duct shall have minimum 1.5-inch width.

G. Fittings: Provide supports at each change in direction of duct for ducts with 4 square foot area or more, or for ducts larger than 24 inch diameter. Locate hangers at inside and outside corners of elbows--or at each end of fitting on each side.

H. Concentrated Loads: Provide additional supports at each side concentrated loads such as modulating dampers (24" x 24" and larger), duct heaters (18" x 18" and larger), sound attenuators (all sizes), and similar items.

I. Exterior Duct: Provide supports for exterior ductwork as shown in SMACNA-DCS; spacing as specified herein.

J. End of Duct: At end of duct run, hangar shall be located no more than 1/2 the allowed hangar spacing from the end of the run.

3.4 CEILING SERVICES

A. Less than 20 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing less than 20 pounds shall be positively attached to the ceiling suspension

main runners (or ceiling support members) or to cross runners with the same carrying capacity as the main runners (or support members).

B. 20 to 56 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing 20 pounds but not more than 56 pounds, in addition to the above, shall have two No. 12 gauge wire hangers (or minimum 1" x 22 gauge hangar straps) connected from the terminal or service to the ceiling system hangers or to the structure above. These added hangers may be slack.

C. Greater Than 56 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing more than 56 pounds shall be supported directly from the building structure by approved hangers.

3.5 MECHANICAL EQUIPMENT ANCHORS AND SUPPORTS

A. General: Provide anchoring and supports for all mechanical equipment. All equipment shall be anchored to (or supported from) the building structure. In lieu of anchoring to the building, anchor outdoor equipment to the concrete pad serving the equipment.

B. Suspended Equipment: Support as indicated on the plans. Where not indicated use the methods shown (or consistent with) Mason SRG and SMACNA-DCS; submit shop drawings of the proposed methods to the Engineer for review.

C. Roof Mounted Equipment: Install on roof curbs or roof sleepers as indicated. Anchor equipment to the curb (or sleeper), with the curb (or sleeper) in turn anchored to the building structure.

D. Vibration Isolation: Equipment shall be supported and anchored in such a way so that no equipment vibration is transmitted to the building structure.

END OF SECTION 23 05 29

SECTION 23 02 00 – SLEEVES AND SEALS FOR MECHANICAL

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Pipe Sleeves.

B. Duct Sleeves.

C. Duct Closure Collars.

D. Firestop Seals.

E. Non-Firestop Seals.

1.3 DEFINITIONS

A. Firestop System: Specific firestop materials or combination of materials installed in a specific way in openings in a specific rated assembly to restore (or maintain) the fire rating and smoke passage resistance properties of the assembly.

B. Firestop Seal: Same as "Firestop System".

C. Rated Assembly: All building floors and corridor wall have a 2-hour fire-resistance rating, and are smoke barriers.

1.4 SUBMITTALS

A. General: Shall comply with Section 23 05 00.

B. Product Data: Provide product data on all material to be use. Provide MSDS for all sealants, caulks and similar materials.

C. Shop Drawings – General: Shop drawings of proposed sealing/flashing assembly for roof and exterior wall penetrations.

D. Shop Drawings – Firestop: Provide firestop system shop drawings showing:

1. Listing agency's detailed drawing showing opening, penetrating items, and firestop materials. Drawing shall be identified with listing agency's name and

number or designation, fire rating achieved, and date of listing for each firestop system.

2. Identify where each firestop system is to be used on the project.

3. Manufacturer's installation instructions.

4. For proposed systems that do not conform strictly to the listing, submit listing agency's drawing marked to show modifications and stamped approval by the firestop system manufacturer's fire protection engineer.

5. Other data as required by the AHJ.

1.5 REFERENCES

A. ASTM A 36: Standard Specification for Carbon Structural Steel.

B. ASTM C534: Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

C. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

E. UL 1479: Standard for Fire Tests of Through-Penetration Firestops.

F. UL 723: Surface Burning Characteristics of Building Materials.

G. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.

H. SMACNA-ARCH: SMACNA Architectural Sheet Metal Manual, 7th Edition.

1.6 GENERAL REQUIREMENTS

A. Corrosion Protection: All sleeves exposed to water, moisture, chemicals, or subject to corrosion shall be constructed of corrosion resistant materials suitable for the exposure. Steel sleeves shall be hot dip galvanized after assembly. Provide additional coatings as noted or as required to resist corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Firestop Seal Materials: 3M, Dow Corning.

C. Non-Firestop Seal Materials: 3M, GE, Dow Corning, Tremco, Pecora, Sonneborn, Pipeline Seal & Insulator.

2.2 PIPE SLEEVES

A. Diameter:

1. Aboveground: Inside diameter of aboveground pipe sleeves shall be at least 1-inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems), so as to allow free movement of piping.

2. Large Movement: Provide larger sleeves where a larger space around pipe exterior is required by code, where specifically noted, where pipe movement will occur (i.e. expansion/contraction or seismic), at expansive soils, other unusual conditions are present, and where required to accommodate large piping movement.

B. Length: Horizontal sleeves through finished areas (where sleeve is exposed to view) shall be sized to be flush with finished surfaces; other horizontal sleeves may terminate flush to 2-inches past the element being penetrated. Vertical sleeves shall be sized to extend one inch above the final floor elevation.

C. Non-Structural Type: Fabricated from 18 gauge galvanized sheet metal or 22 gauge spiral seam galvanized steel duct. Provide with galvanized steel angle tabs, collars, or similar to allow for anchoring where sleeve cannot be retained in place by element being penetrated.

2.3 DUCT SLEEVES

A. Size: Inside dimension of duct sleeves shall be at least 1-inch larger than the outside dimension of the duct or duct covering (for covered duct systems). For duct system conveying air or gases operating above 200 deg F provide sleeve dimension minimum 2-inch larger than duct or duct covering (for covered duct systems). Provide larger sleeves where a larger space around duct exterior is required by code, by duct or flue system manufacturer, to provide required thermal clearances, where specifically noted, where unusual conditions are present and where required to accommodate large movement.

B. Length: Horizontal sleeves through finished areas (where sleeve is exposed to view) shall be sized to be flush with finished surfaces; other horizontal sleeves may terminate flush to 2-inches past the element being penetrated. Vertical sleeves shall be sized to extend one inch above the finished floor.

C. Non-structural: 24 gauge spiral seam galvanized steel duct or 20 gauge longitudinal seam galvanized steel duct for round openings. Fabricated of 18 gauge galvanized sheet metal for other openings; configured to suit duct.

2.4 DUCT CLOSURE COLLARS

A. General: Closure collars shall provide closure of opening between duct and opening in element penetrated and shall abut tight up to and overlap duct and shall consist of rolled angle material (for round ducts) and welded framed angles (for rectangular and round ducts).

B. Size: Closure collars shall be sized to match duct and opening applied to and shall have minimum 2-inch overlap on duct side and 2-inch overlap at opening/penetrated element side but shall completely cover opening in element penetrated with minimum 1-inch overlap to undisturbed element (i.e. wall, floor, etc.).

C. Material: Closure collars shall be fabricated of 20 gauge galvanized steel for ducts 15 inches diameter and less and shall be fabricated of 18 gauge galvanized steel duct for all larger ducts and all square and rectangular ducts.

2.5 FIRESTOP SEALS

A. General: Commercially manufactured through-penetration and membrane-penetration firestop systems to prevent the passage of fire, smoke and gases, and to restore the original fire-resistance rating of the barrier penetrated.

B. Listing: Firestopping shall be listed by UL in "Fire Resistance Directory" (category to match the application), or be qualified by another independent agency acceptable to the AHJ.

C. Rating: Firestop system and devices shall be tested in accordance with ASTM E 814 or UL 1479, with "F" and "T" ratings as required to maintain the fire-resistance rating of the barrier penetrated, and as required by code.

D. Fire Hazard: Materials shall have a flame spread of 25 or less, and a smoke development rating of 50 or less; when tested in accordance with ASTM E 84 or UL 723.

E. Cabling Applications: Firestop systems used with loose electrical cabling shall be the type that allows for removal of the cable or installation of new cables without damage to the firestop system, or the need to replace or repair firestop materials.

F. Insulation: Firestop system shall be applicable to insulated systems to allow the insulation to run continuous through the firestop system (unless noted otherwise).

2.6 NON-FIRESTOP SEALS

A. Indoor Sealants:

1. Smoke or Sound Sealant Applications: For use where a firestop seal is not required, but smoke or sound seal is required. Single component, elastomeric or acrylic latex type sealant with STC ratings per ASTM E90. Sealants shall be of the following types, or approved equal:

a. 3M "Smoke and Sound Sealant SS100".

b. Tremco "Tremstop".

2. Other Areas - Dry (Not Normally Exposed to Water/Moisture): Single component, latex sealant complying with requirements of ASTM C834. Sealants shall be of the following types, or approved equal:

a. Tremco Corporation "Tremflex 834".

b. Pecora Corporation "AC-20 Arylic Latex".

c. Sonneborn Building Products "Sonolac".

3. Other Areas - Wet (Exposed to Water/Moisture): Single component, mildew resistant silicone sealant complying with requirements of ASTM C920, Type S, Grade NS, Class 25. Color white. Sealants shall be of the following types, or approved equal:

a. Dow Corning "786 Mildew Resistant Silicone".

b. Pecora Corporation "898 Silicone Sanitary Sealant".

c. Tremco "Tremsil 200".

B. Outdoor Sealants:

1. General: Single component, non-sag, low modulus, silicone elastomeric sealant conforming to requirements of ASTM C920, Type S, Grade NS, Class 100/50. Sealant shall be of the following types, or approved equal.

a. Dow Corning "790 Silicone Building Sealant".

b. Pecora Corporation "890 Silicone".

c. Tremco "Spectrem 1".

2. Adjacent to Aluminum: Single component, non-sag, medium modulus, silicone elastomeric sealant conforming to requirements of ASTM C920, Type S, Grade NS, Class 50. Sealant shall be primer-less type for use in joints adjacent to fluoropolymer coatings. Sealants shall be of the following types, or approved equal:

a. Dow Corning "795 Silicone Building Sealant".

b. GE Silicones, Momentive, SCS2000 and SCS7000.

c. Pecora "895 Silicone".

d. Tremco "Spectrem 2".

C. Expanding Foam Sealant:

1. General: Single component, polyurethane insulating sealant with flame spread index of 25 or less and smoke development rating of 50 or less. Shall expand and fully cure within 24 hours to a semi-rigid, closed cell, water and air resistant foam. Sealant shall be of the following types, or approved equal.

    a. DAP "Kwik Foam".

    b. Fomo Products "Handi-Foam".

    c. Todol Products "EZ Flo Gun Foam".

D. Specialty: Packed fiberglass or wool insulation; with silicone sealant rated for use with temperatures and other conditions encountered.

PART 3 - EXECUTION

3.1 PIPE SLEEVES

A. General: Provide sleeves for all piping passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements. Except that sleeves are not required at core drilled penetrations through solid concrete or where formed openings equivalent to a core drilled opening are provided.

B. Installation: Set sleeves plumb or level (or sloped as required for sloped pipes) in proper position, tightly fitted into the work. Set sleeves properly in element for specified projection past adjacent surfaces (see sleeve product specification); cut ends of sleeve as necessary.

C. Insulation: Insulation shall run continuous through sleeves (unless noted otherwise).

3.2 DUCT SLEEVES

A. General: Provide sleeves for all ducts passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements, except that sleeves are not required at core drilled penetrations through solid concrete or where formed openings equivalent to a core drill and provided and where no floor drain serves the room where the penetration occurs.

B. Installation: Set sleeves plumb or level (or sloped as required for sloped duct) in proper position, tightly fitted into the work. Set sleeves properly in element for specified projection past adjacent surface (see sleeve product specification); cut ends of sleeve as necessary.

C. Insulation: Insulation shall run continuous through sleeves (unless noted otherwise).

3.3 DUCT CLOSURE COLLARS

A. General: Closure collars shall be provided for all exposed ducts on each exposed penetration where the duct passes through any floors, walls, ceilings, roofs,

partitions, and similar elements. Closure collars shall additionally be provided where so noted on the drawings and at all duct penetrations into mechanical rooms, boiler rooms, and rooms housing mechanical equipment (on both sides of the penetration).

B. Installation: Collar shall be installed tight against surfaces and shall fit snugly around the duct or duct covering. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier of insulated ducts. Collars shall be anchored to element penetrated, with fasteners appropriate to material fastening to, on maximum 6 inch centers.

3.4 FIRESTOP SEALS

A. General: At each through-penetration and membrane-penetration in rated assemblies, where required to limit the passage of smoke, and as required by code or in the Contract Documents, provide a firestop system. Firestop system shall be installed in accordance with the manufacturer's instructions and listing.

B System Selection: Contractor is responsible to select the firestop systems to be utilized, corresponding to the construction of the assembly penetrated, and types of penetrations. Contractor shall submit proposed firestop systems to be utilized, shall also review such systems with the AHJ and obtain AHJ approval.

C. Preparation: Prepare surfaces as recommended by firestop material manufacturer. Examine and confirm that conditions are acceptable to proceed with the installation. Provide maskings and temporary coverings to prevent contamination or defacement of adjacent surfaces.

D. Installation Review:

1. Notify Architect/Engineer when firestopping work is complete and ready for review. Provide minimum 7 days notice to allow scheduling of review. An independent testing agency may be utilized to perform an inspection.

2. Notify AHJ when firestopping work is complete and ready for inspection. Provide sufficient advance notice to allow scheduling of the inspection without adversely impacting project schedule.

3. Do not cover or conceal firestopping until all inspections have been satisfactorily completed.

3.5 NON-FIRESTOP SEALS

A. General: Provide seals around all ducts, conduit, and piping passing through sleeves, walls, floors, roofs, foundations, footings, partitions, and similar elements. Seals shall be watertight where the penetration may be exposed to water or moisture. Provide type of sealant to suit the application. Provide smoke and sound type at all penetrations of rooms which contain mechanical equipment on both side of element penetrated to a depth of 5/8-inch (unless noted otherwise).

B. At Sleeves:

1. Between Sleeve and Penetrated Element: Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating and properties that allow a tight seal between the sleeve and the surrounding construction. Seal full depth of sleeve for vertical penetrations.

2. Between Pipe and Inside of Sleeve: Provide sealant between outside of pipe or pipe covering (for covered piping systems) and inside of sleeve. Seal depth shall be minimum 1-inch each side. Provide Link Seal type for belowground penetrations, vault wall penetrations, and slab-on-grade penetrations (not required where flexible type sleeves are used).

C. Preparation: Remove loose materials and foreign matter impairing adhesion of seal. Perform preparation in accordance with recognized standards and sealant manufacturers recommendations. Protect elements surrounding area of work from damage or disfiguration due.

D. Installation: Install sealants immediately after joint preparation. Install sealants free of air pockets, foreign embedded matter, ridges, and sags. Tool exposed joint surface concave and with a neat finished appearance.

END OF SECTION 23 05 30

SECTION 23 05 93– TESTING, ADJUSTING, BALANCING FOR MECHANICAL

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Air Balancing.

B. Hydronic Balancing.

C. Report.

1.3 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Company: Submit name of Company proposed to do the balancing and sample balancing forms. Where the Company has not been pre-qualified, and substitutions are allowed after bidding (see Division 00 and 01), submit information regarding firm qualifications.

C. Personnel: Submit list of personnel that will be assigned to the project and their qualifications, and list of past projects.

D. Reports: Preliminary and final balancing reports.

1.4 REFERENCES

A. AABC-NS: Associated Air Balance Council, National Standards for Field Measurements and Instrumentation.

B. ASHRAE: Handbook of Fundamentals.

C. NEEB-PS: National Environmental Balancing Bureau Procedural Standard for Testing, Adjusting and Balancing Environmental Systems.

1.5 GENERAL REQUIREMENTS

A. General: Balancing shall be done by a company which specializes in this type of work and is totally independent and separate from the Company which has installed the systems to be balanced.

B. Balancers Qualifications:

1. General: Work of this Section shall be performed by balancing firms meeting the following and having prior approval from the Engineer:

a. Professional Affiliation: Firm shall be an Associated Air Balance Council (AABC) member balancer or National Environmental Balancing Bureau (NEBB) certified balancer.

b. Experience: Firm shall have satisfactorily completed the balancing work for at least 5 similar projects in the last 3 years. Similar is defined to mean: within 10% of the same quantity of units and air inlets/outlets, involve same type of systems, be the same type of facility (i.e. school, hospital, etc.). The lead field balancer (i.e. the individual who will be on site directing and participating in the balancing efforts) shall have at least 5 years of experience performing balancing work on similar projects.

c. References: Have five references for similar projects which have been completed in the last three years that will give a good or better performance rating. References shall be engineers, architects, or building owners. As part of the qualification process at least three of these references will be contacted and a rating obtained for the following: timeliness of work (i.e. able to complete work on schedule), cooperative nature of balancer's staff (i.e. ability to work well as a team with other project trades and professionals), overall quality of balancing work, quality of balancing report. Each item will be rated on a scale of 1 to 5 (5 being excellent), with the result averaged, score must be of 4 or better.

C. Balancing Issues: Notify the Engineer in writing of all problems or discrepancies between actual conditions and what design documents show as work proceeds.

D. Engineer's Authority: The Balancer shall be directly responsible to the Engineer and shall perform this work and make system adjustments as directed by the Engineer.

E. Lead Balancer: The Balancer shall assign an individual as "lead balancer" to work in the field to directly supervise the balancing work and field technicians. This lead field balancer shall have at least 5 years of experience performing balancing work on similar projects.

F. Added Site Visits:

1. Trade Coordination Purposes: The Balancer shall include in his bid one extra site visits (beyond those otherwise included) and associated added time to assess system readiness for balancing, resolve system issues, coordinate balancing work, and perform other activities related to balancing and commissioning.

PART 2 - PRODUCTS

2.1 GENERAL INSTRUMENTATION

A. General: Balancing equipment shall comply with Associated Air Balance Council recommendations for field measurement instrumentation.

B. Calibration: All measuring instruments shall be accurately calibrated and maintained in good working order. Calibration dates and certifications shall be available at Engineer's request.

C. Instruments: Shall be capable of:

1. Air velocity instruments, direct reading in feet per minute with 2% accuracy.

2. Static pressure instruments, direct reading in inches water gauge with 2% accuracy.

3. Tachometers, direct reading in revolutions per minute with 1/2% accuracy; or revolution counter accurate with 2 counts per 1,000.

4. Thermometers, direct reading in degrees Fahrenheit with 1/10 of a degree accuracy.

5. Pressure gauges, direct reading in feet of water or psig with 1/2% accuracy.

6. Water flow instruments, direct reading in feet of water or psig with 1/2% accuracy suitable for readout of balancing valve provided.

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship: All measurements and adjustments shall be in accordance with AABC-NS, NEEB-PS, and ACGIH-IV and recognized best balancing procedures. Measurements and adjustments of equipment shall be executed in a manner consistent with the manufacturer's recommendations.

B. Flow Rates:

1. General: All air and water systems shall be completely balanced and adjusted to provide the flow rates indicated (within tolerances indicated in this specification Section), and to produce an even heating and cooling effect and control response and to produce even water circulation.

2. Balancer Determined: Where flow rates have not been indicated the balancer shall determine such flow rates using acceptable practices in accordance with AABC-NS, NEEB-PS, and ASHRAE standards and submit the proposed flow rates to the Engineer for review.

3. Confirmation: Prior to beginning balancing confirm any flow rate changes since design with the submittals and flow rates indicated therein, and with the Engineer to confirm changes made since design. Assume that new flow rates will be issued.

C. Controls: Consult and coordinate with the Control Contractor for the adjustment and setting of all control devices to allow for the balancing work, and for proper system operation and proper flow rates. Set all controls and valves as required to maintain design flow rates and temperatures as shown on the drawings. Make measurements and provide data to the Control Contractor to allow for proper control of items.

D. Comfort Adjustments: Make final adjustments for flow rates in order to optimize each space's comfort, including such considerations as temperature, drafts, noise, pressurization, and air changes. Where variances are made from design values, state reasons in report (e.g., "too noisy", "too drafty," etc.). All such variances are subject to approval by the Architect/Engineer.

E. Deficiency Reports: Submit deficiency reports where the work does not allow balancing to occur or balancing issues develop. Indicate date, system and equipment involved, location, description of deficiency, and related information to allow for diagnosing the problem. Provide suggestions for resolution where possible.

3.2 AIR BALANCING

A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:

1. Verify that clean filters have been installed, that system is free from debris, and that all inlets/outlets are not obstructed.

2. Check all fans and equipment to verify that proper start-up and system preparation has been done by the installing contractor.

3. Check all door/window and similar building opening status to insure building is ready and proper pressurization can be obtained.

4. Open all dampers to full flow position, check positions and operation of all motorized dampers to allow full system flows.

5. Review controls and sequences of operation.

B. Tolerances: All air flow rates (supply, return, and exhaust) shall be adjusted to within plus 5 percent and minus 5 percent of the values shown in the contract documents, except that relative space-to-space pressure relationships shall always be maintained (e.g., restrooms shall be negative relative to other areas, general offices shall be positive, etc.).

C. Draft and Noise Adjustments: All diffusers, grilles, and registers shall be adjusted to minimize drafts and to eliminate objectionable noise.

D. Filters: Air balancing shall be done with new, clean air filters installed. Adjust air deliveries so that design quantities will be obtained when filters are half dirty. This condition shall be simulated by covering a portion of the filter area.

E. Fan Speeds and Drives:

1. Adjust fan speeds and fan drives (adjustable sheaves) as required to produce design flow rates.

2. Where new sheaves are required, calculate sizing of new sheave and coordinate requirements with the Division 23 Contractor; Division 23 Contractor to furnish new sheaves. Replace existing sheave with new one furnished by the Division 23 Contractor; include bid costs for sheave replacements on all of belt driven fans.

3. Adjust belts for proper tension.

F. Marking: Upon completion of flow readings and adjustments permanently mark the balanced position of all balancing valves by stamping the indicator plate of the valve.

G. Duct Traverse: Rectangular duct traverses shall measure the center of equal areas in the air flow stream, with centers not more than 6 inches apart. Round duct traverses shall measure at least 20 locations, with locations being the centers of equal annular area. Reference ACGIH Industrial Ventilation Manual.

H. One Open Run: Balance each branch run so that there is at least one wide open run; balance branches relative to one another so that at least one branch damper is wide open (except that where unique conditions exist, and the Engineer gives prior approval, one open damper on runs or branches is not required).

I. Data: Data to be measured/recorded and provided in report for all air handling systems and equipment:

1. Floor plans clearly showing and identifying all diffusers, grilles, OA louvers, ducts and all other items where air flow rates were measured.

2. Identify manufacturer, model number, size, and type of all air inlets/outlets.

3. Initial, trial, and final air flow measurements for all diffusers, grilles, OA louvers, ducts, and all other items where air flow rates were measured.

4. Design air flow rates and percentage final air flow rates are of design values.

5. Final damper (or other balance device) final position (as a percentage of full open).

6. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all fan motors.

7. Initial and final RPMs of all fans.

8. Static pressures on inlet and outlet of all fans.

9. Fan initial and final CFMs.

10. Outdoor air CFMs (record minimum and maximum values).

11. Entering and leaving air temperatures across coils with coils operating at 100% capacity.

12. Static pressure drop across each filter bank and coil.

13. Final position of any speed controls (as percent of full).

14. In addition to data noted elsewhere, provide the following for all equipment which are part of balanced systems:

    a. Equipment name and number (as used on drawings).

    b. Service.

    c. Equipment manufacturer and model number.

    d. Sheave and belt sizes (where applicable).

    e. Filters sizes and quantities (where applicable).

    f. Motor manufacturer and complete nameplate data.

    g. Design operating conditions.

    h. Actual operating conditions (flows, pressure drops, rpm, etc.).

3.3 HYDRONIC BALANCING

A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:

1. Verify that all strainers have been cleaned.

2. Examine fluid in system to verify system treatment and cleaning.

3. Check for proper rotation and operation of all pumps.

4. Verify that expansion tanks are not air bound and properly charged and that system is full of fluid.

5. Verify that all air vents at high points in the fluid system are properly installed and are operating freely. Verify that all air has been removed from the circulating system.

6. Open all valves to full flow position, close any bypass valves, and open fully

balancing valves. Set temperature controls so that automatic valves are open to full flow.

7. Check operation of automatic bypass valves and similar flow/pressure controls.

8. Check and set operating temperature of equipment to design requirements when balancing by temperature drop.

9. Check equipment for proper start-up and system preparation by installing contractor.

10. Review controls and sequences of operation.

B. Tolerances: All water flow rates shall be adjusted to within plus 5 percent and minus 5 percent of the values shown in the contract documents.

C. Marking: Upon completion of flow readings and adjustments permanently mark the balanced position of all balancing valves by stamping the indicator plate of the valve.

D. Requirements for All Hydronic Systems: Data to be measured/recorded and provided in report:

1. Floor plans or schematics showing and identifying all valves, coils, pumps and other items where temperatures, pressure drops, or water flow rates were measured.

2. Identify manufacturer, model number, size and type for all balancing devices.

3. Initial, trial, and final water flow measurements (pressure drops, temperatures, and GPMs) for all items where measurements were made.

4. Design water flow rates, and percentage final water flows are of design values.

5. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all pump motors.

6. Pump operating suction and discharge pressures and final total developed head.

7. Pump initial and final GPMs.

8. Entering and leaving fluid temperatures at coils and major equipment.

9. GPM flow of each coil and major equipment.

10. Pressure drop across each coil and major equipment.

11. Pressure drop across bypass valve.

12. Final position of all valves (percent open or setting position on valve).

13. Final position of any speed controls (as percent of full).

14. In addition to data noted elsewhere, provide the following for all equipment which are part of balanced systems:

    a. Equipment name and number (as used on drawings).

    b. Service.

    c. Equipment manufacturers and model number.

    d. Equipment capacities.

    e. Motor manufacturer and complete nameplate data.

    f. Design operating conditions.

    g. Actual operating conditions (flows, pressure drops, etc.).

3.4 BALANCING REPORT

A. General: A balancing report shall be submitted as specified herein, documenting all balancing procedures and measurements.

B. Report Organization: The report shall be divided into logical sections consistent with the building or system layout (i.e. by floors, building wings, air handling units, or other convenient way). Tabulate data separately for each system. Describe balancing method used for each system.

C. Preliminary Report: Two preliminary review copies of the balancing report shall be submitted to the Architect/Engineer when the balancing work is 90% complete (or as near 90% complete as possible due to uncompleted work of other trades). In addition to containing all the information required of the final report, the preliminary report shall contain a list of all the work required of other trades in order to allow the balancing work to be completed. The Architect/Engineer will review the preliminary report and inform the Contractor of any additional items or revisions required for the final report. Preliminary reports may be omitted where the Architect/Engineer grants approval.

D. Final Report: Shall be included in the Operation and Maintenance Manual. Submit reports to Contractor for inclusion in Manuals (or, when manuals have been already sent to Engineer, send report to Engineer who will insert report into Manual). Provide number of reports as required to match quantity of O&M Manuals, but in no case less than five.

E. Format: 8-1/2" x 11" size, neat, clean copies, drawings accordion folded. Report shall be typed, shall have a title page, table of contents, and divider sheets with identification tabs between sections. Information shall be placed in a three hole

notebook, with the front cover labeled with the name of the Job, Owner, Architect/Engineer, Balancing Contractor, and Report Date.

F. Electronic Copy: Provide copy of reports in *.pdf format; submit final report with closeout documents per Divisions 00 and 01.

G. General Balancing Information Required:

1. At the beginning of the report, include a summary of problems encountered, deviations from design, remaining problems, recommendations, and comments.

2. List of instruments used in making the measurements and instrument calibration data.

3. Names of personnel performing measurements.

4. Explanation of procedures used in making measurements and balancing each system.

5. List of all correction factors used for all diffusers, grilles, valves, venturi meters, and any other correction factors used.

6. Areas where difficulties were encountered in obtaining design flow rates, or where unstable operating conditions may exist.

7. Note any parts of the system where objectionable drafts or noises may be present and efforts made to eliminate same and why they may still be present.

8. Note where variances from design values occur; explain why.

9. All specified measurements, balancing data, any additional recorded data, and observations.

END OF SECTION 23 05 93

SECTION 23 21 13 – HYDRONIC PIPING

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Chilled Water Piping.

B. Valves.

C. Balancing Valves.

D. Air Vents.

E. Flushing and Initial Testing.

F. Chemical Cleaning, Treatment and Final Testing.

1.3 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Product Data - General: Submit product information data for all items.

C. Balancing Valves: Submit list and sizing for all balancing valves; list by unit used with and flow rate.

D. Product Data – Balancing valves: Submit proposed balancing valve sizes for flow rate scheduled.

E. Shop Drawings: Submit shop drawings of underground piping system.

F. System Flushing, Cleaning and Testing: Submit documentation of work performed.

G. Water Treatment:

1. Submit name and qualifications of Water Treatment Specialist and chemical product data.

2. MSDS sheets for all chemicals.

3. Proposed flushing, cleaning, and treatment plan.

4. Submit Water Treatment Specialist report.

H. Operation and Maintenance: Submit operation and maintenance data, submittal data, and Water Treatment Specialist report for inclusion in project O&M Manuals.

1.4 QUALITY ASSURANCE

A. Water Treatment Specialists (WTS): Shall be a company regularly engaging in this work, having local representation and staff with at least 5 years experience, separate and independent from the system installers. WTS shall have staff trained and experienced in hydronic system chemistry and water treatment. WTS shall have water treatment research and laboratory services available for analyzing hydronic water systems and prescribing proven treatment systems.

1.5 REFERENCES

A. ASME B16.3: Malleable Iron Threaded Fittings.

B. ASME B16.15: Cast Bronze Threaded Fittings: Classes 125 and 250.

C. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

D. ASME B18.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

E. ASME B18.24: Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500.

F. ASME B31.1: Power Piping.

G. ASME B31.9: Building Service Piping.

H. ASTM A 53: Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

I. ASTM A 530: General Requirements for Specialized Carbon and Alloy Steel Pipe.

J. ASTM B 16.18: Seamless Copper Water Tube.

K. ASTM B 32: Solder Metal.

L. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

M. AWS A5.8: Filler Metals for Brazing and Braze Welding.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic Manufacturers only.

C. Valves: Milwaukee, Nibco, Watts, Conbraco/Apollo, Stockham, Kitz, Red-White.

D. Balancing Valves: Bell & Gossett, Armstrong, Taco, Nibco, Red-White. Oventrop.

E. Air Vents – Manual: Same as listed for valves.

F. Chemicals: Hydrochem, Dow Chemical, Hercules Chemical Company, Rhomar Water Management, U.S. Water

2.2 PIPE AND FITTINGS

A. Steel Pipe and Fittings:

1. Pipe: Black steel pipe, per ASTM A 53, Type E or S, Grade A or B, Schedule 40 unless indicated otherwise.

2. Fittings:

a. Threaded: Malleable iron fittings per ASME B16.3 or threaded cast iron fittings per ASME B16.1 or ASME B16.4.

b. Welded: Steel weld fittings per ASTM A 234; butt weld type per ASME B16.9; socket weld type per ASME B16.11.

c. Flanged: Fittings, bolts, nuts, and bolt patterns per ASME B16.5, Class 150. Flanges shall comply with ASTM A105. Bolts shall be high strength or intermediate strength, with material conforming to ASTM A193.

3. Threads: Shall conform to ASME B1.20.1

4. Coupled Piping Systems: See Section 23 21 15.

B. Copper Pipe and Fittings:

1. Pipe: Seamless copper water tube, hard temper (unless noted otherwise), type K or L as indicated, per ASTM B88.

2. Fittings:

a. Solder Joint: Wrought copper and bronze fittings per ASME B16.22 and cast copper alloy fittings per ASME B16.18, cast bronze threaded fittings per ASME B16.15.

b. Flanged: Cast bronze fittings per ASME B16.24.

c. Solder Material: 95/5 tin-antimony solder per ASTM B32 or "Silvabrite 100" (95.5 tin/4 copper/0.5 silver) solder; lead free.

d. Brazing Material: AWS A5.8, BCuP-5.

3. Coupled Piping Systems: See Section 23 21 15.

2.3 VALVES

A. Ball Valves:

1. 2 Inches and Smaller: 125 psi-swp bronze body, full port, 2 piece construction, anti-blowout stem, reinforced TFE seats, stainless steel or chrome plated brass ball, extended stem, cadmium plated steel lever handle with vinyl covering, solder or threaded connections as required. Provide with extension stem for handle where valve is installed in systems with insulation thickness greater than 0.5 inch. Nibco S-585, T-585 (or approved).

2. 2-1/2 Inches and Larger:

a. Stainless: Class 150 stainless steel body, split-body full bore design, anti-blowout stem, carbon filled TFE seats, stainless steel ball, stainless steel trim. Nibco F-515-S6-F-66-FS (or approved).

b. Cast Iron: Class 125 cast iron body, split-body full port, anti-blowout stem, PTFE seats, stainless steel ball. Conbraco/Apollo IBV-125 Series (or approved).

B. Butterfly Valves:

1. 2 Inches and Smaller: 125 psi-swp bronze body, stainless steel disc and extended stem, with solder or threaded connections as required. Milwaukee "Butterball" Model No. BB2 (or approved).

2. 2-1/2 Inches and Larger: 200 psi non-shock cold water, ductile iron body, extended neck, molded-in seat EPDM liner, stainless steel stem, and aluminum bronze disc. Provided with lugs for dead-end service. Nibco LD-2000, WD-2000 (or approved).

C. Drain Valves: Bronze ball valve, minimum 125 psi-swp, anti-blowout stem, stainless steel or chrome plated brass ball, reinforced TFE seat, solder or threaded inlet connection, male 3/4 inch hose thread outlet connection, with brass cap and chain. Nibco S-585-70-HC, T-585-70-HC (or approved).

2.4 BALANCING VALVES - MANUAL

A. General: Valve shall have, as an integral factory manufactured part of the valve, ports which allow measurement of the pressure drop across the valve to determine the flow rate using factory calibrated pressure drop versus flow charts. Valve shall have a means to adjust the flow rate through the valve and shall have a numerical readout indicating

valve position. Valve shall have a concealed locking memory stop feature which prevents opening the valve beyond its balanced setting. Locking position may be unlocked by use of a standard size allen wrench. Victaulic "T/A" (or approved).

B. Sizing: Manufacturer shall select balancing valve sizes to best suit required flow rates and providing the most accurate flow values for available valve sizes.

C. Construction: Rated 300 psig at 250 deg F, Y-pattern, globe type, constructed of brass copper alloy or ASTM A536 ductile iron, with EPDM O-ring seals. Handwheel controlling valve position shall be of plastic construction, containing readout of valve position.

D. Connections: Valves 2-1/2 inch and smaller shall have solder or threaded end connections; larger valves shall have flanged or grooved ends.

2.5 AIR VENTS

A. Manual Air Vent: Same as drain valve.

2.6 CHEMICALS

A. General: Chemicals shall be compatible with system materials and suitable for system operating conditions. Chemical shall be acceptable by local utility for discharge to sanitary sewer. Chemicals shall be delivered to the site in manufacturer's original sealed and labeled containers.

B. Cleaner: Single liquid chemical product formulated for use as a cleaner in hot water heating and chilled water piping systems. Product shall have detergents, dispersants, alkaline emulsifiers, and additional agents to effectively remove grease, oil, dirt, mill scale and other contaminants from the piping systems. Cleaner shall be biodegradable. Rhomar "Hydro-Solv 9100" (or approved).

C. Biocide: Broad spectrum microbiocide for use in hydronic piping systems.

D. Corrosion Inhibitor: Liquid chemical product formulated for use in hot water heating and chilled water cooling systems to provide protection from corrosion. Shall be compatible with system heat exchanger and other materials (i.e. aluminum, stainless steel, or copper). Product shall be compatible with antifreeze, and all materials in the hydronic system that the product may come in contact with. For work on existing systems where portions of the existing system water will remain in the system use the same corrosion inhibitor type as currently in the system and compatible with the existing chemicals.

E. Antifreeze: Industrially inhibited propylene glycol, formulated for use in hot water heating and chilled water cooling systems. Shall have operating range from -28 deg F to 325 deg F. Antifreeze shall contain corrosion inhibitors to prevent system corrosion. Product shall be dyed a bright color for easy leak identification. Reserve alkalinity shall be at least 15 to provide long term resistance to acidic pH. Dow "Dowfrost HD" (or approved).

PART 3 - EXECUTION

3.1 GENERAL

A. Installation: Installation of all items shall comply with code, best professional practices, and manufacturers written installation instructions.

B. Complete System: Provide all piping as indicated and as required to allow complete supply and return connections to each item requiring hydronic service. Provide piping connections to equipment furnished by others in accordance with Section 23 05 00.

C. Coordination: Coordinate installation of items with all trades that are affected by the work to avoid conflicts. Review all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

3.2 PIPE AND FITTINGS

A. General:

1. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

2. Install piping at such heights and in such a manner so as not to obstruct any portion of windows doorways, passageways, or access to any items requiring routine service, maintenance, or inspection. Offset of reroute piping as required to clear any interferences which may occur.

3. Install return piping graded up in the direction of flow. Piping pitch shall be 1/4-inch per 10 feet. Supply piping may be installed with slope parallel to return.

4. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal exposed straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

5. Use eccentric reducers for changes in pipe sizing, keeping the top of pipes in line.

B. Insulation: Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.

C. Escutcheons: Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.

D. Electrical Items: Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, and are required per this paragraph.

E. Joints: Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by pipe and fitting manufacturer.

F. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

G. Soldered and Brazed Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.

H. Welding: Shall conform to ASME B31.1 and ASME B31.9. Welders and welding operators shall be qualified as required by ASME B31.1, ASME B31.9, and governing code. Welded joints on piping system shall be continuous, without backing rings, and pipe ends beveled for butt weld connections. Gas cuts shall be square and free from burned material. Before welding, surfaces shall be thoroughly cleaned. Piping shall be carefully aligned, with no weld material projecting inside the pipe.

I. Unions: Install unions in pipe connections to valves, coils, and any other equipment where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise.

J. Insulating Unions: Install dielectric insulating unions or insulating type flexible connectors between all connections of copper piping and steel piping of steel equipment. Where flanged connections occur use insulating type flanges.

L. Manual Air Vents: Provide manual air vents where shown on the drawings and at each coil, except that automatic air vents shall be used where specifically called for on the drawings or where it is a high point in the system or where air may become trapped.

M. Drains: Install drain valves at the low points in the piping system and at the base of each system riser. Provide additional drains as required to allow for complete draining of the system. These drain valves shall take off of the bottom of any horizontal pipe that they are connected to. Identify system drains on record drawings.

N. Accessories: Install flow measuring devices, balancing valves, and related items per manufacturer's instructions; with the proper distances upstream and downstream to any pipe fittings.

3.3 VALVES

A. General: Provide isolation valves as shown on the drawings. In addition to those shown, provide added valves to allow for the isolation of all individual equipment items.

B. Installation: Install valves so as to be easily accessible and oriented to permit ease of operation. Valve stem shall be directed toward operator in either the vertical or horizontal direction. Provide access doors for valves not otherwise accessible.

C. Balancing Valves: Provide balancing valves in piping where indicated and where required to allow for equal distribution of water flows. Install in full open position unless noted otherwise. Verify proper sizes with valve manufacturer prior to installing.

3.4 FLUSHING, TESTING, AND CHEMICAL TREATMENT

A. General:

1. All new work and portions of the existing system affected by the work are to be flushed and pressure tested. The entire system is to be chemically treated to restore proper chemical levels. It is not the intent to flush or test existing portions of the system not affected by the work.

2. Due to limited ability to isolate portions of the system, it may be required to flush, fill, and test larger portions of the system than those worked on, or the entire system. Contractor shall review and make his own determination of the extent of the work and include all costs in his bid.

3. The activities specified herein represent the minimum work required; Provide additional work as necessary to suit unique aspects of the project (e.g. phased construction, long pipe runs, etc.) and as recommended by the Water Treatment Specialist (WTS) in order to provide clean, pressure tested, and chemically treated hydronic systems ready for service.

4. Prior to beginning work have WTS confirm existing system treatment levels, conditions, and chemicals being used. Submit written report of condition and any adverse conditions discovered.

5. System shall not be allowed to remain in a condition that is deleterious or aggravates corrosion. After being filled with water systems may not remain without chemical treatment for more than 48 hours; after having been filled and drained, systems may not remain empty for more than 24 hours. Provide added chemical treatment cycles during initial fill periods as needed to suit project phasing or extended testing/flushing periods.

6. Provide clear, accurate, and readable pressure gauges to ensure accurate pressure testing. Make a written record of the gauge readings, time, date, and where connected to the system and mark this information on site as-builts.

B. Sequence: Work shall occur in the following order:

1. Prepare system for work.

2. Initial fill and initial leak testing.

3. Flushing (includes initial strainer blow-down).

4. Final leak testing.

5. Chemical treatment.

C. Preparation: Prepare system for flushing and testing. Isolate from the piping any parts of the system or equipment that may be damaged by the test pressure or entrapment of debris during the flushing process, or that are not part of the flushing process. Verify all system valves are in the required positions. Install any required (or recommended) start-up strainer screens or related items to protect components or to aid the flushing process.

D. Initial Fill and Leak Test: Fill portions of the system to be flushed with clean water or existing system hydronic water. Open local air vents and valves to allow filling. Maintain isolation from systems not worked on. Check system for leaks during filling. Pressurize system to at least 20% above what system will experience during flushing process (but not less than 75 psig) and check for leaks. Any leaks shall be repaired and the system re-filled and re-checked until system proves tight. Provide temporary hose and piping as necessary.

E. Flushing and Cleaning:

1. Flush all new work and portions of system affected by the work to remove system of debris. Use clean water or existing system hydronic water. Blow-down all strainers that are part of system being flushed. Protect existing systems to prevent contamination. Existing systems are not intended to be flushed unless they have not been sufficiently protected from contamination (in which case flushing will be required), or it is not possible to isolate them from the areas worked on. Open system valves (where possible) and other components to ensure full flushing. Provide temporary fill and drain piping as necessary. Provide sufficient number of drain points to ensure that all parts of the new piping are flushed.

2. Clean new portions of work by circulating through the system a cleaning chemical. Use concentration, flow rates, and duration as recommended by the chemical supplier and WTS.

F. Final Testing: After flushing, drain the initial fill water from the portions undergoing flushing. Apply hydrostatic test to the portions of the system worked on. Where new portions cannot be isolated from existing, then test both. Test pressure on systems with all new components only, shall be 125 psig; test pressure on portions with new and existing shall be 75 psig (unless noted otherwise). Confirm all test pressures with Engineer prior to test. System shall hold the test pressure for a minimum of 2 hours with no drop in pressure. Any leaks shall be repaired and the system re-tested until system proves tight.

G. Documentation: Document all flushing, testing, and strainer cleaning. Documentation shall indicate when these tasks were conducted, description of the extent/scope of work, who did the work, and be signed by the person performing the work or the person supervising the work.

H. Supervision: All work shall be performed under the direct supervision of the Water Treatment Specialist (WTS) subject to approval by the Architect/Engineer.

I. Chemical Treatment: After successfully proven free of leaks, add corrosion inhibitor to the system to achieve pre-project chemical levels, or to a concentration of 100-150 ppm for molybdate inhibitors and 800-1200 ppm for nitrite inhibitors where pre-project chemical levels are not documented. Provide anti-freeze [where noted; provide] to 20% concentration by volume (unless noted otherwise). Existing chemically treated water drained from the system may be re-introduced into the system provided the water is filtered through a 20 mesh strainer and shows no signs of degradation and is acceptable to the WTS.

J. Final Chemical Testing: Test system as recommended by the WTS to confirm proper system cleaning and stability. Test as a minimum for: total dissolved solids, pH, soluble iron, soluble copper, antifreeze percentage (as applicable), and concentration of corrosion inhibitor.

K. Report: The WTS shall submit a report describing the initial system condition, final chemical test results, and the final condition of the system. Report shall include when testing work was performed, and name of individuals doing the testing work or supervising the work.

END OF SECTION 23 21 13

SECTION 23 02 00 – MECHANICALLY COUPLED HYDRONIC PIPING SYSTEM

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Mechanically Coupled Pipe.

B. Mechanically Coupled Pipe Fittings.

C. Mechanical Couplings.

D. Mechanically Coupled Valves.

E. Mechanically Coupled Piping Specialties.

1.3 SUBMITTALS

A. General: Submittals shall comply with Section 23 05 00.

B. Product Data: Submit product information on all pipe, pipe fittings, valves, and specialty products proposed to be used. Indicate gasket materials and coupling types to be used for each system and pressure/temperature limitations of all products.

C. System Expansion/Contraction: Submit information indicating how system expansion/contraction will be accommodated. Provide plans with locations and details of all expansion joints, loops, anchors, guides, and other system features.

1.4 GENERAL REQUIREMENTS

A. Contractor Option: The Contractor, at his option, may use mechanically coupled pipe, pipe fittings, valves and piping specialties in lieu of those materials otherwise specified. Only the valve and specialty items specifically called out in this specification section may be used.

B. Systems: Mechanically coupled piping products are approved for use on the following only: Chilled Water Piping System.

C. Standardization: All mechanically coupled piping products shall be of one manufacturer.

D. Quality: All mechanically coupled piping products shall be equal to or superior than the otherwise specified product (i.e. if standard threaded, welded or flanged items were used). Mechanically coupled piping products shall only be used where the operating conditions do not exceed the design parameters of the gasket and product, and where system operation/performance is not adversely affected. The use of mechanically coupled piping products does not eliminate the requirement to provide other components indicated on the plans (i.e. flex connectors, expansion devices, etc.). Product manufacturer shall be ISO-9001 certified.

E. Costs: Contractor shall bear all added costs of using mechanically coupled piping products in lieu of otherwise specified products.

F. Tools: Tools used in grooving pipes and in assembling mechanically coupled system components shall be approved for such use by the mechanical coupled product manufacturer.

1.5 QUALITY ASSURANCE

A. Domestic Manufacturing: Major components (piping, fittings, couplings, and valves, exclusive of minor hardware) shall be made in the United Stated of America, and shall permanently marked as such.

1.6 REFERENCES

A. ASTM A53: Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

B. ASTM A183: Carbon Steel Track Bolts and Nuts.

C. ASTM A234: Standard Specification for Piping Fittings or Wrought Carbon Steel and Alloy Steel.

D. ASTM A449: Quenched and Tempered Steel Bolts and Studs.

E. ASTM A536: Ductile Iron Castings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Pipe: See system specification sections.

C. Mechanically Coupled Piping Products: Victaulic Company of America, Anvil International, ("Gruvlock").

2.2 PIPE AND FITTINGS

A. Pipe: See system specification sections.

1. Pipe shall be roll/cut grooved in accordance with the latest manufacturer's recommendations.

2. Pipe ends shall be free from indentations, projections, and roll marks.

B. Fittings:

1. General: Fittings shall be full flow type, with grooves, shoulders and other provisions for use with mechanical couplings by the same manufacturer as the fitting. Shall be products as indicated in the manufacturer's latest catalog literature.

2. Steel Piping Systems: Fittings shall be constructed of malleable iron conforming to ASTM A47, ductile iron conforming to ASTM A536, segmentally welded schedule 40 steel pipe conforming to ASTM A53 (type F, E or S, Grade B), or forged steel conforming to ASTM A234, (Grade WPB). Fittings shall be factory coated with an orange colored alkyd enamel paint; except where piping system is galvanized the fitting shall be hot dipped galvanized (conforming to ASTM A153).

3. Copper Piping Systems: Fittings shall be constructed of copper, conforming to ASTM B-75 alloy C12200 or ASTM B-152 alloy C11000, up through 4 inch size; or conforming to ASTM B-584, copper alloy CDA 836, 5 inch and larger. Fittings shall be factory coated with a copper colored alkyd enamel paint.

2.3 MECHANICAL COUPLINGS

A. Coupling Components:

1. Coupling housings shall be malleable iron conforming to ASTM A47 or ductile iron conforming to ASTM A536; hot dip galvanized per ASTM A153 where the connecting piping or fittings are galvanized.

2. Couplings shall be factory coated with an alkyd enamel paint; copper colored for fittings used on copper piping systems and orange colored for other systems.

3. Bolts shall be carbon steel track type conforming to ASTM A183 Grade 2, or ASTM A449; minimum tensile 110,000 psi. Nuts shall be hex style, conforming to ASTM A183 Grade 2, or ASTM A563 Grade A. Bolts and nuts shall be zinc electroplated to ASTM B633.

4. Gaskets shall be grade "E" EPDM conforming to ASTM D2000 Grade 2, with temperature range from -30 degrees F to +230 degrees F. Gasket selection for each system shall be in accordance with latest manufacturer's recommendations and so as to suit system pressures, temperatures and chemicals.

B. Couplings:

1. Steel Piping Systems: Couplings shall be equal to those manufactured by Victaulic, Styles 77, 177, 72, 750, and 107, or approved.

   a. Victaulic Style 77, 177, 72, W77 and 750 coupling (or approved) shall be used to provide allowance for controlled pipe movement expansion/contraction/deflection to absorb movement for thermal changes, settling or seismic action.

   b. Victaulic Style 107 "Zero Flex" W07 rigid coupling (or approved) with angular bolt pads shall be used for all pipe joint connections where joint flexibility is not desired.

2. Copper Piping Systems: Couplings shall be equal to those manufactured by Victaulic, Style 607. Coupling housings shall be cast with angular bolt pads.

2.4 VALVES

A. Butterfly Valves:

1. Shall have housing cast of ductile iron conforming to ASTM A-536, or malleable iron conforming to ASTM A-47, with grooved ends and shall be coated with a black alkyd enamel or epoxy coating or polyphenylene sulfide (PPS). Disc shall be of ductile iron construction, conforming to ASTM A-536, with electroless nickel coating conforming to ASTM B-733, or with grade "E" EPDM coating. Disc seat shall be pressure responsive elastomer, "E" EPDM. Stem shall be Type 416 stainless steel. Valve shall be rated for bubble-tight shut-off service up to 300 psi; vacuum service up to 29.9 inches of mercury; and for dead-end service. Provide valves with extended necks where used on insulated piping to allow for insulation without inhibiting valve operation. Victaulic "Vic-300, MasterSeal-W761" (or approved).

2. Operator: Manual lever lock/infinitely variable handle with memory stop. Shall be fabricated of ductile iron, with painted enamel finish, and steel zinc plated fasteners. On valves 5-inch and larger, provide with manual gear operator with round handwheel.

3. Alternative Valves: Other valves having equal pressure capabilities and of like construction to the above may be used with the Engineer's approval prior to bidding.

B. Check Valves: Body shall be constructed of ductile iron conforming to ASTM A-536 and ASTM A-395, with grooved ends. Disc shall be aluminum bronze conforming to ASTM B-148 or ductile iron conforming to A-536, or Type 304 stainless steel; with spring assist. Body shall be coated with a black alkyd enamel or epoxy coating or polyphenylene sulfide (PPS). Spring shall be constructed of Type 316 stainless steel. Seal shall be grade "E" EPDM with temperature range -30 degrees F to +230 degrees F continuous service, and be rated for up to 300 psi working pressure. Valve shall be operational when installed in horizontal or vertical positions, and shall close off tight with as low as 5' of head on discharge side.

Victaulic Series 716/779 W716 (or approved).

C. Balancing Valves:

1. General: Valve shall have, as an integral factory manufactured part of the valve, ports which allow measurement of the pressure drop across the valve to determine the flow rate using factory calibrated pressure drop versus flow charts. Valve shall have a means to adjust the flow rate through the valve and shall have a numerical readout indicating valve position. Valve shall have a concealed locking memory stop feature which prevents opening the valve beyond its balanced setting. Locking position may be unlocked by use of a standard size Allen wrench. Victaulic/TA Hydronics Series 786, 787, 788, or 789 (or approved).

2. Construction: Rated 300 psig at 250 deg F, Y-pattern, globe type, constructed of brass copper alloy or ASTM A536 ductile iron, with EPDM O-ring seals. Handwheel controlling valve position shall be of plastic construction, containing readout of valve position.

3. Connections: Valves 2-1/2 inch and smaller shall have solder or threaded end connections; larger valves shall have flanged or grooved ends.

4. Sizing: Valve shall be same size as pipe installed in, except where required for proper flow measuring, valve may be one pipe size smaller.

2.5 PIPING SPECIALTIES

A. Strainer: “T” or “Y” type configuration. Body shall be constructed of ductile iron conforming to ASTM A536 and ASTM A395 or malleable iron conforming to ASTM A47. Body shall be coated with an alkyd enamel or epoxy coating or polyphenylene sulfide (PPS). Screen shall be removable by removing end cap coupling. Screen shall be basket type, constructed of Type 304 stainless steel, 6 mesh. End cap shall have NPT blow-down connection, minimum 1/2-inch, and utilize manufacturers standard coupling style and gasket matching other couplings used in the system. Strainer Cv shall be no less than the nominal strainer diameter squared times 26. Rated for 300 psi working pressure at 250 deg F. Victaulic style 730/W730 (or approved).

B. Branch Outlets: Victaulic Style 923 "Vic-Let", Style 924 "Vic-O-Well", Victaulic Style 920 and 920N “Mechanical-T” outlets (or approved); rated for 300 psi working pressure at 230 deg F.

C. Dielectric Connection: Victaulic Style 47 "Clearflow Dielectric Waterway” fitting (or approved). Constructed of steel or ductile iron pipe, with zinc electroplating and internal thermoplastic lining. Rated for 300 psi working pressure at 230 deg F.

D. Adapter Connection: Conversion of flanged outlets to mechanically coupled system connection shall be accomplished by Victaulic Styles 741 Flange Adapter (or approved), conforming to ANSI Class 125/150 bolt pattern, or Style 743 Flange Adapter (or approved), conforming to ANSI Class 250/300 bolt pattern.

E. Flanged Adapter Nipples: Victaulic Style 41, 45, 46 (or approved) for connecting ANSI class 125, 150, and 300 flanged components to mechanically coupled piping system connection. Nipples shall be constructed of carbon steel pipe (same schedule as the piping system being connected); flanges of cast iron or carbon steel construction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install all components according to the manufacturer's written installation instructions and applicable codes and standards. See piping system specification section for piping and system installation requirements.

B. Pipe Preparation: Piping shall be prepared in strict accordance with the coupling manufacturer's instructions and ANSI/AWWA C-606.

C. Coupling Fasteners: Torque as required by manufacturer. Demonstrate equipment used upon Engineer's request.

D. Dielectric Connection: Provide dielectric at all piping connections between dissimilar metals and equipment to protect from local cell corrosion.

E. Coupling Types: Couplings that allow for system flexibility and expansion/contraction shall be used except where a rigid coupled system is specifically required. Couplings shall provide a rigid system equivalent to threaded or welded systems, except where indicated otherwise (or where system flexibility is required to accommodate system expansion/contraction, movement, vibration, or similar requirements).

END OF SECTION 23 21 15

SECTION 23 21 28 – HVAC CONDENSATE PIPING

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Cooling Coil Condensate Drains.

B. Fabricated P-Traps.

C. Condensate Pumps.

D. Testing and Inspection.

1.3 SUBMITTALS

A. Submittals shall comply with Section 23 05 00.

B. Submit product information on all items to be used.

1.4 REFERENCES

A. ASME B 16.15: Cast Bronze Threaded Fitting Classes 125 and 250.

B. ASME B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. ASME B 16.23: Cast Copper Alloy Solder Drainage Fittings.

E. ASME B 16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV).

F. ASTM B 32: Solder Metal.

G. ASTM B 88: Seamless Copper Water Tube.

H. ASTM B 306: Copper Drainage Tube (DWV).

I. ASTM D 1785: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

J. ASTM D 2466: Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

K. ASTM D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

L. ASTM D 2665: Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, 2.01, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic Manufacturers only

C. Fabricated P-Trap: Rectorseal.

D. Condensate Pumps: Little Giant.

2.2 PIPE AND FITTINGS

A. Copper DWV Pipe and Fittings: Copper drainage tube per ASTM B 306. Wrought copper and wrought copper alloy solder joint fittings per ASME B 16.29; or cast copper alloy solder joint fittings per ASME B 16.23.

B. Copper Pipe and Fittings: Seamless copper water tube, tube L or M, per ASTM B 88. Solder joint wrought copper and bronze fittings per ASME B 16.22 cast copper alloy fittings per ASME B 16.18, and cast bronze threaded fittings per ASME B 16.15 with 95/5 tin-antimony solder per ASTM B 32.

C. PVC DWV Pipe and Fittings: Polyvinyl chloride drain waste and vent pipe and fittings per ASTM D 2665, with solvent cement joints. Solvent cement shall comply with ASTM D 2564.

D. PVC Pipe and Fittings: Polyvinyl chloride pipe, schedule 40, per ASTM D 1785. Solvent cement socket type fittings per ASTM D 2466. Solvent cement shall comply with ASTM D 2564.

2.3 FABRICATED P-TRAPS

A. Type: Factory fabricated p-trap with dual cleanouts and clear trap, for cooling coil condensate. Rectorseal "EZ Trap" (or approved).

B. Construction: Fabricated of schedule 40 PVC, with transparent plastic trap portion. Portion connection to HVAC unit (or coil) drain shall consist of a PVC cross, with top and side cleanouts having caps with integral retaining strap and ring. Outlet portion shall consist of PVC tee fitting, with top portion able to serve as vent.

C. Size: 3/4-inch unless indicated otherwise. Trap heights shall be sized to suit HVAC

unit static pressures, unit configuration (i.e. blow through or draw through), and be consistent with HVAC unit manufacturers installation recommendations.

D. Cleaning Brush: Provide with bristled flexible shaft cleaning brush, sized for cleaning of p-trap.

2.4 CONDENSATE PUMP

A. Type: Automatic condensate pump with integral tank; for pumping cooling coil condensate, combustion condensate and similar fluids. Little Giant VCMA, VCMX or VCL series (or approved).

B. Capacity: Pump shall be rated to pump minimum of 1.4 gallons per hour per ton of unit cooling capacity served (e.g. 10 ton unit shall have a 1.4 x 10 = 14 gph capacity) at 15 feet of head (unless a different capacity is indicated). Pumps serving combustion condensate shall have a capacity of 25 gph per 1000 MBH of equipment capacity at 15 feet of head (unless a different capacity is indicated). Tank shall be 1/2 gallon capacity (unless indicated otherwise). Unit shall be rated for continuous operation.

C. Construction: Tank body and pump shall be constructed of oil resistant polypropylene or ABS, with discharge check valve, and float for pump on/off control, factory wired.

D. Accessories: Provide with overflow safety switch for wiring to low voltage controls to stop HVAC unit on high condensate (or to indicate an alarm).

E. Electrical: Provide with integral electric motor, having thermal overload protection, for use with 115 volt or 230 volt (as required to suit available power) AC single phase power, with minimum 6-foot 3-prong grounded plug.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of all items shall comply with code, best professional practices, and manufacturers written installation instructions.

B. Provide all piping as indicated and as required for all drip pans, unit condensate drains, unit p-traps, and miscellaneous drains and vent connections to all items requiring such drains (i.e. HVAC units, furnaces, boilers, AC units, etc.).

C. Coordinate installation of items with all trades that are affected by the work to avoid conflicts.

D. Consult manufacturers data and drawings for information on equipment before beginning drain rough-in.

E. Verify points of connection, elevations, and grade requirements before beginning installation or ordering materials.

F. Trap all equipment items as required by code; provide proper venting for each trap as indicated and as required by code.

G. Run piping to nearest point of drainage, or as shown on drawings. Where routing is not shown, route to nearest point of proper drainage.

3.2 PIPE AND FITTINGS

A. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

B. Install piping so as not to obstruct access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur. Prior to running any exposed piping, confirm with Architect/Engineer (unless is clearly noted to be ran exposed). Install exposed piping so as not to obstruct any portion of windows, doors, doorways, passageways, or items requiring service or access.

C. Consult all drawings for location or pipe spaces, ducts, electrical equipment, structural elements, ceiling heights, door items requiring access, openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

D. Install all drain lines with a slope of 1/4-inch per foot unless noted otherwise. Coordinate with AHJ if written approval is required for exceptions to 1/4-inch per foot slope.

E. Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.

F. Install all piping parallel to equipment and nearby walls and in a neat, workmanlike manner. Horizontal straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

G. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, but are required per this paragraph.

H. Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by piping and fitting manufacturer.

I. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

J. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.

K. PVC Pipe:

1. Solvent Joints: The outside of the PVC pipe shall be chamfered to a minimum of 1/16 inch at approximately 22 degrees. Chemicals used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.

2. Plastic to Metal Connections: Work the metal connection first. Use a non-hardening compound on threaded connections. Use only light wrench pressure. Connections between metal and plastic are to be threaded utilizing female threaded adapters only, not male adapters.

3.3 TESTING AND INSPECTION

A. All piping shall be inspected and approved prior to being concealed or covered.

B. Provide testing as required by code. Testing shall be by water and shall comply with governing code. Testing shall be witnessed by the plumbing inspector and the Engineer's representative (at his option).

C. All leaks shall be eliminated and the system re-tested before proceeding with additional work or concealing pipe.

D. All repairs to piping shall be with new pipe and fitting material's; no caulking of screwed joints or holes is allowed.

END OF SECTION 23 21 28

SECTION 23 31 00 – HVAC DUCTS AND CASINGS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Environmental Ductwork Systems.

B. Flexible Duct.

C. Acoustical Duct Lining.

D. Preparation of Duct for Service.

E. Duct Pressure Testing.

1.3 DEFINITIONS

A. Duct Sizes: All duct dimensions shown are inside clear dimensions. Where inside duct lining is specified or indicated, duct dimensions are to the inside face of lining.

1.4 QUALITY ASSURANCE

A. All work and materials shall comply with SMACNA-DCS, NAIMA-DLS, ASHRAE-F, IBC, IMC, NFPA-90A, NFPA-90B, and code. The most restrictive criteria governs.

B. Leakage Criteria: Duct system shall be constructed and sealed so that leakage does not exceed 3%.

C. Fabrication Proximity: The Contractor performing the work of this section shall have fabricating facilities located within 100 miles of the project site.

D. Drawing Review: Prior to beginning any work review all drawings, duct routing, duct connections, equipment configuration, equipment connection locations, building dimensions, available space for duct routing, equipment required access, work of other trades, and other work details to discover conflicts in anticipated duct arrangement and improper or incomplete connections. Review shall include the following: supply ducts not connected into return (or exhaust) ducts, ducts not crossed and improperly connected in shafts, air outlets/inlets connected to ducts, unit configuration compatible with planned duct connections, louver locations match

architectural plans, adequate space available for duct sizes, selection of duct gauge/reinforcement is suitable for space available. Submit resolutions of such possible conflicts as submittals with shop drawings of proposed solutions; written description in lieu of shop drawings is acceptable for minor issues.

1.5 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Product Data: Submit product data for duct lining, flexible duct, and factory fabricated items.

C. Shop Drawings: Submit shop drawings for all HVAC ductwork which is to be installed differently than as shown on the drawings.

D. Conflict Resolution: Submit additional shop drawings showing proposed resolution of conflicts after review of documents, proposed products, and again after review of field conditions and space available.

1.6 DUCT PRESSURE CLASS

A. Constant Volume Systems: Ductwork shall be constructed to the pressure class corresponding to the static pressure indicated for the fan which serves the duct system or 1-inch pressure class (plus or minus as appropriate), whichever is higher; unless noted otherwise.

1.7 REFERENCES

A. ADC-FLEX: Air Diffusion Council Flexible Duct Performance and Installation Standards.

B. ASHRAE-F: ASHRAE Handbook of Fundamentals.

C. ASTM A 653: Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

D. ASTN C 916: Standard Specification for Adhesives for Duct Thermal Insulation.

E. ASTM A 924: General Requirements for Steel Sheet Metallic-Coated by the Hot-Dip Process.

F. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

G. IMC: International Mechanical Code.

H. NAIMA-DLS: North American Insulation Manufacturers Association Fibrous Duct Liner Standards.

I. NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating

Systems.

J. NFPA 90B: Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

K. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.

L. UL 181: Underwriter Laboratories Factory-Made Air Ducts and Air Connectors.

M. UL 181A: Underwriter Laboratories Closure Systems for Use with Rigid Air Ducts.

N. UL 181B: Underwriter Laboratories Closure Systems for Use with Flexible Air Ducts and Air Connectors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Sheet Metal: All domestic manufacturers.

C. Spin-in Fittings and ATTO: Sheet Metal Connectors Inc., United McGill, Royal Metal Products, Airflow Products Inc.

D. Gasketing: Preson, Insulfab, Duraco.

E. Duct Sealant and Tape: Carlisle (Hardcast), Ductmate, Benjamin Foster, Grace Construction Products, United McGill, Polymer Adhesives Sealant Systems, RCD Corporation, Nashua, 3M.

F. Flexible Duct: Flexible Technology Inc., JP Lamborn Co.; Hart & Cooley, Thermaflex.

G. Acoustical Duct Lining: Johns-Manville.

2.2 GENERAL MATERIALS

A. Ducts: Construct of galvanized sheet steel, suitable for lock forming without flaking or cracking, conforming to ASTM A653 and A924, having a zinc coating of 0.90 ounces total per square foot for both sides of a sheet, corresponding to coating G90.

B. Fasteners: Steel construction, electroplated zinc coated, having strength properties adequate for the application, compatible with materials being joined, and in accordance with SMACNA-DCS. Where exposed to corrosive conditions shall be of Type 304 or 316 stainless steel. Type to meet duct pressure class and duct leakage requirements. Where used for the support and anchorage of ducts shall comply with Section 23 05 29, with independent test reports regarding strength.

C. Spin-in Fittings: Factory fabricated of galvanized steel with die-formed mounting groove and damper with raised damper quadrant where ducts are to be insulated. Collar length for flexible duct attachment shall be at least 2" long.

D. Air-Tight Take-Off Fittings (ATTO): Factory fabricated branch duct connector, of galvanized steel. Flange shall be 1-1/2" wide with 1/8" self-adhesive gasket and pre-drilled fastener holes. Collar length for flexible duct attachment shall be at least 2" long. Where used on round duct mains, shall be saddle type appropriately sized for main duct diameter.

E. Draw Bands:

1. Metal: Worm gear type clamp, constructed of galvanized steel, stainless steel, or aluminum; minimum 1/2-inch wide band; suitable for 200 pound loading.

2. Non-Metal: Nylon "zip-tie" with self-locking ability, designed for flexible duct usage, minimum 1/4 inch wide, rated for 175 pound load, suitable for temperatures from 0 to 185 deg F; listed per UL181B and labeled "UL181B-C".

F. Gasketing: Vinyl nitrile, vinyl neoprene, or neoprene nitrile PVC blend; designed for HVAC use with size to suit the application having minimum 1.5-inch width at equipment roof curb applications. Fire hazard rating not to exceed 25 for flame spread and 50 for smoke development per ASTM E 84.

G. Duct Sealant/Mastic: Water based duct sealant, listed per UL 181B-M and UL 181A-M, suitable for indoor and outdoor use. Fire resistant with a flame spread rating of 5 or less, and a smoke developed rating of 0. Sealant shall be resistant to ultraviolet radiation and ozone. Fiberglass mesh shall be minimum 0.006-inches thick, with minimum 9 x 9 weaves per inch, and 2-inch width; for use with mastic in sealing ductwork. Sealant system shall be suitable for duct system pressure class and materials used with. Carlisle Hardcast "Versa-Grip 181".

H. Foil Tape: Foil back adhesive tape, listed per UL181A-P and UL181B-FX, with listing labeled on tape outer foil face. Minimum 3-inch width for metal-to-metal applications; minimum 2-inch width for flexible duct applications. 3M No. 3340 or Nashua No. 324A.

2.3 DUCT FABRICATION

A. Duct Gauge and Reinforcement: Shall be as shown in SMACNA-DCS according to the pressure classification of the system and the duct dimensions; with heavier gauge duct used as required to minimize duct reinforcement to suit space available and other project constraints. In no case shall ducts be constructed of less than 26 gauge material.

B. Joints and Seams: Construct in accordance with SMACNA -DCS, code requirements, and these specifications (more stringent governs). Ducts shall be constructed and sealed so that the leakage criteria is not exceeded. Round ducts shall be the spiral seam type; except that branch ducts to individual air inlets/outlets less

than 16" diameter may be of other types as allowed by SMACNA-DCS. Coordinate joint spacing with duct reinforcement requirements so that transverse joints having the required stiffness may be incorporated in the reinforcement spacing schedule. Round duct transverse joints shall be made with beaded sleeve joints or flanged connections in accordance with SMACNA-DCS; except that branch ducts to individual air inlets/outlets less than 16" diameter may use other joining methods as are allowed by SMACNA-DCS.

C. Elbows and Tees: Shall be long-radius type with a center-line radius not less than 1-1/2 times the width or diameter of the duct. Where space does not permit the use of long-radius elbows, short-radius or square elbows with turning vanes may be used. Elbows in round duct systems with duct pressure class above 2-inches shall be stamped type, welded segmented type, or standing seam segmented type.

D. Transitions: Increase duct sizes gradually. Transitions for diverging air flow shall be made with each side pitched out not more than 22.5 degrees. Transitions for converging air flow shall be made with each side pitched in not more than 30 degrees. Except that eccentric transitions for round to flat oval may have up to a 45 degree pitch.

E. Branch Connections: Shall comply with SMACNA-DCS, and as required herein.

1. Rectangular-to-Rectangular: Rectangular take-off with 45 degree angle on "inside" of take-off, minimum 4" length. Reference SMANCA-DCS Figure 4-6. Close corner openings.

2. Rectangular-to-Round:

a. Serving Individual Air Inlet/Outlet: Spin-in type connector or air-tight take-off (unless a different fitting type is specifically noted).

b. Serving Branch Duct: Rectangular to round transition, with maximum degree pitch as specified for transitions. Rectangular end size shall have free area no less than round end. Rectangular connection to rectangular main shall be made as specified for "Rectangular-to-Rectangular" connections.

c. Serving Individual VAV Terminal Unit: Conical type connector, with connector 2" larger on one end and maximum 15 degree pitch on sides.

3. Round-to-Round:

a. Serving Individual VAV Terminal Unit: Conical type connector (or conical tee fitting), with connection at the main duct 2" larger than the end serving the VAV terminal unit, and a maximum 15 degree pitch on sides; or "Lo-Loss" tee fitting, equivalent to that manufactured by United McGill.

b. Other Connections: Air-tight take-off or constructed in accordance

with SMACNA-DCS and recognized professional practices.

4. Other Connections: In accordance with SMACNA-DCS and recognized professional practices.

F. Lined Ductwork:

1. Rectangular Ducts: Contractor Fabricated ductwork with interior duct lining. Duct fabrication and liner installation shall comply with NAIMA-DLS. Lining material shall comply with paragraph titled "Duct Lining" in this specification section.

2. Round and Oval Ducts: Shall consist of acoustic insulation in between a perforated interior duct liner and solid exterior duct. Acoustic insulation shall be 1-inch thick, except where noted to be greater. Duct sections shall connect by mechanical means to maintain positive concentricity of liner with duct. All fittings and transitions shall have perforated inner liner (except where noted otherwise). Lining material shall comply with paragraph titled "Duct Lining" in this specification section. United McGill "Acousti-k27" (or approved).

2.4 FLEXIBLE DUCT

A. Type: Factory insulated fully lined flexible duct.

B. Construction: Double-ply neoprene coated polyester fabric hose, reinforced with a steel wire helix. Black color. Fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E84.

C. Thermal Characteristics: Certified thermal resistance "R" of 4.2 Hr-SF-deg F/Btu, rated in accordance with ADC-FLEX. Except where duct is installed in an unconditioned area (and where required by code) provide certified thermal resistance "R" of 8 Hr-SF-deg F/Btu, rated in accordance with ADC-FLEX.

D. Working Pressure: As required to suit maximum pressure to be encountered on system, but no less than 4-inch wc positive, 0.5-inch wc negative.

E. Length: Shall not exceed 8 feet where used on duct systems with a pressure class of 2-inches and less; maximum 5 feet length on higher pressure class systems.

F. Code Compliance: Comply with code and applicable standards; including NFPA 90A, NFPA 90. Shall be UL listed and labeled as a Class 1 connector per UL 181.

2.5 DUCT LINING

A. Material: Flexible, inorganic glass fiber material, bonded with thermosetting resin, maximum thermal conductivity of 0.24 Btu-inch/hr-sq. ft.-degree F at 75 degrees F, coated to prevent erosion, conforming to NAIMA-DLS and exceeding that standard as specified herein. Suitable for air temperatures to 250 degrees F, and duct velocities to 6000 feet per minute. Surface shall be coated with an acrylic coating

having anti-microbial agents and factory applied edge coating. Johns-Manville "Permacote Linacoustic" (or approved).

B. Thickness: Lining shall be 1-inch thick except where noted otherwise.

C. Adhesives and Fasteners: Conform to NAIMA-DLS, as recommended by the duct liner manufacturer, and suitable for the application. Adhesive shall comply with ASTM C 916. Edge sealant shall use duct liner manufacturers approved adhesives or sealants (Hardcast "Seal Tack" or Durodyne "Dyn-O-Coat").

D. Fungi and Bacteria Resistance: Conform to ASTM C 1338 and ASTM G21 for fungi resistance and ASTM G 22 for bacteria resistance.

PART 3 - EXECUTION

3.1 DUCTWORK INSTALLATION

A. General: Install all ductwork with all accessories and connections to provide complete and operable duct systems, in accordance with plans and specifications. See Section 23 05 29 for hangers and supports. Provide quality assurance review of all drawings prior to beginning work (see paragraph titled Quality Assurance, this specification Section and see Section 23 05 00). Provide duct and plenum sizes and locations as shown on the drawings; except as adjusted for field conditions and work of other trades, and with prior approval of the Engineer. See Section 23 05 00 for offsets and transitions to be included in project.

B. Coordination: The Contractor shall fully coordinate the work of all trades to avoid interferences and conflicts. Due to the extremely tight spaces in portions of the building, the Contractor shall coordinate duct reinforcement spacing and supports with other trades as necessary to avoid interferences. In addition, the Contractor shall select duct gauge and reinforcement types to avoid interferences. Changes required due to lack of coordination between trades, improper spacing or selection of hangers, or improper duct gauge and reinforcement selection, shall be done at no additional cost to the owner.

C. Field Measurements: Prior to fabricating any duct materials, the Contractor shall field measure all areas where ducts will be installed to verify room available and all offsets and fittings required. Field verify duct connection sizes and locations to equipment, louvers, and similar items.

D. Workmanship: All work shall comply with code, SMACNA-DCS, and other applicable standards. Ducts shall be installed level (unless noted otherwise) and in neat lines with the building construction using best professional practices.

E. Exposed Ducts: All ducts are to be installed concealed unless indicated otherwise. Ducts that are exposed shall be carefully fabricated, stored, and installed for best appearance. All dents, dings, scratches and other damage shall be repaired for a high quality finished look; all dirt, debris, labels, stickers, lettering, and marks removed; and the duct completely cleaned. Any sealant shall be cleaned to form a straight and

even seam adjacent to joints, have no overlap onto duct areas not needing sealant, and have all excess sealant removed (mask off adjacent areas as necessary).

F. Flexible Duct: May only be used where specifically shown on the plans. Attach flexible duct inner core to sheet metal duct (or connector) with draw band. For insulated type, pull insulation and outer jacket completely over the inner core (at the connection to the sheet metal duct) with outer jacket covering the inner core and tucked back at its end to provide a continuous vapor barrier cover; install draw band to secure the outer jacket and insulation. Use metal type draw bands on duct systems where duct pressure class exceeds 3-inches or where temperature or other conditions do not allow the non-metal type and where indicated; use type of metal suitable for the conditions without corrosion or other deterioration. Install flexible duct with a centerline turning radius not less than one duct diameter. Where this turning radius cannot be maintained with the flexible duct use sheet metal elbows or (at air inlets/outlets) provide a plenum having a side connection.

G. Spin-in Fittings/ATTO's: May be used for branch ducts to individual outlets only. Apply a bead of duct sealant to all spin-in fittings where fitting seals against sheet metal duct.

H. Sealing:

1. General: Use materials listed and approved for the specific application. Foil tape may only be used at duct connections to air inlets/outlets (unless specifically noted otherwise). Clean surfaces to be sealed of moisture and all contaminants. Seal joints in accordance with SMACNA-DCS, sealant manufacturer's instructions, and UL 181.

2. Ductwork: Seal to meet duct leakage criteria as follows: Seal Class B; except on duct system with pressure class greater than 2" shall be Seal Class A.

3. Flexible Duct: Coat connection of flexible duct to metal duct with duct sealant prior to installing the flexible duct.

4. Air Inlets/Outlets: Seal duct connections (including "cans" or plenums) at air inlets and air outlets with duct sealant or foil tape; except at louvers and exposed ducts only sealant shall be used.

I. Protective Caps: Provide temporary sheetmetal caps or heavy visqueen covers over all open portions of ductwork to prevent debris, dirt, and dust from entering the ductwork. Such covers shall be installed at the end of each work shift, and shall remain in place until all work activities or events that may cause duct contamination will no longer occur.

3.2 ACOUSTICAL DUCT LINING INSTALLATION

A. General: Install acoustical duct lining in ducts to extent shown on drawings, covering all interior surfaces. Round ducts shall use factory fabricated double-wall ducts as specified.

B. Installation: Installation shall comply with NAIMA-DLS, SMACNA standards and these specifications. The liner shall be cut to assure tightly butted joints and in a manner to minimize any gaps and exposed edges.

C. Liner Attachments: The duct liner shall be applied with a 100% coverage of adhesive. Mechanical Fasteners shall be installed flush with the liner surface, and shall be spaced in accordance NAIMA-DLS.

D. Horizontal Duct Runs: Tops of ducts over 12" wide and sides of duct over 16" high shall have liner additionally secured with mechanical fasteners.

E. Vertical Duct Runs: Any side of duct over 12" in size shall have liner additionally secured with mechanical fasteners.

F. Exposed Edges: All joints, exposed edges and any damaged areas of the liner, shall be heavily coated with fire resistant adhesive or mastic.

G. Metal Nosing: Install metal nosings on the leading edges of the liner in ducts where the velocity exceeds 4000 feet per minute.

3.3 PREPARATION FOR SERVICE

A. Cleaning: All ducts shall be wiped or blown clean of all dust and debris prior to the installation of grilles or diffusers. Notify the Engineer to allow for an inspection prior to installing grilles or diffusers.

B. Contaminated Ducts: Where ducts have been contaminated by dirt or debris during the construction process, the affected duct systems shall be cleaned by an independent firm specializing in the vacuum cleaning of ductwork. All costs associated with such cleaning shall be the responsibility of the Contractor.

END OF SECTION 23 31 00

SECTION 23 33 00 – DUCT ACCESSORIES

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Manual Dampers.

B. Turning Vanes.

C. Flexible Connectors.

D Duct Access Doors.

E. Sound Attenuation Materials.

1.3 QUALITY ASSURANCE

A. General: Comply with Section 23 05 00.

B. Workmanship: Construction and installation of all duct accessories shall comply with applicable SMACNA-DCS, and exceed those standards as noted.

1.4 SUBMITTALS

A. General: Submittals shall comply with Section 23 05 00.

B. Product Data: Submit product information on all items to be used.

C. Sound Attenuators: Submit dynamic insertion loss and pressure drop data for all sound attenuators. Submit listing of all sound attenuators by unit served, airflow application, cfm, size, velocity, and pressure drop.

1.5 REFERENCES

A. AMCA 500D: Laboratory Methods for Testing Dampers for Rating.

B. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Manual Damper Hardware: Duro-Dyne, Young Regulator Co., Ventfabrics, Krueger, Rossi.

C. Turning Vanes: Duro-Dyne, Aero-Dyne, Oil Capital Sheet Metal, Airsan.

D. Flexible Connections: Ventfabrics, Duro-Dyne Elgen.

E. Duct Access Doors: National Controlled Air, Ventfabrics, United-McGill, Kees, Ruskin, Vent Products, Duro-Dyne.

F. Building Access Doors: J.R. Smith, Zurn, Acudor, Elmdoor, Kees, J.C. Industries, Milcor.

G. Sound Attenuators: Industrial Acoustics, Environmental Air Products, DynaSonics.

2.2 MANUAL DAMPERS

A. Type: Manually adjustable volume dampers.

B. Blades: Damper blades shall be fabricated of galvanized steel or stainless steel (unless a specific material is indicated), two gages heavier than duct in which installed, and in accordance with SMACNA-DCS. Maximum blade width 12 inches; fabricate multi-blade dampers with opposed blade pattern for ducts larger than 12" x 48".

C. Regulators: Damper regulator sets shall have quadrant dial regulator with locking nut, square end bearing one side, and spring round end bearing other side (small sizes) or open end square bearing (larger sizes), axis of blade the long dimension. Multiple blade dampers shall have individual quadrants for each blade or one quadrant with interconnected blades. Regulator sets shall be Duro-Dyne model numbers (or approved equal) as follows:

Max. Blade Dimension	Duro-Dyne Regulator Set	Shaft Size
10" and less	KS-145, 145L	1/4"
11" to 14"	KSR-195, 195L	3/8"
15" to 23"	SRS-388, SB-138, KP105	3/8"
24" and larger	SRS-128, SB-112, KP105	1/2"

D. Concealed Regulator: For remote damper adjustment with finished ceiling appearance. Shall consist of self-locking regulator of cast alloy construction (with serrated core, spring washer, housing, indicator, lock nut) cast into a cylindrical housing for flush ceiling installation. Housing cover shall be of steel construction, shall telescope into the regulator housing to be flush with the finished ceiling, and be secured to the housing with two screws. Provide with extension rods, linkages, miter

gears, and all accessories as needed for proper damper operation. Plain Finish. Ventfabrics No. 666, 667 or Young Regulator Co. No. 301 (or approved equal).

2.3 TURNING VANES

A. Type: Galvanized steel turning vanes to guide airflow through duct elbows to minimize pressure drop.

B. Construction: Turning vanes shall comply with SMACNA-DCS. Vanes shall be fabricated of minimum 26 gauge galvanized steel; rails shall be fabricated of minimum 24 gauge galvanized steel. For duct widths less than 12 inches, vanes may be single wall construction; for widths 12" and greater, vanes shall be double wall "airfoil" type.

C. Spacing: Turning vanes shall be equally spaced in accordance with SMACNA-DCS, parallel to each other, and securely attached to runners.

D. Unequal Elbows: For elbows where the inlet and outlet dimensions are not the same, modify vane shape or angle to provide optimum turning.

2.4 FLEXIBLE CONNECTORS

A. Type: Flexible fabric type connectors, to provide vibration isolation at equipment duct connections and to allow for movement in duct systems.

B. Fabric:

1. Width: Minimum 3" wide except at equipment 3 hp or larger with external vibration isolators fabric shall be minimum 6" wide.

2. Indoor Applications: Flexible woven glass fiber fabric with neoprene coating, minimum 22 oz/sq. yard, 500 lbs x 450 lbs tensile strength. Suitable for temperatures from -40 to 200 deg F.

3. Outdoor Applications and Where Exposed to Chemicals: Flexible woven glass fiber fabric with hypalon coating, ozone resistant, 24 oz/sq. yard, 225 lbs x 300 lbs tensile strength. Suitable for temperatures from -40 to 250 deg F.

4. High Temperature Applications: Fiberglass/satin weave with Teflon coating; temperature rating of minimum 500 deg F and to suit application, 400 lbs x 300 lbs tensile strength.

C. Metal Collars: Minimum 24 gauge galvanized steel 3" wide metal edge connectors, each side of fabric, connected to fabric by folded over metal seam. Fabricate of same material as ducts connected to.

D. Fire/Smoke Rating: Flame spread rating not over 25, and smoke developed rating not higher than 50; complying with IMC requirements and NFPA standards.

2.5 DUCT ACCESS DOORS

A. Construction: Access doors shall be of double wall construction, made with minimum 24 gage galvanized steel, tight fitting, with sealing gasket, and cam locks (or may be hinged type with latches).

B. Size:

1. General: Access doors shall be of sufficient size so that items concealed in duct can be serviced and inspected, and shall be adequately sized to allow complete removal of the item being served (where removal cannot be made without disturbing fixed ductwork).

2. Minimum size: Doors shall be minimum 14" x 14". Where duct size will not accommodate this size door, the doors shall be made as large as practicable.

3. Large Sizes: Doors larger than 14" x 14" shall have a minimum of 4 cam locks (or where hinged type is used, have a minimum of two (2) latches).

C. Insulation: Doors in insulated ducts shall be insulated type, with minimum 1 inch thick fiberglass insulation.

D. Round Ducts: Access doors on round ducts shall use either lined rectangular tap off with rectangular access door or curved insulated access door (for insulated duct); or curved type un-insulated access door (for un-insulated duct).

2.6 BUILDING ACCESS DOORS

A. Type: Hinged lockable steel access doors, for wall or ceiling installation.

B. Construction: Minimum 16 gauge frame and 14 gauge door, concealed hinge, cam and cylinder lock, anchoring provisions, and 1" wide frame to conceal rough building opening. Provide of 18-8 stainless steel construction with No. 4 finish where used in restrooms, locker rooms, kitchens, and similar "wet" areas. Provide of steel construction with prime coated finish in other areas.

C. Size: Size shall be 12" x 12" (unless indicated otherwise) but shall be large enough to allow necessary access to item being served and sized to allow removal of the item (where access door is the only means of removal without disturbing fixed construction).

D. Fire Rating: Door shall maintain fire rating of element installed in; reference drawings for required rating.

E. Keys: Access doors shall all be keyed alike. Provide two (2) keys for each door.

2.7 SOUND ATTENUATION MATERIALS

A. Sound Barrier Wrap: Peabody Kinetics Model KNM-100F1 (1 lb./SF) loaded vinyl limp mass barrier material, with a STC of 27 or better.

B. Damping Compound: Peabody Kinetics Type KDC-E-162 viscoelastic emulsion damping material.

2.8 SOUND ATTENUATORS

A. Type: Duct mounted rectangular and tubular packed type acoustic silencers. IAC "LFM", (or approved equal).

B. Construction: Shall be constructed of galvanized steel, with internal streamlined perforated baffles, packed with fiberglass acoustic insulation. Entry and exit shall have radiused edges at baffles.

C. Size: Size and shape to match ducts connected to (unless noted otherwise), minimum 3 feet long (unless noted otherwise).

D. Acoustic Performance: Shall be rated in accordance with ASTM E 477 with air flowing through the attenuator. Sound attenuator (3 foot length) shall have minimum Dynamic Insertion Loss (DIL) performance at 2000 feet per minute face velocity as follows (forward flow noted +; reverse flow noted -):

Octave Band	Hz	-2000 DIL	+2000 DIL
1	63	7	5
2	124	9	7
3	250	18	15
4	500	21	18
5	1000	19	17
6	2000	14	12
7	4000	11	10
8	8000	10	10

E. Pressure Drop: Pressure drop at 1000 fpm shall not exceed 0.25 inches w.g. (for a 3 foot long unit).

PART 3 - EXECUTION

3.1 MANUAL DAMPERS

A. General: Dampers shall be fabricated and installed in accordance with SMACNA-DCS requirements for volume dampers.

B. Locations: Install dampers at locations shown on the drawings in branch ducts to all air inlets/outlets, and at all other locations as required by the Balancer to allow for the balancing of the system. Locate dampers at a point where the damper is most accessible; orient damper regulator for best access.

C. Non Accessible Dampers: Provide flush-mounted concealed type damper quadrants for ducts concealed in walls or non-removable ceilings and where a remote damper operator has been indicated.

D. Initial Setting: Set and lock all dampers in the full open position prior to balancing.

E. Extractor Fittings: Provide where indicated on the plans and at wall type inlets/outlets where such outlets cannot be served by a manual damper in the branch duct.

F. Identification: Provide orange surveyor's tape, approximately 18" long tied to each damper regulator (except not required on dampers in ducts exposed to view in finished areas).

3.2 BACKDRAFT DAMPERS

A. General: Install in accordance with manufacturer's instructions.

B. Application: Use counterbalanced type at all non-fan powered building exhausts and reliefs; all others shall be the standard type.

C. Adjustments: Adjust counterbalanced backdraft dampers to be open at 0.07" building pressure (unless noted otherwise), or as necessary for proper space pressurization and building air balance. Coordinate work and settings with air balancer.

D. Access Doors: Provide access doors to backdraft dampers, except that where damper is installed immediately behind a ceiling or wall grille, and is accessible by removing this grille, an access door is not required.

3.3 TURNING VANES

A. General: Install turning vanes in all duct elbows and "T" fittings, and at locations shown on the drawings.

B. Attachment: Securely attach turning vane runners to ductwork.

3.4 FLEXIBLE CONNECTORS

A. General: Provide flexible connectors at all duct connections to all equipment, where ducts of dissimilar metals are connected, and where shown on the drawings. Except that flexible connectors are not required on internally spring isolated fans where the fan is located in a separate mechanical room and a flexible connector has not been shown.

B. Round: For round ducts, the flexible material may be secured by zinc-coated, iron clinch type draw bands directly to adjoining duct; or with normal duct joining methods and using metal collars furnished with flexible connectors.

C. Slack: Install flexible connections with sufficient slack to permit 1 inch of horizontal or vertical movement of ducts or equipment at flexible connection point without stretching the flexible material. At building expansion joints install sufficient flexible material to allow for 2 inch movement in any direction; provide two flexible connectors separated by a 12 inch section of duct.

3.5 DUCT ACCESS DOORS

A. General: Provide duct access doors at all automatic control dampers, fire dampers, fire/smoke dampers, smoke dampers, backdraft dampers, all duct coils, thermostats, filters, control devices, and any other components in the duct system that require service or inspection. Coordinate with Division 25 to confirm quantity and location of control devices.

B. Size and Location: Access doors shall be of sufficient size and so located so that the concealed items may be serviced and inspected or completely removed and replaced.

3.6 BUILDING ACCESS DOORS

A. General: Provide access doors in walls, floors, ceilings, etc. as indicated on the drawings and where needed to provide service access or maintenance to duct access doors, backdraft dampers, damper actuators, automatic dampers, coils, control devices, fans, HVAC equipment and similar items.

B. Coordination: Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation.

3.7 SOUND ATTENUATORS

A. General: Install in accordance with manufacturers written instruction.

B. Locations: Provide sound attenuators in all ductwork connecting to air handlers having capacity greater than 8,000 cfm fans greater than 8,000 cfm capacity, and where indicated.

END OF SECTION 23 33 00

SECTION 23 34 00 – FANS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Rooftop Low Profile Fans.

B. In-Line Fans.

1.3 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Product Data: Submit manufacturer's product data for all items to be used. Submit fan curves showing SP vs. CFM and BHP vs. CFM with system operating point clearly marked.

C. Sound Power: Submit sound power level data showing sound power levels in decibels referenced to 10 watts for each of the eight octave bands (not required for fans under 2000 CFM). Submit sound power levels in sones for fans under 2000 CFM (or decibel values if available).

1.4 QUALITY ASSURANCE

A. AMCA: Fans shall bear the AMCA certified seal unless indicated otherwise.

1.5 REFERENCES

A. AMCA 99-0401: Classification of Spark Resistant Construction.

B. AMCA 210: Laboratory Methods of Testing Fans for Ratings.

C. IMC: International Mechanical Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Products shall comply with Section 23 05 00. See Section 23 05 00, paragraph 2.01 for Acceptable Manufacturer requirements.

B. Fans: Greenheck, Twin City, Penn Barry, Cook, Carnes.

C. Accessories: Fan manufacturers listed, NCA, Ruskin, Thybar, RPS.

2.2 GENERAL

A. Guards: All belt drives shall be equipped with belt guards, or enclosed within fan casing. Guards shall be factory fabricated and furnished with equipment, and comply with OSHA and WISHA regulations. Exposed openings into fan housings shall be protected with substantial metal screens or gratings.

B. Drives: Shall be sized for not less than 150% of the rated motor horsepower.

C. Adjustable Sheaves: All belt drive fans shall have adjustable sheaves and adjustable supports for adjusting belt tension. Sheaves shall be selected so that they are at their midpoint at design conditions.

D. Motors:

1. General: Comply with Section 23 05 00. Motors on belt drive fans shall have adjustable supports for adjusting belt tension. Motor speed controllers shall be VFD type except where solid state speed controllers are provided or EC motors with integral speed controller. VFD's shall be as specified in Division 25.

2. Fractional Horsepower Motors: Shall be the electronically commutated (EC) type with speed control where noted and where non-EC motors are not available which comply with code motor efficiency requirements. Unless noted otherwise, provide with manual speed control mounted at the motor for air balancers use. Motors shall be specifically designed for fan applications, have permanently lubricated ball bearings, speed controllable down to 20%, and have internal thermal overload protection.

3. Belt Drive Fans: Motors shall have adjustable supports for adjusting belt tension.

E. Performance: Fan capacity shall not be less than the values listed on the drawings. Fan performance shall be based on laboratory tests conducted in accordance with AMCA 210.

F. Outlets and Inlets: Fans shall be furnished with attachment angles and/or flanges as required for attaching ductwork and/or flexible connections indicated.

G. Fan Types: The type of each fan is indicated on the Fan Schedule, under the "Type" column, and corresponds to the types specified herein.

H. Fan Arrangement and Drive: Shall be as indicated. Select motor and drive access side to allow best access and to suit available space.

I. Electrical: Fan disconnects and motor starters shall comply with Division 26 specifications. Disconnects furnished with fan shall come factory wired to motor or shall be field wired by Division 23.

J. Finish: All fans shall have factory applied enamel finish (manufacturer's standard color, unless noted otherwise) over a rust inhibiting primer base coat; except a painted finish is not required on rooftop type fans of aluminum or equivalent corrosion resistant construction.

K. Backdraft Dampers:

1. General: Provide all fans with backdraft dampers.

2. Rooftop Fans: Multi-blade backdraft damper, to close automatically to prevent airflow in the opposite direction than intended when fan is off, aluminum or galvanized steel construction (except shall be of stainless steel construction where duct system served is constructed of stainless steel). Frame shall be minimum 0.090-inches thick, with minimum 0.025-inch thick blades, synthetic bearings, concealed linkage connecting all blades, vinyl or felt blade edge seals, rated for 2500 feet per minute velocity, counterbalanced with adjustable weights to allow for proper operation. Leakage less than 10 cfm at 0.5-inch w.g. pressure differential for a 36-inch square damper. For installation in fan roof curb (unless indicated otherwise).

3. Other Fans:

a. General: Multi-blade backdraft damper, to close automatically to prevent airflow in the opposite direction than intended, aluminum or galvanized steel construction, except shall be of stainless steel construction where duct system served is constructed of stainless steel. May be "butterfly" type where used on fans with round connections. Provide with flanges where needed for installation. Provide with coating where fan has internal coating (same type as indicated for the fan served).

b. Where Duct Velocity is Under 1000 Feet per Minute: Frame minimum 18 gauge thick, with minimum 0.025-inch thick blades, synthetic bearings, concealed linkage connecting all blades, vinyl or felt blade edge seals, and rated velocity of 2500 feet per minute or duct velocity at point of application (whichever is higher). Provide with counterbalanced and adjustable weights as required by the application in order to have proper damper operation.

c. Where Duct Velocity is Equal or Greater Than 1000 Feet per Minute: Frame minimum 0.125-inches thick, with minimum 0.070-inch thick blades, synthetic bearings, concealed linkage connecting all blades, vinyl or felt blade edge seals, and rated velocity of 2500 feet per minute or duct velocity at point of application (whichever is higher). Provide with counterbalanced and adjustable weights as required by

the application in order to have proper damper operation. Leakage less than 15 cfm at 1-inch w.g. pressure differential for a 36-inch square damper.

2.3 ROOF TOP LOW PROFILE FANS

A. Type: Low profile centrifugal fan for roof top curb mounting, with backward inclined fan wheel and louvered penthouse hood.

B. Housing: Shall consist of louvered penthouse type hood constructed of minimum 0.040-inch thick aluminum with mitered and welded corners. Hood shall have aluminum hinged removable cover, allowing access to complete drive assembly and wheel. Curb cap shall be of aluminum construction, with pre-punched mounting holes (minimum two each side). Lower windband shall be of aluminum construction and shall be welded to curb cap and support unit drive assembly. Inlet cone shall have deep venturi shape and match fan wheel inlet. Provide with birdscreen on outlet. All fasteners shall be corrosion resistant type. Conduit chase shall be provided through the curb cap for routing electrical conduit/wiring into the power compartment.

C. Fan Wheel: Shall be aluminum, backward inclined, non-overloading centrifugal type; dynamically and statically balanced. Wheel shall overlap inlet venturi to allow maximum performance.

D. Drive Assembly: Entire drive assembly shall be mounted on rubber vibration isolators. Belt driven units shall have motor and drive located out of the airstream. Drive assembly support frame shall be constructed of heavy gauge steel or aluminum. Drive shafts shall be constructed of ground and polished steel, with permanently lubricated sealed ball bearings. Fan shall be direct or belt drive as indicated on the Fan Schedule.

E. Motor: Shall comply with Section 23 05 00. Motors shall be the EC type (unless indicated otherwise).

F. Roof Curbs: Constructed of minimum 18 gauge galvanized steel or 0.064-inch thick aluminum, all-welded construction, with top wooden nailer held in place by metal wrap-around, and internally insulated with minimum 1-inch thick rigid fiberglass suitable for exposure to the airstream in contact with the insulation. Where air being conveyed is contaminated or corrosive, provide an interior metal liner. Curb shall be oversized as needed to allow for the duct size indicated on the plans with a custom transition from the fan curb to match the fan dimensions. Where a curb size matching the fan dimensions will accommodate the duct size indicated, no transition is required. Provide with built-in cant and step height (to allow for roof insulation), as required to match roof type. Provide with damper type as shown.

G. Electrical Disconnect Switch: NEC rated; factory mounted in motor compartment (unless indicated to be mounted at another location).

H. Motor Speed Control: Factory wired and mounted for EC motors, per Section 23 05 00. For other motor types provide either a VFD or solid state speed controller

allowing speed reduction down to 25% of maximum. Solid state speed controller shall be for mounting in a standard junction box.

I. Sound Attenuating Roof Curb: Same as specified for roof curb but with acoustical baffles to attenuate noise. Acoustical baffles shall be constructed of perforated aluminum sheet formed into baffles and filled with fiberglass wool and held in place by steel spring wire clips. Greenheck Model "AT", or approved.

2.4 IN-LINE FANS

A. Type: Square housed, in-line centrifugal fan.

B. Housing: Shall be constructed of galvanized steel, minimum 20 gauge for fans with up to 14" diameter fan wheels, minimum 18 gauge 14" to 29" fan wheels, and minimum 16 gauge for 30" diameter fan wheels and larger. Housing shall be of square shape, with inlet and outlet square duct mounting collars. Housing shall have removable or hingeable access covers providing complete access to fan internals. Housing shall be lined with minimum 1" thick 1-1/2 lb per cubic foot fiberglass duct liner.

C. Fan Wheel: Shall be aluminum, backward inclined, non-overloading, centrifugal type; dynamically and statically balanced.

D. Drive: Fan shall be direct drive.

E. Supports: Fans shall be provided with supports for horizontal base mounted, horizontal ceiling suspended, or vertical mounting as shown on the drawings. Provide spring type vibration isolators for horizontal suspended fans and neoprene type for base mounted units. Vibration isolators shall be sized to match fan weight.

F. Electrical Connections: Fans shall be factory wired to an external junction box and disconnect switch. Fan shall have flexible wiring for units where fan motor swings out of way for housing access.

G. Vibration Isolators: Spring, seismically housed, with 2-inch deflection. Sized to match unit. Provide suspended or floor mount type to suite application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with Section 23 05 00. Install in accordance with manufacturer's written installation instructions, code, applicable standards and best construction practices.

B. Locations: Install fans at locations indicated and in accordance with the Contract Documents.

C. Connections: Provide flexible connections in ductwork connections to all fans (not required for rooftop type fans mounted on curbs (unless noted otherwise).

D. Vibration Isolation: Install all fans with vibration isolators so that no sound or vibration is transmitted to the structure; except not required for rooftop type fans. See Section 23 05 48 for vibration isolation specifications.

E. Rooftop Type Fans: Rooftop type fans shall be mounted on roof curbs, secured to curb on all sides, and sealed watertight.

F. Speed Controls: Fans with separate speed controllers shall have the speed controller mounted on the fan housing unless another location is indicated on the drawings (for use by Balancer). Install VFD's at accessible locations near item served.

G. Owner Instruction: Instruct Owner on the operation of each fan, including: system start-up, shut-down, emergency shut-down, normal control operation, safety aspects, maintenance and repair instructions.

H. Start-Up: Prior to start-up inspect fans and installation to confirm proper installation and system is ready for start-up. Arrange other trades to be present as needed (i.e. balancer, electrician, etc.). Check fans for correct rotation, tighten belts to proper tension, adjust fan speeds to provide required performance, verify proper electrical and control connections, check vibration isolation (as applicable) for correct operation, and lubricate bearings per manufacturer's recommendations.

END OF SECTION 23 34 00

SECTION 23 37 00 – AIR OUTLETS AND INLETS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. GRD Outlets.

B. GRD Inlets.

C. Louvers.

D. Wall Caps.

1.3 DEFINITIONS

A. GRD's: Grilles, Registers, and Diffusers.

1.4 REFERENCES

A. AHRI 885: Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

B. AMCA 500: Laboratory Methods of Testing Louvers for Rating.

C. ASHRAE 70: Method of Testing the Performance of Air Outlets and Air Inlets.

D. ASHRAE-F: ASHRAE Handbook of Fundamentals.

E. SMACNA-DCS: HVAC Duct Construction Standards, 3rd Edition.

1.5 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Product Data: Submit product information for all items to be used.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Grilles, Registers and Diffusers: Titus, MetalAire, Krueger, Price, Tuttle & Bailey, Kees, Carnes.

D. Louvers: Ruskin, Greenheck, Leader Industries, American Warming and Ventilating.

F. Wall Caps: Greenheck, PennBarry, Nutone, Carnes.

2.2 GENERAL REQUIREMENTS

A. Type: Air outlets and inlets shall be of the size, type, and with number of throws as shown on the drawings; and shall match the appearance and performance of the manufacturers' models specified and scheduled on the drawings.

B. Performance: Air outlet and outlet performance shall be based on tests conducted in accordance with ASHRAE 70.

C. Sound Level: Air outlets and inlets shall not exceed a sound level of NC 30 for the size indicated and airflow rate application. Sound levels shall be determined in accordance with AHRI 885 and ASHRAE-F.

D. Finish: Grilles, Registers and Diffusers shall have factory applied finish, color as selected by Architect/Engineer, except where indicated to have a brushed aluminum finish (or other finish type). Finish shall be an anodic acrylic paint, baked on, with a pencil hardness HB to H. Pint shall pass a 90 hour ASTM B117 salt spray test, 250 hour ASTM D870 water immersion test, and an ASTM D2794 reverse impact test with at least a 50 inch-pound force applied.

E. Frame Style: Provide air outlets and inlets with frame style to match ceiling or wall construction installed in. Where supply air outlets or inlets are installed in T-bar ceiling systems, they shall be factory installed in 2' x 2' or 2' x 4' metal panel to match ceiling layout. Where installed against gypsum board surface, brick or similar hard surface, or where exposed, provide with 1-1/4-inch wide outer border. Where space does not permit installing 2' x 2' metal panel, provide outlets or inlets with 1-1/4-inch wide outer border. Where air outlets are installed adjacent to surface mounted light fixtures, outlets shall have 4-inch deep drop frames. (See reflected ceiling plan and/or electrical lighting plan for ceiling and lighting types).

F. Transfer Grilles: Ceiling transfer grilles shall be same as ceiling exhaust grilles (CEG) unless noted otherwise; wall transfer grilles (WTG) shall be same as wall exhaust grilles (WEG) (unless noted otherwise).

G. Construction: Air outlets and inlets shall be of steel or aluminum construction except that:

1. Where noted to be constructed of a specific material, shall be as noted.

2. In assemblies with a required fire rating and required to have fire dampers

shall be of steel construction.

3. In wet areas or subject to condensation (i.e., locker rooms, restrooms, kitchens, exterior soffits, etc.), where not used in fire rated assemblies, shall be of aluminum construction.

4. Air outlets and inlets in the same room, area, or within common view shall be constructed of the same material.

2.3 SUPPLY AIR OUTLETS

A. Ceiling Diffuser (CD): Aluminum or steel construction, modular core, with multiple curved (or angled) discharge blades, and square neck. Cores shall consist of four separate sections which can be repositioned to allow for one, two, three or four way discharges. Cores shall be easily removed with no tools required. Krueger 1240 Series, Titus MCD, MCD-AA Series (or approved equal).

B. Ventilation Grille (VG): Non-corrosive construction, with integral adjustable core for varying air volume. Core shall spin in and out with no tools required. Shall have compression spring tabs for round duct installation, no screws required.

2.4 RETURN AIR INLETS

A. Ceiling Return Grille (CRG): Aluminum construction, "cube-core" or "egg-crate" type, with 0.025-inch thick x 1/2-inch deep strips mechanically joined to form 1/2" x 1/2" x 1/2" cubes. Krueger Series EGC5. Titus Series 50F.

2.5 LOUVERS

A. Type: High performance, 4-inch deep, stationary, drainable louvers. Ruskin Model ELF375DX or approved.

B. Frame: 4-inch deep, constructed of a minimum 0.090-inch, 6063 extruded aluminum, with integral caulking slots and downspouts in jambs and mullions.

C. Blades: Shall be constructed of minimum 0.081-inch, 6063 extruded aluminum, at 37.5 degree angle, on approximately 3-inch centers, with drain gutter.

D. Bird Screen: Shall be constructed of 1/2-inch mesh, 0.051-inch aluminum.

E. Performance: Nominal free area of 50% with pressure drop and water penetration equal to specified manufacturer's model.

F. Wind Loading: Louver shall incorporate structural supports required to withstand a wind load of 30 pounds per square foot.

G. Finish: Provide with clear anodized finish.

H. Accessories: Provide extended sill and top drip cap; of same material and finish as blades. See drawings for configuration.

2.6 WALL CAPS

A. Stainless Steel, Airflows of 250 cfm and Less: Constructed of minimum 0.020-inch thick type 304 stainless steel, hooded configuration, natural finish, with bird screen, built-in spring loaded backdraft damper, and round duct connection. Duct connection size to match connecting duct size (or equivalent free area). For air intake applications delete backdraft damper. Artis SDWVSS, SWVSS (or approved equal).

2.7 ROOF VENTS PENTHOUSE LOUVER TYPE

A. Roof Curbs:

1. General: Type as required to match roof type used with and specific application (i.e., with built-in cant and step height to allow for roof insulation; sloped base to match roof slope and provide level top mounting; designed for shingle type roofs with wide base flange; configured for metal roof; etc.). Greenheck "GPR", "GPS", "GPF", "GRS"; Curbco "Custom"; Roof Curb System "Custom", Thybar "Custom, "ThyCurb"; (or approved equal).

2. Construction: Minimum 18 gauge galvanized steel or 0.064-inch thick aluminum, of all-welded construction, with top wooden nailer held in place by metal wrap-around (nailer only required where needed for roofing or flashing attachment), and internally insulated with minimum 1/2-inch thick rigid fiberglass.

3. Size: Size of curb shall match roof vent used with and to allow for duct size indicated.

4. Base Flashing: Where used on shingle type sloped roofs (or similar type with layered roofing materials) provide curb with a base flashing flange minimum eight inches larger all around than vertical portion of curb (or as required by roofer to properly flash into roof); coordinate with Roofing Contractor and provide base flashing size as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install air outlets and inlets in locations indicated and so as to conform with building features and coordinated with other work. See hangers and supports specification Section for supports and additional requirements.

B. Location Verification: Verify all air inlet/outlet locations with building features and other trades prior to installing any duct systems that will connect to the air outlets/inlets. For locations where air inlet/outlet location is noted to be verified, or location is not clear, develop shop drawings showing the proposed location, or the location that best suits field conditions, and submit for review.

C. Connections: Furnish all necessary screws, clips, duct collars, and transitions required to allow for the installation and connection of ductwork to all air outlets/inlets and for the attachment of air inlets/outlets to the building and to supports. Connect all ductwork to air inlets and outlets with fasteners, minimum one each side and in compliance with SMACNA-DCS. See ductwork specification Section for sealing and additional requirements.

D. Dampers: Install in accordance with manufacturer instructions. Check for free movement of dampers and proper control by damper actuator. See Division 25 for control of motorized dampers.

E. Painting: Paint ductwork and accessories which are visible behind air outlets and inlets flat black. Painting to include ductwork, duct liner, turning vanes, liner attachments, and all visible items (including fastening pins for duct lining).

F. Weather Exposure: All outlets and inlets exposed to the weather shall be adequately flashed and installed in a manner to assure complete weatherproofness.

END OF SECTION 23 37 00

SECTION 23 72 23 – ENERGY RECOVERY VENTILATOR

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Energy Recovery Ventilator (DOAS UNIT)

B. Start-up

1.3 SUBMITTALS

A. General: Submittals shall comply with Section 23 05 00.

B. Product Data: Submit product information on unit including fan curves, coil performance, unit construction details, wiring diagram, data showing energy recovery, filter data, and weight.

C. Shop Drawing: Submit drawings of unit showing all dimensions, locations of unit components, and point of connection of all utilities.

D. Operation and Maintenance: Submit Operation and Maintenance data and submittal data for inclusion in project O&M Manuals.

1.4 GENERAL REQUIREMENTS

A. Standardization: All units of the same type shall be the product of the same manufacturer.

B. Substituted Equipment: The drawings show design configuration based on a particular manufacturer's equipment (i.e. basis of design). Use of another manufacturer's equipment (i.e. substituted equipment) that is configured different from what is shown will require redesign of mechanical ductwork, piping, electrical, structural, unit support systems, and general building construction to accommodate the substituted equipment. Such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate unit installation plans and details; shop drawings shall comply with Section 23 05 00. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of

maintenance, duct connection locations, unit electrical requirements, noise considerations, vibration unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate the substitutional equipment shall be borne by the contractor. Contractor is cautioned that certain aspects of the equipment cannot be fully evaluated until items are installed and operational, and all added costs after installation to make units equal to the basis of design shall be by the Contractor.

1.5 REFERENCES

A. AMCA 230: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.

B. AHRI 1060: Standard for Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. Energy Recovery Ventilator: RenewAire, Broan, Lifebreath.

2.2 GENERAL

A. Guards: Exposed openings into fan housings shall be protected with substantial metal screens or gratings. Electrical components with shock potential shall be physically protected and labeled (label as to hazard and items being accessed).

B. Fan Balancing: The shaft and fan wheel(s) shall be factory statically and dynamically balanced.

C. Motors: Shall be UL listed and comply with Section 23 05 00. Motor efficiency shall comply with Code. Motors shall have integral thermal protection with automatic reset.

D. Outlets and Inlets: Equipment shall be furnished with attachment angles and/or flanges to allow for attaching external ductwork.

E. Fan Performance: Shall be based on laboratory tests conducted in accordance with AMCA 230. Fan capacity shall not be less than the values scheduled on the drawings and shall be constructed to be able to operate with total pressures 20% higher than that indicated.

F. Controls: Coordinate with Division 25 Contractor for required interfaces between air handling equipment. VRF system, and building control system.

2.3 ENERGY RECOVERY VENTILATOR

A. Type: Indoor energy recovery ventilator using fixed plate enthalpy heat exchanger.

B. General:

1. Unit shall be complete single package, self contained factory assembled unit, requiring only electrical, duct, and control connections to operate.

2. Capacity: Shall be as scheduled at the conditions noted.

3. Unit configuration shall be as shown on plans.

C. Cabinet:

1. General: Constructed of minimum 20 gauge G-90 galvanized steel, reinforced and constructed for maximum anticipated static pressures involved, but no less than 4" w.c. with cabinet leakage less than 1% of scheduled airflow.

2. Liner: Interior of cabinet shall be insulated with minimum 1/2-inch thick, 4 pound per cubic foot density foil scrim faced fiberglass insulation to provide a cleanable surface. Double-wall construction with foam injected insulation and interior 20 gauge G-90 galvanized steel is also acceptable.

3. Access Doors: Constructed same as cabinet, size to access unit internals, with full perimeter gasket. Doors shall be opened by releasing multiple latches or similar method requiring no tools.

D. Fan(s): Integral supply and exhaust fans, direct drive, steel or aluminum construction, multi-blade centrifugal type. Motors shall be ECM type.

E. Energy Recovery Core:

1. General: Total enthalpy type, capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air. No condensate drains shall be required.

2. Certifications: The energy recovery cores used in these products shall be third party Certified by AHRI 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacturer's published performance for airflow, static pressure, temperature and total effectiveness, outdoor air (OACF) and exhaust air leakage (EATR). OACF shall be no more than 1.02 and EATR shall be a 0% against balanced airflow.

F. Filters: Unit shall be provided with filter racks for accommodating 2" thick filters (unless noted otherwise), with minimum filter area (or sizes) as scheduled. Access to filters shall be through unit access doors.

G. Electrical:

1. General: Unit shall be for use with single point electrical power connection. Unit shall be furnished with all necessary wiring, raceway, transformers, contactors, relays, motor starters, and accessories with power and controls connected to all unit devices for unit operation and with the specified sequence. Electrical shall comply with NEC and local code requirements. Unit shall have a main fused power disconnect. Disconnects shall comply with NEC, and be accessible from outside unit enclosure.

H. Controls: Unit control shall be by VRY system, to operate when VRF system is in the occupied mode. Unit shall be furnished with all necessary relays, starters, wiring terminal strips, timers, safety devices, etc. to allow for operation using the Section 23 81 27 control system or Division 25 control system. Unit wiring shall be color coded and numbered corresponding to unit's wiring diagram. Access panels to unit controls shall be hinged with latches (or equivalent device), requiring no tools to open.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install the units as shown on the drawings, in accordance with manufacturer's instructions, Code, and best construction practices.

B. Locations: Install at locations indicated, to allow for maintenance access and proper clearances.

3.2 START-UP

A. Initial Checks: Prior to operating units, checks shall be made to insure that adequate voltage, duct connections, electrical connections, control connections, and other items as listed by the manufacturer are properly provided/connected and ready to ensure safe and proper unit operation.

B. Testing and Adjustment: Operate unit to test for proper operation, including fan rotation, and correct interface to other controls.

END OF SECTION 237223

SECTION 23 81 27 – VRF SYSTEM

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. VRF Split System Heat Pumps.

B. Refrigerant Piping.

C. System Controls and Control System Design.

D. System Interface to Other Controls and Equipment

E. Start-up and Commissioning.

1.3 QUALITY ASSURANCE

A. Listing: Units shall be listed by an approved testing agency for the use and application intended.

B. Ratings and Certification: Unit performances shall be tested and rated in accordance with AHRI Standards and shall be AHRI certified.

C. Energy Efficiencies: Equipment energy efficiencies shall not be less than code requirements and shall exceed code efficiencies as indicated.

D. Installer Qualifications:

1. General: The installer shall have experience installing VRF systems by the manufacturer being used for this project. Installer shall be certified by the VRF system manufacturer as a "certified installer".

2. Refrigeration Components: Shall be installed by a licensed refrigeration mechanic having experience with VRF systems, and the work shall be supervised by personnel trained by the VRF system manufacturer.

3. Controls: Control work shall be done by individual trained and certified by the VRF manufacturer for the installation of the specified controls.

1.4 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Product Data: Provide complete product information submittals on all units; include performance capacities as a function of indoor and outdoor coil db/wb temperatures and indoor coil air flow rates, supplementary heater capacity, fan performance (cfm vs. esp), and information on all filters and accessories.

C. Refrigerant Piping: Submit proposed refrigerant pipe sizes, schematic of routing, and refrigerant system accessories.

D. Control Shop Drawings: Submit shop drawings of complete control system, including the following information: interconnect drawings showing all wiring and control connections, all control device locations, sequence of operation for all controlled systems, building floor plans with all proposed thermostat and other control device locations shown.

E. Installer Qualifications: Submit qualifications of the personnel installing the refrigeration system components and the system controls (when requested by the Engineer).

1.5 GENERAL REQUIREMENTS

A. System Type: System shall be a Variable Refrigerant Flow (VRF) heat pump system, allowing for simultaneous heating and cooling modes operation of indoor units, with indoor units operating independently of other indoor units, changeover from one mode to the other (heating to cooling, cooling to heating) with no interruption to system operation, and the recovery of energy between units in different modes. The system shall be capable of accommodating a range of the sum of all indoor unit capacity, from 50% to 150% of outdoor unit capacity.

B. Standardization: In interests of Owner's standardization, all system heat pumps and heat pump controls shall be the product of the same manufacturer.

C. Alternate Manufacturers: The project has been designed around equipment by the manufacturer scheduled on the drawings. Alternate manufacturers may be used (see Acceptable Manufacturers, Section 23 05 00); however, any redesign (from what is shown on the drawing) to mechanical, electrical, structural, or general construction to accommodate such an alternate manufacturer shall be provided by the Contractor. Furthermore, such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate installation plans and details; shop drawings shall comply with Section 23 05 00. The redesign shall be equal or superior in all respects to the Architect/Engineer's design, including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate the alternate heat pumps shall be borne by the Contractor.

D. Refrigerant Pipe Sizing: Due to the use of proprietary selection criteria by the heat pump manufacturers, the heat pump supplier shall size all refrigerant piping between

the indoor and outdoor units and provide such sizes to the installing Contractors prior to the bid date. The heat pump supplier shall also determine the need for any additional accumulators, solenoid valves, and similar accessories and size/select such devices and inform potential installing contractors to allow proper bids. The heat pump supplier is obligated to furnish complete heat pump units, with properly calculated pipe sizes and accessories so as to allow the unit performances as scheduled.

E. Electrical and Controls: Component wiring shall comply with NEC and be color coded and numbered and match unit wiring diagrams. All necessary terminal blocks, fuse, wiring, junction boxes and electrical/control accessories shall be factory installed within the unit cabinet (unless noted otherwise).

1.6 WARRANTY

A. General: See Division 00 and 01 for general warranty requirements.

B. Warranty - VRF System Equipment:

1. Basic: Entire heat pump (outdoor and indoor sections) shall be warranted by the manufacturer to be free from all manufacturing defects and capable of providing satisfactory operation for the project warranty period. Repair and/or replacement of defective items (labor and parts) during the project warranty period shall be at no additional cost to the Owner.

2. Extended: Compressors and all coils shall be warranted by the manufacturer to be free from defects and capable of operating satisfactorily for a period of 5 years beyond the basic project warranty. Extended Warranty shall cover all warranted parts and associated shipping to the site, with repair labor by the Owner.

C. Warranty - VRF System Controls:

1. Basic: System shall be warranted for the project warranty period to provide the sequence of operation and basic features specified, with the accuracy and flexibility specified. The system shall be repaired or replaced, including materials and labor, if in Owner's reasonable opinion, system is other than as warranted.

2. Emergency Service: During the warranty period maintain a 24-hour emergency phone service and be able to respond by a trained and qualified Controls Engineer familiar with the installed system.

3. Warranty Service Allowance: Include 8 hours of control technician/programmer's time for special service (i.e. software changes, system consultation, setting up additional trends, etc.) and other services during the warranty period as required by the Owner or Engineer. The Owner and Contractor will jointly track the amount of time used. Only time directly authorized and agreed to by the Owner may be tracked as part of this allowance. This allowance is for work outside of other required project

work, and is for specific tasks assigned to the Contractor by the Owner or Engineer.

4. End of Warranty Service: At the end of the warranty period, the Contractor shall provide a re-check of the entire system operation, including calibration testing of a sample number of components and providing any necessary control adjustments for proper system operation. Such work shall be for a minimum of 8 hours on site.

5. Extended Warranty: Controls and control system shall be warranted for 2 years, beyond the project warranty period.

1.7 REFERENCES

A. AHRI 210/240: Standard for Unitary Air Conditioning and Air Source Heat Pump Equipment.

B. AHRI 350: Standard for Sound Rating of Indoor Air Conditioning Equipment.

C. AHRI 270: Standard for Sound Rating of Outdoor Unitary Equipment.

D. AHRI 1060: Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

E. ASME B16.22: Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

F. ASME B16.26: Standard for Cast Copper Alloy Fittings for Flared Copper Tubes.

G. ASME B280: Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 23 05 00, Paragraph 2.01, Acceptable Manufacturers.

B. VRF Heat Pumps: Trane, Mitsubishi, Carrier, Toshiba, Samsung, Daikin.

C. Refrigerant Pipe and Fittings: Domestic made products only.

2.2 SPLIT SYSTEM HEAT PUMP - OUTDOOR UNIT

A. Type: VRF air-to-air heat pump, outdoor section, for serving multiple indoor units.

B. Capacity: Units shall allow the indoor units to have the minimum cooling and heating capacities scheduled on the drawings at the conditions shown; rated in accordance with AHRI standards.

C. General: Unit shall be fully factory assembled and shall be complete with casing, coils, fans, compressor, piping, wiring, controls, and all other accessories required to be ready for field connections and operation. Unit shall be capable of operating in the cooling mode from 30 to 125 degrees F ambient, and in heating mode from -13 to 65 degrees F ambient. Unit shall be factory run-tested to verify proper heating, cooling, defrost, control, and fan operation.

D. Unit Casing: Shall be constructed of galvanized steel, bonderized and finished with manufacturer's standard color. Casing shall be able to withstand 960 hours per ASTM B117 criteria.

E. Compressor(s): Shall be high performance, inverter driven, modulating capacity scroll type. Compressor shall have internal overcurrent protection and thermal overload protection, high pressure safety switch, and crankcase heaters. Compressor(s) shall be mounted to avoid transmission of vibration.

F. Refrigerant Circuit: Units shall be for use with refrigerant R-410A and shall be fully charged at the factory for the piping and indoor units used with. Unit shall include an accumulator with refrigerant level sensors and controls.

G. Coils: Shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing, with a factory applied corrosion resistant finish and integral metal guard protector.

H. Fan: Shall be direct drive, variable speed propeller type with a raised guard to prevent contact with moving parts. Fan motor shall have permanently lubricated bearings and inherent overcurrent protection.

I. Electrical and Controls: Units shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall have over-current protection and DC bus protection. Unit shall include all controls for units components, interconnection to other system components for automatic operation, safeties to prevent unsafe operation, to accommodate system defrost, and to allow for 8 stages of operation. Units controls shall be 24 volt.

J. Sound: Unit shall have a sound rating not higher than 60 db(A) individually, and 64 dB(A) where twinned. In "night mode" unit shall have a sound rating not higher than 50 db(A) individually, and 53 dB(A) where twinned.

2.3 SPLIT SYSTEM HEAT PUMP – INDOOR - CEILING CASSETTE

A. Type: Indoor VRF heat pump for overhead suspended installation in a ceiling (or at ceiling height).

B. General: Unit shall be fully factory assembled and shall be complete with fan, four-way discharge outlet, evaporator coil, refrigerant metering device, heavy gauge steel chassis, refrigerant piping controls, condensate pan, drain connection, and related accessories to operate properly with VRF system.

C. Capacity: Unit shall have minimum cooling and heating capacities as scheduled on

the drawings at the conditions shown and with the outdoor unit indicated; rated in accordance with AHRI standards. Unit shall be able to operate in heating mode down to outdoor -13 deg. F.

D. Unit Casing: Fabricated of galvanized steel, with support provisions for hanging from building structure. Unit shall have bottom discharge grille, adjustable for two, three, or four-way discharge. Grille vane angles shall be adjustable via room wall thermostat. Exposed portion of unit shall have finished paint, manufacture's standard color.

E. Refrigerant Circuit: Shall be fully factory piped and shall include an electronic linear thermostatic expansion device to allow for both heating and cooling operation. Units shall be factory charged with dehydrated air (or an inert gas).

F. Coil: Non-ferrous construction with plate fins on copper tubing, with all joints silver brazed. Coils shall be factory tested to a minimum of 1.5 time's normal working pressure. Coil shall have corrosion resistant drain pan and drain fitting; configured to allow draining either end of unit. Unit shall have an integral condensate pump, rated for unit condensation rate and 2.5 feet of head.

G. Fan: Direct drive, multi-speed type, statically and dynamically balanced, with permanently lubricated motor, manually adjustable guide vanes for side to side discharge, and a motorized discharge louver directing air up and down automatically. Fan speed shall be adjustable via room wall thermostat to a set level, or be able to be set to vary according to heating or cooling demand.

H. Filter: Unit shall have an integral washable filter, easily removable.

I. Electrical and Controls: Unit shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall include all controls for unit's components, interconnection to other system components, and to provide the specified sequence of automatic operation. Unit shall include controls providing self-diagnostic checks, auto restart (on power outage or loss of control communication), test run switch, auxiliary contacts for control of an external heat source, four digital inputs for custom control applications, and three digital outputs for custom control applications.

J. Condensate Pump:

1. Provide unit with condensate pump. Where not available internal to unit, or where internal pump doesn't meet the pumping capacity required, provide external type, with controls, and gpm capacity to suit unit maximum condensate rate, at 10 feet of head. Provide mounting assembly, accessories for complete connections, and an architectural cover to match the finish of the unit to minimize visibility.

2. Provide unit with high level condensate overflow sensor. Sensor shall detect high condensate levels in the indoor unit and stop indoor unit operation before an overflow can occur. Provide mounting assembly and accessories required to install on specified indoor unit.

2.4 SPLIT SYSTEM HEAT PUMP – INDOOR – AHU – MULTI-POSITION

A. Type: Suspended indoor VRF heat pump, ducted, air handling unit.

B. General: Unit shall be fully factory assembled and shall be complete with fan, motor, evaporator coil, refrigerant metering device, heavy gauge steel chassis, refrigerant piping controls, condensate pan, drain connection, and related accessories to operate properly with VRF system.

C. Capacity: Units shall have minimum cooling, heating, and airflow capacities as scheduled on the drawings at the conditions shown and with the outdoor unit indicated; rated in accordance with AHRI standards. Unit shall be able to operate in heating mode down to outdoor -13 deg. F.

D. Unit Casing: Fabricated of galvanized steel, with provisions for mounting in any position. Provide with access doors for side access.

E. Refrigerant Circuit: Shall be fully factory piped and shall include an electronic linear thermostatic expansion device to allow for both heating and cooling operation. Units shall be factory charged with dehydrated air (or an inert gas).

F. Coil: Non-ferrous construction with plate fins on copper tubing, with all joints silver brazed. Coils shall be factory tested to a minimum of 1.5 time's normal working pressure. Coil shall have corrosion resistant drain pan and drain fitting; configured to allow draining either end of unit. Provide integral electric heating coil as scheduled.

G. Fan: Direct drive, multi-speed type, statically and dynamically balanced, with permanently lubricated motor. Air speed shall be adjustable via room wall thermostat to a set level, or set to vary according to heating or cooling demand.

H. Electrical and Controls: Unit shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall include all controls for unit's components, interconnection to other system components, and to provide the specified sequence of automatic operation. Unit shall include controls providing self-diagnostic checks, auto restart (on power outage or loss of control communication), test run switch, auxiliary contacts for control of an external heat source, four digital inputs for custom control applications, and three digital outputs for custom control applications.

I. Condensate Pump:

1. Provide unit with condensate pump. Where not available internal to unit, or where internal pump doesn't meet the pumping capacity required, provide external type, with controls, and gpm capacity to suit unit maximum condensate rate, at 10 feet of head. Provide mounting assembly, accessories for complete connections, and an architectural cover to match the finish of the unit to minimize visibility.

2. Provide unit with high level condensate overflow sensor. Sensor shall detect high condensate levels in the indoor unit and stop indoor unit operation

before an overflow can occur. Provide mounting assembly and accessories required to install on specified indoor unit.

2.5 BRANCH CIRCUIT CONTROLLER

A. Type: Refrigerant Branch Circuit (BC) Controller controlling refrigerant flow and with controls and accessories for system heating/cooling operation.

B. General: The BC Controller shall be fully factory assembled, and complete with all piping, valves, controls, and wiring. Unit shall be factory run tested. Provide unit size and capacity appropriate for the system and number/size of indoor units.

C. Unit Cabinet: Fabricated of galvanized steel, sized to enclose all components. An integral condensate pan and drain connection shall be provided. Provided with factory supplied condensate pump.

D. Refrigerant Circuit: Unit shall have multiple tow-position automatic refrigerant valves to control refrigerant flow, and each branch line shall have a service valve to allow servicing any indoor unit without interruption of service to other units. Unit shall have a liquid-gas separator a tube-in-tube heat exchanger. Linear electronic expansion valves shall be provided for control of refrigerant flow.

E. Electrical: Unit shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall include all controls for proper operation interconnection to other system components.

2.6 VRF SYSTEM CONTROLS

A. General:

1. System shall have VRF manufacturer's controls to control all space indoor units, heat recovery unit, outdoor unit, and additional HVAC system components, as a unified system. System shall provide the sequence of operation specified.

2. The control system shall consist of a low voltage communication network of controllers and control devices, communicating over a high-speed communication bus, with a web-based operator interface. A web controller with a network interface shall gather data from the VRF and HVAC control system and generate web pages accessible through a conventional web browser for PC's connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

3. System shall be capable of email generation for remote alarm annunciation.

4. Provide all control system software, programming, and control devices to allow for the system operation, the specified sequence, specified features, and to allow remote access via a standard web browser. Provide graphics accessible by the web browser which display the systems in a schematic

fashion with system data overlayed on the graphics. Provide all software licensing to the project Owner.

B. EMCS Interface: System controls shall have BACnet interface for connection to a future building EMCS to allow the EMCS to monitor complete system operation and to allow enable/disable of the overall system components (i.e. placing in off or auto modes remotely).

C. Room Thermostats: Shall provide space temperature control for indoor units, completely independent of other indoor units. Thermostats shall include: occupant setpoint adjustment of plus or minus 3 deg F, room temperature display, room setpoint display, fan speed adjust, indoor unit diagnostics, discharge vane/louver adjust (where indoor units are specified with adjustable vanes/louvers), and related features as specified with the system equipment.

D. Master Controller:

1. General: Shall provide time schedule, warm-up, optimum start, night setback, monitoring system status, unit on/off control, unit airflow control, temperature settings, and other control functions for the system and to serve as one of the users' interface. Shall allow for system programming, start-up, trouble-shooting, setup, and provide the specified sequence of operation. Wall mounted, backlit, color touch panel, with visual display of all settings, and system diagnostics.

2. Communication Ports: Controller shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to a network switch for IP communication to other controllers for display of up to two hundred indoor units.

3. Scheduling:

a. Time Schedules: The Control System shall provide time clock schedule with at least 20 time schedules. Each schedule to be 8-day type, 5 entries per day. All entries to be in 12 hour AM/PM format. The complete schedule shall be displayed at one time on the master controller for easy editing. Each time program shall be able to include on/off, high/low speeds, temperature setpoints, dduty cycle commands, as required to provide the specified sequence of operation.

b. Holiday Schedules: A minimum of 20 holiday time schedules shall be available and shall be assigned to any number of available points. Holiday schedule shall display entire year and shall also allow for an interval holiday time, program showing holiday start date to end date (example: December 24 to January 2).

1. Warm-up Mode: Control System shall have warm-up mode prior to occupied mode on heating to pre-warm building prior to occupancy. Time of

beginning warm-up cycle shall be determined by an optimum start/stop program.

2. Optimum Start/Stop: Control System shall have optimum start/stop program to reduce run time of HVAC equipment. Optimum start/stop program shall consider building mass, building temperatures, outdoor air temperatures, and other system factors in determining time of system start-up or shut-down. Program shall record previous warm-up times versus actual warm-up times and shall adjust the program algorithm so that program calculated warm-up time corresponds to actual.

3. Standard software functions shall be available so that the user can securely log into each master controller via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics.

E. Sub-Controllers: Controllers providing control system equipment in conjunction with the VRF system and master controller. Controller capabilities shall be as required to provide the specified sequence of operation and communicate via the VRF control system network. Controls to include inputs/outputs as required for the application for adjustment of system setpoints, control HVAC equipment (VRF and non-VRF), detect system errors, and monitor system (and equipment) status. See specified sequence of operation for requirements and specified system features.

F. Input/Output Devices: Devices with binary and analog inputs/outputs to control general HVAC equipment in conjunction with the VRF system, master controller, and sub-controllers. Device capabilities shall be as required to provide the specified sequence of operation and communicate via the VRF control system network. See specified sequence of operation for requirements and specified system features.

G. Wiring and Conduit:

1. General: As manufacturer's system requires; complying with Division 26, and in accordance with NEC.

2. Low Voltage: Multi-conductor, 16 AWG, twisted, stranded shielded wire; unless required otherwise by the VRF system manufacturer.

3. Network Wiring: CAT-5 with RJ-45 connection; unless required otherwise by the VRF system manufacturer.

H. Labels:

1. General: Shall comply with Section 23 05 00.

2. Control Devices: Labels on control devices shall use the same designation that appears on the control shop drawings and an indication as to purpose; except that devices in finished rooms shall be labeled as to the generic item controlled for better user understanding (i.e. "Room Exhaust Fan", "Hood Fan").

3. Wiring: Wiring labels shall be the self-laminating or heat shrink type with numbering, lettering, or an alpha-numeric identifier indicating the wire signal/power purpose and matching the designation that is used on the control drawings

I. Control Cabinets: Wall mounted, NEMA rated construction, type and rating to suit location environment, UL listed, minimum 14-gauge sheet metal, hinged front door with latch. Size as required to house controls. Controls/devices shall be logically assembled in cabinet, with all devices and cabinet labeled.

J. Relays/Contactors: Shall be the single coil electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contacts shall be doubled break silver to silver type protected by arching contact where necessary. Number of contacts and rating shall be selected for the application intended. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage. Relays shall have mechanical switching to allow manual operation of relay and LED light to indicate the energized state.

K. Miscellaneous Control Components: Complying with Section 23 05 00 and Division 26. Standard components, for use in commercial and institutional occupancies, rated and designed for the application and able to provide the specified sequence of operation.

L. Maintenance Tool:

1. Tool: Hardware and software to allow system monitoring and to aid technicians in system maintenance; shall monitor system operational functions, status, and settings.

2. Parameters: Tool shall enable the user to monitor and record the following parameters in a centralized system.

a. Outdoor Unit: Operation mode (cooling only, heating only, cooling main, heating main), compressor frequency, amperages and voltages, compressor high- and low-side pressure, system temperatures, outdoor temperature, status of reversing valve.

b. BC Controller: Valve on/off status, temperatures, pressures.

c. Indoor Unit: Entering Air temperature, entering/leaving Refrigerant temperature, superheat/subcool temperatures, expansion valve position, room temperature setpoint, unit mode and status (heat, cool, dry, auto, fan).

3. Manual Control: The Maintenance Tool shall have be able to control the following system components manually: indoor unit, indoor unit on/off, mode (heat, cool, dry, auto, fan), room temperature setpoint, fan speed, expansion valve position, BC controller valve open/close.

4. Connections: The Maintenance Tool shall be connectable to the control system communication bus and be connectable to a PC via a USB cable.

5. Trending: Trended data from Maintenance Tool shall be available to export to a data file for offline analysis.

6. Software: For use with the "Maintenance Tool", provide as part of tool; compatible with Windows operating system (latest available version).

2.7 REFRIGERANT PIPING AND ACCESSORIES

A. Piping and Fittings: Rated for system pressures per VRF system manufacturer. Hard drawn ACR copper tubing per ASTM B280, Type L, with silver brazed joints and wrought copper fittings per ASME B16.22. Use only long radius elbows. Flared fittings (at equipment connections only) shall comply with ASME B16.26. Soft copper tubing may only be used on runs less than 50-feet or where necessary (i.e. when routing through sleeves, or similar poor access areas) where hidden from view in finished areas, and where acceptable to VRF system manufacturer.

B. Isolation Valves: Brass ball valve, full port, rated for system pressures and temperatures, but no less than 700 psig and -40 deg F to 300 deg F. Compatible with refrigerant used with, UL listed, with rupture proof encapsulated stem, extended copper connections for ease in brazing. Provide in configuration (i.e. angle, straight, with access port) as required to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install system in accordance with code, manufacturers written installation instructions, and best construction practices. Set units in locations as shown on the drawings and maintenance to units.

B. Location and Arrangement: Install all equipment at locations and as shown on the drawings. Install so as to allow maximum access to units. Prior to selecting unit final location, confirm that: Proper unit clearances and access will be provided; no adverse airflow conditions are present; confirm location and installation details with other trades. Units shall be level and aligned with building walls. Set outdoor unit on concrete pad (or roof sleepers); anchor to pad (or sleepers).

C. Complete Connections: Connect and install all items shipped loose with units; provide and connect all utilities and accessories as required for proper unit operation.

D. Protection: Equipment and all system components shall be protected during construction to prevent mud, dirt, paint overspray, plaster materials, and similar debris from depositing on the unit. Units shall be clean and in new condition prior to Owner acceptance.

E. Cleaning: Units shall be thoroughly cleaned of all debris prior to operation. Units shall be clean and in new condition prior to Owner acceptance.

F. Operation: Units shall not be operated until all construction activities that generate dust, dirt, fumes, or odors are complete; system checkout has occurred; and the Engineer has reviewed the system and granted approval.

3.2 PIPE AND FITTINGS

A. General:

1. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

2. Install piping at such heights and in such a manner so as not to obstruct any portion of windows doorways, passageways, or access to any items requiring routine service, maintenance, or inspection. Intsall piping to allow for the future removal of equipment, coils, fixtures, and similar items. Offset of reroute piping as required to clear any interferences which may occur.

3. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal exposed straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

B. Insulation: Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.

C. Escutcheons: Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.

D. Electrical Items: Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, and are required per this paragraph.

E. Refrigerant Piping: Shall be silver brazed. Bleed dry nitrogen through piping during brazing to minimize oxidation. Keep all open ends of piping capped when not being worked. Soft copper shall have long radius bends; install without kinks or excess bends. Piping shall be routed concealed, except where routed outdoors and where noted.

3.3 REFRIGERANT LEAK TESTING AND EVACUATION

A. Notification/Witnessing: Prior to beginning any testing, notify the Architect/Engineer when the testing will occur. The Architect/Engineer will witness (at his option) various parts of the test. Failure to notify the Architect/Engineer will be cause to re-test all piping in the presence of a representative of the Architect/Engineer.

B. General: Perform leak testing and evacuation in accordance with manufactures

published instructions and consistent with these specifications. Disconnect and isolate from the system any components that may be damaged by the test pressure.

C. Initial Test: Connect oil-pumped, dry nitrogen to the system through a pressure reducing gauge manifold. Charge enough nitrogen into the system to raise the pressure to 50 psig. Let stand for 2 hours and check for signs of leakage. If no leakage is noted, slowly increase pressure to 300 psig (or as required by local code or manufacturer, whichever is higher). Tap all brazed connections with a rubber or rawhide mallet sufficiently hard to start any leak that might subsequently open from thermal expansion/contraction or vibration. Check the manifold gauge for any drop in pressure. Let the system stand pressurized for 24 hours. Re-check the manifold gauge. If no change in pressure is noted (after adjusting for temperature) the system may be considered free of leaks.

D. Leak Review: If leakage is suspected or apparent, check joints with a glycerin soap solution or other means to locate the leaks. Repair any leaks found by completely disassembling the connection, cleaning the fitting and remaking the connection. Re-test the system after repairs are made both with pressure (300 psi for 24 hours) and at the leak location with a glycerin soap solution or other means of determining leaks.

E. Evacuation: When the system has been proven free of leaks with the above methods, the system shall be completely evacuated of all air and moisture. Connect a vacuum pump to the system and pump the system down to 500 microns and let stand for a minimum of 2 hours. If the vacuum reading remains unchanged, the system may be charged with refrigerant.

F. Charging: After satisfactory pressure testing and vacuum evacuation, fully charge the system with refrigerant. Refrigerant to be added to the system shall be delivered to the site in factory charged containers and charged into the system through a filter/drier. Any final connections that were not subject to the full test pressure (e.g. connections at unit, etc.) shall be carefully checked with a halide or electronic leak detector after the system has been charged.

G. Final Check: System shall be checked for proper refrigerant charge and oil level and charged to proper levels after all leak testing and evacuation work has been completed and prior to system start-up.

3.4 VRF SYSTEM CONTROLS

A. General: Installation shall comply with VRF system manufacturer written instructions and recommendations. Provide all software, hardware, licensing, sensors, relays, switches, dampers, actuators, conduit, tubing, wiring, transformers, motor starters and all other devices required to provide a complete integrated VRF control system with the system features and sequence of operation specified. Control system shall be contractor designed to comply with Contract Document requirements.

B. Room Sensors: Room sensors (i.e. thermostats) shall be mounted at an ADA

accessible height (unless indicated otherwise). Thermostats shall control the equipment which affects the temperature serving the space the thermostat is located in (unless indicated otherwise). Not all room sensors are shown on the drawings and the locations shown are preliminary only. Contractor shall review all drawings, coordinate with other trades, and indicate all final proposed room sensor locations on the submittal shop drawings. Contractor is responsible for coordinating locations to avoid chalkboards, tack boards and other interferences.

C. Electrical Power:

1. General: Provide all electrical wiring and devices in accordance with codes, and Division 26 requirements.

2. Sources: It shall be the responsibility of the installer of the VRF control system to provide power for all VRF control devices requiring power. Coordinate with the Division 26 Contractor to arrange for necessary power circuits. System Master Controller shall obtain power from a UPS (uninterruptible power supply); unless the unit has an internal battery back-up adequate for 24 hours.

3. Conduit: All wiring shall be installed in conduit and in accordance with Division 26, except that low voltage wiring within the ceiling plenum spaces may be ran without conduit provided that plenum rated cable is used. Install all conduit and wiring parallel to building lines.

D. Equipment Interconnect Wiring: In addition to control wiring between equipment and control devices (furnished under this Section) to accomplish the specified sequence, provide added control wiring to interconnect equipment and to interconnect equipment and associated control/safety devices. Provide as required by the equipment manufacturers to allow for proper operation of the equipment and system.

E. Component Labeling: All control components, except regular room thermostats, shall be equipped with name plates to identify each control component. Components in finished rooms shall be labeled as to generic item controlled for better user understanding; other devices shall be labeled with the same designation which appears on the Control Diagrams. Contractor shall submit list of proposed labeling prior to installing.

F. Complete System: Provide all devices as required to allow for automatic control with sequence of operation specified. Provide all control interconnections between indoor and outdoor units, and other equipment.

G. Adjustability: All setpoints and differentials shall be adjustable. Setpoints indicated are initial settings.

H. Confirm Settings: Confirm with Owner all setpoints, all time schedules, and all other adjustable programming parameters before substantial completion.

I. Thermostats Setpoints: Shall be adjustable, with initial settings as follows unless

indicated otherwise:

Occupied Heating	70 degrees F
Unoccupied Heating	65 degrees F
Occupied Cooling	76 degrees F
Unoccupied Cooling	85 degrees F

J. Sequence Terminology: Wherever the control sequences refer to an article, device or piece of equipment in the singular number, such reference shall mean to include as many of such articles, devices, or equipment as are shown on the plans, required for the sequence, or required to complete the installation. Wherever the control sequence refers to an operating stage in the singular number, such reference shall mean to include as many stages as are specified for the equipment and shall mean analog (i.e. proportional) type control where specified for the equipment (reference drawings and equipment specifications).

K. EMCS Interface: Provide interface device with proper protocol to allow communication of exchange of system data with the Division 25 EMCS.

L. Provide system with dry contacts to allow interlock with area DOAS unit.

3.5 VRF HEAT PUMPS - SEQUENCE OF OPERATION

A. General: VRF controls shall provide time schedule control and heating/cooling/fan operation of indoor units, with BC and outdoor units automatically operating in response to system loads and needs using their integral controls.

B. Occupied Mode:

1. Fan: Indoor fan shall run continuously when heating or cooling is required; fan shall cycle to low speed (or as an option cycle off) when no heating or cooling is required.

2. Heating: Indoor heat pump section shall operate in heating as required to satisfy the space setpoint. Airflow shall vary from minimum to maximum depending on load, and shall be programmable to remain at a fixed value instead of varying.

3. Cooling: Indoor heat pump section shall operate in the cooling mode as required to satisfy the space setpoint. Airflow shall vary from minimum to maximum depending on load, and shall be programmable to remain at a fixed value instead of varying.

C. Unoccupied Mode: Indoor fan and indoor heat pump heating/cooling shall cycle on and off as required to maintain unoccupied setpoints.

D. Mode Control: Units' mode of operation shall be determined by time schedule and time schedule override; warm-up mode shall be initiated by optimum start controls.

E. Outdoor unit and Refrigerant Controller: Shall operate to provide adequate and

correct refrigerant flow to serve indoor units and to reject or recover heat.

3.6 START-UP/TESTING AND ADJUSTMENT

A. Initial Checks: Prior to operating units, checks shall be made to insure that adequate voltage, air flow, duct connections, electrical connections, control connections, auxiliary heaters (where applicable), refrigerant work, and other items as listed by the manufacturer are properly provided/connected and operating to insure safe and proper unit operation.

B. Testing and Adjustment: Manufacturers representative shall provide start-up. Operate unit in various modes of operating to test for proper operation, including fan rotation, proper damper travel (where applicable), proper cooling/heating, correct interface to other controls (time clock, fans, etc.), etc. Make necessary adjustments.

C. System Commissioning: As the systems become operational, the VRF system installer shall test and observe the operation of each and every air moving and heating/cooling unit and shall adjust all controls so that the items function according to the intent of the specifications. The VRF system installer shall commission the VRF system controls, including a point-to-point check of all devices, and provide documentation substantiating the work. This commissioning work is separate from the Section 23 08 00 commissioning, and is to occur prior to the commissioning work of Section 23 08 00.

D. Report/Statement: After making all necessary system testing and adjusting, the Contractor shall submit a report to the Engineer indicating all testing/adjustment work done and comment on how system is operating. Such report shall be signed by the individual directly responsible for supervision of the installation of the control system. When the Contractor feels that the system is complete and ready for review by the Engineer, Contractor shall submit a written statement (signed by same individuals as for report) stating that the system is in compliance with the project requirements and ready for review.

3.7 OWNER INSTRUCTION

A. General: Comply with Section 23 05 00. After all testing and adjustments have been satisfactorily completed for the first phase of the project, the Owner shall be provided with operator instructions (including start-up, shut-down, emergency, maintenance, and repair instructions). Instruction shall be by the manufacturer's authorized service representative.

B. Time Period: Instruction period shall be for a minimum of three separate sessions of four hours each. Training to be provided to three Owner staff members.

C. Maintenance Tool Training: Provide training on maintenance tool.

END OF SECTION 23 81 27

SECTION 23 81 44 – SPLIT-SYSTEM HEAT PUMPS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Split-System Air Source Heat Pumps.

B. Refrigeration Piping and Accessories.

C. System Leak Testing and Charging.

D. Start-Up.

1.3 SUBMITTALS

A. General: Shall comply with Section 23 05 00.

B. Product Data: Provide complete product information on all units; include cooling performance capacities as a function of indoor and outdoor coil db/wb temperatures and indoor coil air flow rates, fan performance (cfm vs. esp), unit efficiencies, dimensions and information on all filters and accessories. Provide information showing dimensions and location of refrigerant, power, and control connections.

C. Installation: Submit manufacturer's installation instructions.

D. Submit unit inspection and start-up report.

1.4 QUALITY ASSURANCE

A. Listing: Units shall be listed by an approved testing laboratory for the use and application intended.

B. Rating and Certification: Cooling performances shall be tested and rated in accordance with AHRI 210/240.

C. Applications: Units shall be intended for commercial use and shall include all manufacturers recommended accessories for proper operation for the application intended.

D. Code Compliance: Units shall be rated in accordance with recognized standards and

meet code requirements for energy efficiencies. Units shall be constructed and designed to conform to applicable codes and standards.

E. Standardization: In interests of Owner's standardization, all equipment of the same type shall be the product of the same manufacturer.

F. Operating Conditions: Unless more extreme temperatures are noted elsewhere, or required by local conditions or the specific application, unit shall comply with the following:

1. Unit and all components exposed to ambient conditions shall be able to withstand ambient temperatures from -20 deg F to 125 deg F, plus direct exposure to sun and weather elements without adverse affects.

2. Unit shall be able to operate and produce cooled air between ambient temperatures of 45 deg F and 115 deg F. Unit shall be able to operate and produce heated air between ambient conditions of -13 deg F and 65 deg F. Unit shall be able to operate with supply air temperatures between 50 deg F and 125 deg F; and with room temperature setpoints between 65 deg F and 85 deg F.

G. Alternate Manufacturers: The project has been designed around units by the manufacturer scheduled on the drawings. Alternate manufacturers may be used (see Acceptable Manufacturers, Paragraph 2.01 and Section 23 05 00); however, any redesign (from what is shown on the drawing) to mechanical, electrical, structural or general construction to accommodate such an alternate manufacturer shall be provided by the Contractor. Furthermore, such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate unit installation plans and details; shop drawings shall comply with Section 23 05 00. The redesign shall be equal or superior in all respects to the Architect/Engineer's design, including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate alternate manufacturers shall be borne by the Contractor.

1.5 WARRANTY

A. General: Entire unit shall be warranted to be free of all manufacturing defects and meeting all Contract Document requirements for a period of one year after Owner project acceptance.

B. Compressors: Unit compressors shall be warranted by the manufacturer for five years after Owner project acceptance. All labor and materials associated with compressor replacement and repair shall be warranted.

1.6 REFERENCES

A. AHRI 210/240: Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment.

B. ASME B16.22: Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.26: Standard for Cast Copper Alloy Fittings for Flared Copper Tubes.

D. ASTM B280: Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

E. ANSI/AHRI 270: Sound Rating of Outdoor Unitary Equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All products shall comply with Section 23 05 00, Paragraph 2.01; Acceptable Manufacturers.

B. Air Conditioning Units: Mitsubishi, Trane, Carrier, LG, Samsung.

C. Refrigerant Pipe and Fittings: Domestic manufacturers only.

2.2 HEAT PUMP UNIT – OUTDOOR UNIT

A. Type: Split system ductless heat pump, for use with indoor ducted or ductless unit.

B. Capacity: As scheduled on drawings at the conditions indicated. Unit shall be able to operate with refrigerant runs up to 164 feet long. Shall be rated in accordance with AHRI standards.

C. Unit: Outdoor condenser and compressor unit, with high efficiency rotary compressor, condenser coil, condenser fan, accumulator, refrigerant piping, wind baffle accessory, heavy gauge steel chassis, baked enamel finish steel cabinet, controls, coil guard, mounting legs, and related accessories to provide capacity indicated.

D. Refrigerant: Units shall be for use with refrigerant R-410A or R-407C.

E. Electrical and Controls: Units shall be provided with all contactors, relays, wiring terminals, safety controls, microprocessor devices, dip switches, and accessories to allow for specified sequence of operation requiring only connection of room controller, power, and interconnection between indoor and outdoor units.

F. EMCS Interface: LonWorks controller to interface with Division 25 controls to allow for the specified sequence and communication indicated. Interface shall allow external enable/disable, reset of setpoint, equipment status, and alarm indication.

2.3 SPLIT SYSTEM HEAT PUMP – INDOOR - CEILING CASSETTE

A. Type: Indoor VRF heat pump for overhead suspended installation in a ceiling (or at ceiling height).

B. General: Unit shall be fully factory assembled and shall be complete with fan, four-way discharge outlet, evaporator coil, refrigerant metering device, heavy gauge steel chassis, refrigerant piping controls, condensate pan, drain connection, and related accessories to operate properly with VRF system.

C. Capacity: Unit shall have minimum cooling and heating capacities as scheduled on the drawings at the conditions shown and with the outdoor unit indicated; rated in accordance with AHRI standards. Unit shall be able to operate in heating mode down to outdoor -13 deg. F.

D. Unit Casing: Fabricated of galvanized steel, with support provisions for hanging from building structure. Unit shall have bottom discharge grille, adjustable for two, three, or four-way discharge. Grille vane angles shall be adjustable via room wall thermostat. Exposed portion of unit shall have finished paint, manufacture's standard color.

E. Refrigerant Circuit: Shall be fully factory piped and shall include an electronic linear thermostatic expansion device to allow for both heating and cooling operation. Units shall be factory charged with dehydrated air (or an inert gas).

F. Coil: Non-ferrous construction with plate fins on copper tubing, with all joints silver brazed. Coils shall be factory tested to a minimum of 1.5 time's normal working pressure. Coil shall have corrosion resistant drain pan and drain fitting; configured to allow draining either end of unit. Unit shall have an integral condensate pump, rated for unit condensation rate and 2.5 feet of head.

G. Fan: Direct drive, multi-speed type, statically and dynamically balanced, with permanently lubricated motor, manually adjustable guide vanes for side to side discharge, and a motorized discharge louver directing air up and down automatically. Fan speed shall be adjustable via room wall thermostat to a set level, or be able to be set to vary according to heating or cooling demand.

H. Filter: Unit shall have an integral washable filter, easily removable.

I. Electrical and Controls: Unit shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall include all controls for unit's components, interconnection to other system components, and to provide the specified sequence of automatic operation. Unit shall include controls providing self-diagnostic checks, auto restart (on power outage or loss of control communication), test run switch, auxiliary contacts for control of an external heat source, four digital inputs for custom control applications, and three digital outputs for custom control applications.

J. Condensate Pump:

1. Provide unit with condensate pump. Where not available internal to unit, or where internal pump doesn't meet the pumping capacity required, provide external type, with controls, and gpm capacity to suit unit maximum condensate rate, at 10 feet of head. Provide mounting assembly, accessories for complete connections, and an architectural cover to match the finish of

the unit to minimize visibility.

2. Provide unit with high level condensate overflow sensor. Sensor shall detect high condensate levels in the indoor unit and stop indoor unit operation before an overflow can occur. Provide mounting assembly and accessories required to install on specified indoor unit.

2.4 SPLIT SYSTEM HEAT PUMP – INDOOR – AHU – MULTI-POSITION

A. Type: Suspended indoor heat pump, ducted, air handling unit.

B. General: Unit shall be fully factory assembled and shall be complete with fan, motor, evaporator coil, refrigerant metering device, heavy gauge steel chassis, refrigerant piping controls, condensate pan, drain connection, and related accessories to operate properly with VRF system.

C. Capacity: Units shall have minimum cooling, heating, and airflow capacities as scheduled on the drawings at the conditions shown and with the outdoor unit indicated; rated in accordance with AHRI standards.

D. Unit Casing: Fabricated of galvanized steel, with provisions for mounting in any position. Provide with access doors for side access.

E. Refrigerant Circuit: Shall be fully factory piped and shall include an electronic linear thermostatic expansion device to allow for both heating and cooling operation. Units shall be factory charged with dehydrated air (or an inert gas).

F. Coil: Non-ferrous construction with plate fins on copper tubing, with all joints silver brazed. Coils shall be factory tested to a minimum of 1.5 time's normal working pressure. Coil shall have corrosion resistant drain pan and drain fitting; configured to allow draining either end of unit.

G. Fan: Direct drive, multi-speed type, statically and dynamically balanced, with permanently lubricated motor. Air speed shall be adjustable via room wall thermostat to a set level, or set to vary according to heating or cooling demand.

I. Electrical and Controls: Unit shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall include all controls for unit's components, interconnection to other system components, and to provide the specified sequence of automatic operation. Unit shall include controls providing self-diagnostic checks, auto restart (on power outage or loss of control communication), test run switch, auxiliary contacts for control of an external heat source, four digital inputs for custom control applications, and three digital outputs for custom control applications.

J. Condensate Pump:

1. Provide unit with condensate pump. Where not available internal to unit, or where internal pump doesn't meet the pumping capacity required, provide external type, with controls, and gpm capacity to suit unit maximum

condensate rate, at 10 feet of head. Provide mounting assembly, accessories for complete connections, and an architectural cover to match the finish of the unit to minimize visibility.

2. Provide unit with high level condensate overflow sensor. Sensor shall detect high condensate levels in the indoor unit and stop indoor unit operation before an overflow can occur. Provide mounting assembly and accessories required to install on specified indoor unit.

2.5 REFRIGERANT PIPING AND ACCESSORIES

A. Piping: Hard drawn ACR copper tubing per ASTM B280, Type L, with silver brazed joints and wrought copper fittings per ASME B16.22. Use only long radius elbows. Flared fittings (at equipment connections only) shall comply with ASME B16.26. Soft copper tubing may only be used on runs less than 50-feet or where necessary (i.e. when routing through sleeves, or similar poor access areas).

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install in strict accordance with manufacturer's written instructions and code.

B. Location and Arrangement: Install all equipment at locations and as shown on the drawings. Install so as to allow maximum access to unit. Prior to selecting unit final location, confirm that: proper unit clearances and access will be provided; no adverse airflow conditions are present; confirm location and installation details with other trades. Units shall be level and aligned with building walls. Set outdoor unit on concrete pad (or roof sleepers); anchor to pad (or sleepers).

C. Complete Connections: Connect and install all items shipped loose with units; provide and connect all utilities and accessories as required for proper unit operation. See Section 23 21 28 for cooling coil condensate drain piping.

D. Refrigerant Piping: Shall be silver brazed. Bleed dry nitrogen through piping during brazing to minimize oxidation. Keep all open ends of piping capped when not being worked. Soft copper shall have long radius bends; install without kinks or excess bends. Piping shall be routed concealed, except where routed outdoors and where noted. Piping shall be ran plumb and square to building walls, and in a neat professional manner. Provide sight glass in refrigerant liquid piping at outdoor unit.

E. Refrigerant Charge: Units shall be checked for proper refrigerant charge and oil level and charged to proper levels after all leak testing and evacuation work has been completed. Refrigerant to be added to the system shall be delivered to the site in factory charged containers and charged into the system through a filter/drier.

F. Cleaning: Units shall be thoroughly cleaned of all debris prior to operation. Units shall be clean and in new condition prior to Owner acceptance.

G. Operation: Units shall not be operated until all construction activities that generate dust, dirt, fumes, or odors are complete; system checkout has occurred; and the Engineer has reviewed the system and granted approval.

3.2 LEAK TESTING AND EVACUATION

A. Disconnect and isolate from the system any controls, relief valves, or other components that may be damaged by the test pressure.

B. Connect oil-pumped, dry nitrogen to the system through a pressure reducing gauge manifold. Charge enough nitrogen into the system to raise the pressure to 140 psig (or as required by the local Code authority).

C. Test all joints for leaks with a glycerin soap solution. Check the manifold gauge for any drop in pressure. Tap all solder/brazed connections with a rubber or rawhide mallet sufficiently hard to start any leak that might subsequently open from thermal expansion/contraction or vibration.

D. Repair any leaks found by completely disassembling the connection, cleaning the fitting and remaking the connection. Re-test the system after repairs are made.

E. When the above tests are successfully completed, allow the system to remain under test pressure (140 psig or as required by the local code authority) for 24 hours. Note the initial pressure and temperature. If the system pressure has not changed (when corrected to account for any change in temperature) the system may be considered free of leaks.

F. When all testing is completed the system shall be completely evacuated of all air and moisture. Connect a vacuum pump to the system and evacuate the system to 500 microns, and let stand for a minimum of 12 hours. If the vacuum reading remains unchanged, the system may be charged with refrigerant.

3.3 START-UP

A. Initial Checks: Prior to unit operation, the system shall be inspected to ensure all equipment and controls are properly connected and ready to operate. As a minimum, the following items shall be checked.

1. Adequate refrigerant charge.

2. Gauges installed to read suction and discharge pressure.

3. Proper voltage at outdoor unit.

4. Proper voltage at indoor unit.

5. Unit safeties properly set and connected.

6. Fan motors lubricated and ready to operate.

7. Temperature controls connected.

8. Pipe leak testing completed.

9. Condensate drain installed.

10. System service valves in proper position.

11. Controls properly connected and powered.

B. Initial Operation: After start-up, check unit for proper unit operation including: proper fan rotation, no excessive vibration, no unusual noises, proper unit cycling in response to room temperature, no excessive room temperature swings, no safeties or electrical devices tripping out.

END OF SECTION 23 81 44

SECTION 23 82 46 – ELECTRIC HEATERS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Electric Heaters.

1.3 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Product Data: Submit product information on all items.

1.4 GENERAL REQUIREMENTS

A. Listing: All heaters shall be listed by an independent testing laboratory for the application indicated.

B. Installation Verification: Prior to ordering units confirm finishes at heater location and type of installation and associated trim required; i.e. fully recessed, semi recessed, surface mount, etc.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products: Shall comply with Section 23 05 00 Part 2.01 - Acceptable Manufacturers.

B. Ceiling Heaters: Q-Mark, Chromalox, Berko, Markel.

C. Duct Heaters: Indeeco, Berko, Markel, Q-Mark, Warren.

2.2 CEILING ELECTRIC HEATERS

A. Type: Heavy duty ceiling mounted electric forced air heater.

B. Construction: Exposed sheet metal shall be constructed of minimum 20 gauge steel, with extruded louvered front, for surface, recessed, or suspended (T-bar) ceiling installation as shown on the drawings. Provide with mounting kits and trim to suit

ceiling type being installed in. Unit shall have a powder coated finish on steel, white color.

C. Heating Elements: Unit shall have two or three heavy-duty, totally enclosed, corrosion resistant, steel sheathed elements, mechanically bonded to common corrosion resistant fins.

D. Motor and Fan: Motor shall be total enclosed, permanently lubricated type. Provide with fan delay switch to dissipate residual element heat.

E. Electrical and Controls: Unit shall have integral thermal overload to disconnect heat if normal temperatures are exceeded. Thermostat shall be 7-day programmable wall mount type. Provide with integral disconnect switch per NEC requirements.

2.3 DUCT ELECTRIC HEATERS

A. Type: Open coil type electric duct heaters; of size and capacity as shown on the drawings.

B. Listing: Heaters shall be UL listed for zero clearance to combustibles, and shall be built to meet all requirements of the National Electric Code and NFPA.

C. Construction: Heating coils shall be made of 80% nickel and 20% chromium coiled resistance wire. Coils shall be supported in an aluminized steel frame and insulated by floating ceramic bushings. Heaters shall be of the configuration to suit the application as shown on the drawings.

D. Overtemperature Protection: All heaters shall be equipped with primary and secondary overtemperature safety devices. The primary safety device shall be a disc or liquid filled bulb type with automatic reset; the secondary device shall be a disc type with manual reset, wired in series with each heater stage, set to trip at a higher temperature than the primary safety device.

E. Overcurrent Protection: Fuses shall be provided for overcurrent protection; fuse capacities shall be rated for at least 125% of the circuit amperage.

F. Proof of Air Flow: Where project's control system is the DDC type, and heater is controlled by the DDC, proof of airflow is to be provided via the DDC system; no proof of airflow devices are required to be furnished integral with the heater. For non-DDC control systems or where the DDC control system is not providing heater control, provide heater with differential air pressure device and sensing tube (or sail flow switch), interlocked with the heater to prevent heater operation in case of insufficient airflow across the coil. Differential air pressure device (or sail flow switch) shall have sufficient sensitivity to suit velocity and duct pressures of the application. Configure and arrange differential air pressure device (or sail flow switch) for proper operation as the application requires. Air differential air pressure device shall have a pitot tube on high pressure side installed to sense duct total air pressure; except where heater is used on the suction side of a fan, the air differential air pressure device shall be connected to the low pressure side and be configured sensor to measure static pressure only. Where sensitive enough differential air

pressure devices (or sail flow switches) are not available, provide heater with 24 volt relay for interlocking to a fan proof device (i.e. motor starter auxiliary contacts, fan start relay, or equivalent).

G. Terminal Box: All heater controls shall be mounted in a side mounted terminal box, unless a separate remote mounted terminal box is shown on the drawings. Terminal box shall be insulated from the heater casing.

H. Disconnect: Heaters shall be provided with a built-in power disconnect switch, having a terminal door interlock.

I. Controls: Heaters shall be furnished with 24 volt transformer and shall be for use with 24 volt controls unless indicated otherwise. Transformer shall have secondary fusing, and transformers which are not class 2 shall have primary fusing. Mercury control contactors shall be used for controlling heater stages unless indicated otherwise. Where SCR control has been indicated the heater shall be furnished with a solid state proportional power controller allowing modulation of heater capacity from 0 to 100% of full capacity. The SCR control shall energize the heater only for the number of AC cycles necessary to produce the amount of heat required. For heaters with loads greater than 90 amps SCR control combined with a step controller in a vernier configuration (still providing full proportional control) is acceptable. (Backup or safety contactors - where used - shall be magnetic type).

J. Electrical: Heaters shall be for use with electricity of the voltage and phase indicated, and provide the output and number of control stages indicated. Three phase heaters shall have equal balanced three phase circuits. Heater element circuits shall be subdivided so that no circuit load exceeds 48 amperes. All internal wiring shall be suitable for 220 degrees.

K. Pressure Plate/Baffle: Provide plate to allow for uniform flow across heater; fabricate of galvanized steel; pressure drop shall not exceed 0.20" wc.

2.4 BASEBOARD ELECTRIC HEATERS

A. Type: Electric baseboard heater, commercial style, conventional appearance. Q-Mark QMKC series (or approved).

B. Enclosure and Cover: Enclosure shall be fabricated of minimum 0.024-inch steel with minimum 0.040-inch steel control boxes. Support brackets shall be 0.035-inch steel. Junction box enclosure to have provisions for incoming and outgoing wiring with clamp for restraining wiring without additional hardware. Ground wire pigtail shall be provided in each junction box for grounding. The front cover shall be fabricated of minimum 0.048-inch steel.

C. Size and Capacity: Length and heating capacity as indicated on the plans. Unit depth shall not exceed 3-inches; height shall not exceed 8-inches.

D. Heating Element: The heating element wire shall consist of 80% nickel, 20% chromium, and shall be encased in steel sheath to assure long and trouble free life. Aluminum fins shall be so designed as to block sheath radiation to front and back of

heater body and be pressure bonded to steel sheath.

E. Finish: Heater visible surfaces shall have factory applied off-white polyester powder coat paint finish.

F. Electrical: Heater shall be for use with power of voltage and phase as indicated on plans.

G. Controls:

1. Safety: Heater shall have a linear thermal cut-out, factory installed; cutout shall automatically shut off heater in event of overheating and reactivate heater when temperatures return to normal.

2. Thermostat: Heater shall have line voltage, wall mounted electric thermostat for heater control.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with Section 23 05 00. Install in accordance with manufacturer's written instructions, code, applicable standards and best construction practices.

B. Coordination: Coordinate heater power and control requirements with other trades; confirm location of any required heater contactors, relays, thermostats, and similar devices. Provide any required wiring for proof of fan operation between fan devices and heater; wiring shall comply with the HVAC control portion of the specifications and Division 26.

C. Location and Trim Verification: Install equipment at locations indicated in accordance with the Contract Documents. Review and confirm installation locations, that proper clearances are provided, unit controls are accessible, and installation has been coordinated with other trades.

D. Complete Connections: Connect and install all items shipped loose with units; provide and connect all contactors, relays, wiring, interconnections and accessories as required for proper unit operation.

E. Cleaning: Units shall be thoroughly cleaned (internally and externally) of all debris prior to operation. Units shall be clean and in new condition prior to Owner acceptance.

F. Owner Instruction: Instruct Owner on equipment operation and maintenance.

3.2 START-UP

A. Pre Start-Up Inspection: Inspect equipment and connecting systems to confirm equipment and connecting systems to confirm equipment has been installed properly

and is ready for start-up. As a minimum, check for: proper voltage and phases, correct electrical connections, complete control connections, all unit safety devices properly set and connected, coils clear of obstructions, and other items as listed by the manufacturer are properly provided/connected and operating to ensure safe and proper start-up. If items are discovered that prevent start-up to be completed, notify the installing Contractor and Engineer of issues. Coordinate and re-schedule start-up after items are corrected.

B. Start-Up: Perform start-up in accordance with manufacturers written start-up procedures. Observe proper operation of all unit components.

C. Adjustments: Adjust and set unit components to allow for proper operation. Observe unit to detect any unusual vibration, leakage, loose wiring, or other situations that could affect unit operation.

END OF SECTION 23 82 46

SECTION 25 50 00 – INTEGRATION AUTOMATION FACILITY CONTROLS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 00 and 01 Specification sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 SECTION INCLUDES

A. Control System Design.

B. Complete Mechanical System Controls.

C. Control Devices, Components, and Wiring.

D. Control System Commissioning.

1.3 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Product Data: Submit manufacturer's product data for all items to be used. Provide a complete materials list, labeled to match labeling used on shop drawing, with manufacturer and model number.

C. Shop Drawings: Submit shop drawings of complete control system, including the following information: interconnect drawings showing all wiring and control connections, all control device locations, sequence of operation for all controlled systems ,building floor plans with all proposed thermostat and other control device locations shown.

1.4 QUALITY ASSURANCE

A. Skilled Workers: The entire control system shall be installed by skilled electricians, technicians, and programmers, all of whom are experienced, properly trained and qualified for the work they perform. Contractor shall submit evidence of workers' experience and training upon request of the Engineer.

1.5 GENERAL REQUIREMENTS

A. Single Contractor: One single Company shall be responsible to design, furnish and install
the complete Division 25 control system. Any subcontracted installation work shall be done by firms experienced and qualified in the work they perform, and subject to approval by the Engineer.

B. Local Contractor: System shall be designed, programmed, and commissioned by local office personnel.

C. Programming Point Names: Custom point naming is required to match the Owner's standard point naming scheme. Coordinate with Owner to confirm standards.

D. Existing Systems:

1. Existing Controls: Existing controls are the DDC type, with controllers and other major components manufactured by Automated Logic. New controls shall be the DDC type and shall be an extension and revision of the existing system; using components by the same manufacturer, with the same capabilities, and fully compatible with the existing system. Extend and revise system to include new equipment and items indicated. Revise and add system graphics to reflect all project work and to include new equipment and new items.

2. System Demolition and Revisions: Remove existing controls and revise control system as necessary so that existing items that remain continue to operate properly. Revise existing system graphics to reflect demolished portions of systems. Revise existing control wiring and control components as necessary to properly reconnect to all relocated and revised equipment so that the equipment and system operate properly. Revise and relocate existing wiring and control device locations to suit all revised areas.

3. Wiring and Component Reuse:

a. Existing controls materials may only be reused where specifically indicated.

b. Where indicated to be reused, verify existing system wiring and the details of the components to be reused; confirm they will operate properly with the new equipment and system revisions.

c. Existing components that are indicated to be reused shall be assumed to be in working condition (i.e. temperature sensors, relays, etc.) unless noted otherwise; however, Contractor shall review the operation and functionality of these items to confirm their condition and notify the Owner of any issues or component failure.

d. All reused items shall be cleaned, re-calibrated (where they have a calibration feature), and be adjusted/set for proper operation for the project.

PART 2- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Products shall comply with Section 23 05 00.

B. Control System Manufacturer: Automated Logic.

C. Other Control Components and Accessories: Idec, Hoffman, McDonnell, Tridelta, Veris,
Kele, Edwards, Mamac, APC, Barksdale, Mark-Time, Functional Devices, and control system manufacturer listed.

2.2 BASIC SYSTEM

A. General: The work involves revising the existing control system to accommodate project
demolition, new HVAC equipment and related revisions. The system shall be a distributed processing type direct digital control (DDC) system same type as the existing. System shall provide complete stand-alone temperature control/monitoring and energy management for this project, using a network of various independent controllers, sensors and associated devices interconnected in a communicating network.

B. System Protocol: Same as existing (Automated Logic).

C. Network: All controllers shall be interconnected in a communicating network to provide facility wide access to work stations and sharing of information. A Local Area Network (LAN) shall be provided to interconnect controllers for high speed data transmission. Failure of a single or multiple controllers shall not cause loss of communication between other LAN-connected controllers still active. The control system LAN shall be separate and independent from other building LAN's (except for a single data terminal connection at a single system workstation).

D. System Performance:

1. Graphics: System shall display a graphic with at least 20 dynamic points with all current data within 10 seconds of being initially displayed. System shall refresh a graphic with at least 20 dynamic points with all current data within 8 seconds.

2. Object Command: Commands of a binary object entered at local workstations shall be executed at the commanded device within 2 seconds of being entered; analog objects shall start to adjust within 2 seconds.

3. Current Data: Any data used or displayed at a controller or local workstation shall
be current within the previous 6 seconds.

4. Alarm Response: Maximum time between an alarm event at it being annunciated shall be 45 seconds.

5. Program Execution Frequency: Applications shall be capable of running as often as every 5 seconds; select execution times that are consistent with the process under control and provide optimum comfort and control of setpoints without excess deviation. Controllers shall be able to execute PI and PID control loops at a selectable frequency of at least once per second; with the process value and algorithm output updated at this same frequency.

6. Reporting Accuracy: Control system reporting end-to-end accuracy shall be no less than the following: Temperatures: Plus/minus 1 deg F.

7. Stability: System shall provide stable and accurate control operation without excessive variation of controlled variables; variation shall in no case be more than 1.5 the reporting accuracy for temperatures, and the same as the reporting accuracy for other variables.

2.3 CONTROLLERS

A. General: Shall be manufacturer's standard controllers used for commercial DDC systems similar to others currently used on this Owner's facilities. Controllers shall comply with the system communication protocol specified and allowing the system to provide the specified features and sequence of operation. Type, capacities, arrangement and features shall be Contractor selected to provide an overall system complying with Contract Document requirements.

B. Terminal Unit Controllers (TUC's): Controller specifically designed for control of individual air handling units, fans, VAV terminal units, and similar type units; controllers shall be microprocessor based and shall contain a non-volatile resident program to allow for proper sequencing of controlled equipment. An individual controller shall be provided for each piece of unique equipment. Each terminal controller shall be accessible for purposes of control and monitoring from a central or remote operator's terminal as specified herein.

2.4 TEMPERATURE SENSORS

A. Room Temperature Sensors: Existing to remain (unless noted otherwise).

B. Duct Temperature Sensor: Shall be solid state electronic type, employing a resistance type output. Factory calibrated accuracy of plus/minus 0.5 deg F with a temperature range shall be -40 to 160 deg F. The sensor shall include a utility box and gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 5 foot long sensor element installed so as to sense a representative sample of the medium being controlled.

2.5 ACTUATORS

A. General: Actuators shall use a brushless DC motor controlled by a microprocessor with protection from overload at all angles of rotation. Run time shall be constant, independent of torque. Actuator shall have manual positioning mechanism and direction of rotation control switch and visual position indicator. Housing shall be NEMA rated to suit the conditions at the actuator location.

B. Type: Proportional or two position or floating point type, as required for application. Proportional type shall modulate in response to a 2-10 VDC, or 4 to 20mA control input. Provide with auxiliary switches as required for sequence of operation and to allow for safe operation of items served (and interlocked items), switches shall meet requirements for "double insulation" so an electrical ground is not required.

C. Automatic Closure: Actuator shall spring return upon power interruption, spring return position shall be fail-safe as dictated by freeze, fire or temperature protection requirements; except that actuators required to be the fast operating type may utilize a capacitor discharge for fail-safe closure in lieu of spring (subject to Engineer's approval). Spring return is not required for air terminal units or zone damper.

D. Performance: Actuator power and torque shall be sufficient to match valves being controlled and allow proper damper and valve operation against system pressures liable to be encountered. Actuator shall be capable of driving control devices from full closed to full open in less than 90 seconds (unless indicated otherwise) and where fast operating type are required (i.e. where interlocked with equipment operation). Where actuators serve valves directly serving equipment or are interlocked with equipment operation verify required operating time of actuator with equipment manufacturers and timing of other system components to allow for proper system operation without nuisance shutdowns of equipment or creating undesirable effects due to improper actuator response time.

E. Accessories: Units shall be complete with all brackets, and hardware required for mounting and to allow for the proper control for the application.

2.6 CONTROL DAMPERS

A. Type: Low leakage control dampers, parallel blade or opposed blade type as selected by Division 25 contractor to best suit application (unless a specific type is indicated).

B. Leakage: Class 1A leakage rated in accordance with AMCA 500-D.

C. Construction: Construct of galvanized steel, except where installed in ducts of stainless steel or aluminum construction or handling corrosive air, shall be of stainless steel or aluminum construction (to match duct material) or have corrosion resistant coating. All materials in contact with the airstream shall be suitable for the conditions without deterioration. Frame shall be minimum 16 gauge with reinforced corners.

D. Blades: One-piece airfoil shape, not exceeding 6 inches in width, minimum 16 gauge, with neoprene, extruded vinyl or butyl rubber edge seals and flexible metal jamb seals; linkage interconnecting all blades and actuator axle.

E. Bearings: Nylon, molded synthetic, or oil impregnated sintered metal bearings (or other materials as conditions require).

2.7 ACCESSORIES

A. Wiring and Conduit:

1. Basic Materials: As specified in Division 26.

2. Power Wiring: 18 AWG minimum and rated for 300 VAC service. Wiring for circuits greater than 24 V shall be as specified in Division 26.

3. Analog Signal Wiring: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

4. Life Safety Applications: Wiring that performs code required life safety control (e.g. shutdown of equipment), control of engineered smoke systems, fire alarm interface and similar functions shall comply with code and NFPA standards for fire alarm system wiring and the specific application.

B. Labels:

1. General: Shall comply with Section 23 05 00.

2. Control Devices: Labels on control devices shall use the same designation that appears on the control shop drawings and an indication as to purpose; except that devices in finished rooms shall be labeled as to the generic item controlled for better user understanding (i.e. "Room Exhaust Fan", "Hood Fan").

3. Wiring: Wiring labels shall be the self-laminating or heat shrink type with numbering, lettering, or an alpha-numeric identifier indicating the wire signal/power purpose and matching the designation that is used on the control drawings.

C. Control Cabinets: Wall mounted, NEMA rated construction, type and rating to suit location environment, UL listed, minimum 14 gauge sheet metal, hinged front door with latch. Size as required to house controls. Controls/devices shall be logically assembled in cabinet, with all devices and cabinet labeled.

D. Relays/Contactors: Shall be the single coil electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contacts shall be doubled break silver to silver type protected by arching contact where necessary. Number of contacts and rating shall be selected for the application intended. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage. Relays shall have mechanical switching to allow manual operation of relay and LED light to indicate the energized state.

E. Thermowells: See Section 22 09 00.

F. Miscellaneous Sensors/Transmitters/Switches/Transformers: Shall be manufacturer's standard, designed for application in commercial building HVAC control systems, compatible with other components so as to provide sequence of operation specified.

2.8 SWITCHES

A. Current Monitoring Switches: Electric current sensing device with integral switching contacts. Device shall sense current (amperage) through the conductor the device is applied to and activate switch action (to make and break contacts) once current reaches

a preset value. Device shall be able to be clamped around conductor, and be removable. Switch rating, size, switching current, and type selected by Contractor to suit application and provide the required function. Provide type specifically rated for the motor and load type being applied to.

B. Air Flow Switches: General Purpose utilizing differential air pressure, SPDT snap-acting contacts, adjustable 0.1in. W.C. to 2.0 in. (minimum), neoprene diaphragm, all aluminum construction.

2.9 PRESSURE AND VELOCITY SENSOR/TRANSMITTERS

A. Air Velocity Transmitter: Shall be a duct mounted instrument that measures the difference between total pressure and static pressure to get velocity pressure. Measurement shall be by a pitot tube located in the moving air stream or by a duct mounted air flow measuring station. The transmitter shall be an industrial quality device that produces a linear output directly proportional to the input utilizing an integral square root extractor. The air velocity span shall be a segment of the range between 200 and 5000 feet per minute.

B. Air Pressure Transmitter: Shall universally measure very low static or differential pressure using a variable capacitance technique. Static pressure shall measure in ranges from 0 to 10 inches water column. Differential air pressure shall have a range of 0 to +/-0.5 inches. Transmitter accuracy, including non-linearity, hysteresis and non-repeatability shall be within 1% of full scale. Provide zero and span adjustments for a proportional output of 4-20ma.

C. Air Differential Pressure Sensor: Electronic transducer, incorporating linear variable differential transformer type sensing element with two-wire 0-10 VDC transmitter. Accuracy shall be +/- 2% of full scale. Submit chosen spans for review.

2.10 VARIABLE FREQUENCY DRIVES

A. Type: Adjustable frequency and voltage variable speed controller, pulse width modulated type.

B. Controller: Shall be housed in a NEMA 1 (or better) enclosure, and shall provide 6 to 60 Hz adjustable torque output. Standard Features:

1. Start-stop speed selection.

2. Manual speed potentiometer.

3. Input fuses.

4. Insensitive to incoming power phase sequence.

5. Adjustable volts/Hertz.

6. Output frequency stabilized to + 0.5% of set speed for +10% to -5% change in line voltage of 15 degrees C change in ambient temperature.

7. Three-phase output voltage regulated to + 1% of rated voltage with +10% to -5% variations in plant power.

8. Standard off-the-shelf, NEMA B and synchronous motors (3600, 1800, 1200 rpm) usable without derating controller.

9. Automatic shutoff under output short circuit conditions or when load current exceeds 150% of maximum output amps (RMS).

10. Input fuses.

11. Line transient protection to prevent power line transients from harming the controller.

12. Relay contact to provide external signal for alarm and run condition.*

13. Monitor lamps (or LCD display) indicating: power on, zero speed, enabled, unit failure (with type indicated).

14. Hand-Off-Auto switch.

15. Auto restart after power outage.

16. Isolated Process control Follower - accepts 0 to 5 mA, 1 to 5 mA, 4 to 20 mA, 10 to 50 mA, 0 to 10 V D-C or 25 to 250 V D-C signal.

17. Input Disconnect (meeting NEC requirements for unit power disconnect).

18. Output Contactor - for positive motor disconnect.

19. Output Overloads - using individual phase bimetallic thermal sensors.

20. Ammeter - ampere scale depending upon drive rating.*

21. Voltmeter -0 to 500 volt (460 volt drives); 0 to 750 volts (575 volt drives).*

22. Frequency Meter - 0 to 120 Hz scale.

23. Manual Bypass - To switch the motor to or from the controller to the line.*

* Not required on units serving fans under 2 hp.

C. VFD shall be for use with specified equipment. Unit shall accept appropriate control signal and provide for variable speed operation of unit served.

D. System shall be fully compatible with motors furnished, and shall be free of audible noise exceeding an NC of 45 in any octave band.

E. Basic Control Inputs/Outputs: Unit shall accept 4-20 mA control signal and provide for variable speed control of unit served. Unit shall have dry contacts that when connected enable VFD to operate, secondary dry contacts for emergency stop function,

dry contacts for alarm output.

F. Motor Compatibility: System shall be fully compatible with motors furnished, and shall be free of audible noise exceeding an NC of 45 in any octave band.

G. Outdoor Enclosure: Wall (or floor) mount style, NEMA rating to suit application (NEMA 3R or better), constructed of minimum 16 gauge stainless steel with hinged front door with lockable latch. Size as required to house VFD with suitable clearances. Enclosure shall be fan ventilated and heated to maintain suitable conditions for proper VFD operation with ambient temperatures of 10 deg F to 95 deg F and with exposure to direct sunlight. Provide electrical wiring, controls, devices, and overcurrent protection so that no additional power circuits are required for fan and heater operation.

H. Network Communications:

1. VFD shall include the following communication as standard without additional card. BACnet I/P, Modbus TCP, Modbus RTU, BACnet MS/TP. Drive shall be BTL listed to Revision 14 or later.

2. The drive shall be classified as an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:

a. Data Sharing: Read Property Multiple-B, Write Property Multiple-B, COV-B.

b. Device Management: Time Synchronization-B.

c. Object Type Support: MSV, Loop.

3. The drive's relay output status, digital input status, analog input/output values, Hand-Auto status, warning and fault information shall be capable of being monitored over the network. The drive's start/stop command, speed reference command, relay outputs and analog outputs shall be capable of being controlled over the network. Remote drive fault reset shall be possible.

PART 3- EXECUTION

3.1 INSTALLATION

A. General: Provide complete control system design, all computer software and hardware, operator input/output devices, sensors, relays, switches, dampers, actuators, conduit, tubing, wiring, motor starters, transformers, control cabinets, power panel circuit breakers, and all other components required to provide a complete control system with the system features and sequence of operation specified. Select control components with proper characteristics to suit the application, meet specified system performance, provide specified system features, and provide the specified sequence of operation. Coordinate work with other trades. Review as-builts and field conditions for work involving existing systems or replacements of existing systems. Develop as-builts of

existing systems as needed to perform the Work. Perform field reviews prior to developing shop drawings.

B. Electrical Power and Wiring:

1. General: All work shall comply with code and Division 26 requirements. Run conduit and wiring in neat lines, parallel with building construction and coordinated with other trades. Use wire type and size as required by code and recommended by component manufacturers and to suit the application conditions.

2. Conduit: All wiring shall be installed in conduit and in accordance with Division 26 section of these specifications, except that low voltage wiring within ceiling plenum spaces and in mechanical mezzanine areas may be ran without conduit provided that plenum rated cable is used. Install all conduit and wiring parallel to building lines.

3. Electrical Power:

a. Scope: It is the responsibility of the Division 25 Contractor to provide power for all control devices requiring electrical power. Coordinate with the Division 26 Contractor to confirm which panels and circuits are to be utilized. Provide all electrical wiring, conduit, junction boxes, circuit breakers, grounding, panel circuit breakers (of proper size/type), transformers, enclosures and all other components as needed to power all control devices.in accordance with code and Division 26 requirements.

b. Sources: Power for control devices shall be obtained from electrical panels and not from power serving the equipment (unless noted otherwise or the Engineer gives approval). Utilize panels located closest to the items served to the greatest extent possible. Where the building has a generator, equipment served by the generator shall also have their control power (i.e. power to control devices which allow the item to be controlled and monitored) shall also be served by the generator (this is in addition to any required UPS').

4. Service Loop: Provide minimum of 6" extra wiring at all wiring terminations for ease of future maintenance/servicing. Such extra wiring shall be neatly coiled/bundled to allow for uncoiling when the connected equipment is serviced.

C. Equipment Interconnect Wiring:

1. General: In addition to control wiring between equipment and control devices (furnished under this Section) to accomplish the specified sequence, provide added control wiring to interconnect equipment components and associated control/safety devices. Provide as required by the equipment manufacturers to allow for proper operation of the equipment and system.

2. Minimal Wiring Required: For bidding purposes, assume a minimum of four wiring connections for each piece of equipment to an adjoining/connecting piece of equipment and/or device(s), and special wire type and special connectors as required by the equipment manufacturer. Coordinate and review all requirements with manufacturers, contractor installing the equipment, and local representatives to confirm scope.

3. Equipment: This work applies to:

   a. Split system HVAC Equipment: Connect between indoor and outdoor units, and between the indoor unit and its thermostat.

   b. Chillers: Connect between chillers and devices for field installation in the chilled water system (includes flow switch and temperature sensors).

D. Labeling: All control components, except regular room thermostats, shall be labeled. All control wiring shall be labeled except where color coded wiring is used and the control shop drawings clearly identifier wiring for each color and it is fully consistent through-out the entire project. Submit list of proposed labeling prior to installing.

E. Complete Functions: Provide complete system totally programmed to provide all specified functions, including but not limited to:

1. Time and Holiday Schedules.

2. Alarm Limits.

3. Optimum Start of Each Zone.

4. Dynamic Graphic of Each Distinct Floor Area; include graphic key to allow changes in graphic display.

5. Dynamic Graphic of Each Mechanical System; include graphic key to allow changes in graphic display.

6. Summary of All Zone Temperatures.

7. Summary of Data for Each Zone.

8. All Displays Specified in Sequence of Operation.

9. Master Menu and Graphics as requested by the Owner.

10. All Controller Setpoints and Operational Values Required.

11. Demand Limiting.

12. Optimum Start/Stop and Warm-up.

F. Programming: Provide complete system totally programmed to provide all specified sequences, monitoring data, communications and features.

3.2 MONITORING DATA

A. General: Monitoring information shall be provided at graphic user interface. Provide all necessary controls/devices to provide the data indicated. Monitoring data listed is not a "points list" but is a list of items that shall be monitored and is in addition to data (or "points") required by the sequence of operation and other specification requirements. A complete "points list" shall be compiled by the Division 25 Contractor based on all system requirements and sequence.

B. Chiller:

1. Unit commanded on/off status.

2. Entering water temperature.

3. Leaving water temperature.

4. Alarm Indication each compressor circuit (connect to unit contacts).

5. Compressor on/off (digital signal via CT's at power supply to each compressor).

6. Water temperature setpoint.

7. Water temperature setpoint adjustment.

C. "REF" Fans:

1. Fan on/off status.

2. Fan commanded status (on/off).

3. Fan failure alarm; (i.e. not "proven" on when commanded on).

4. Fan commanded speed (% of max speed).

5. Inlet duct static pressure.

6. Inlet duct static pressure setpoint.

D. Air Handling Units (all units with fans and ability to heat or cool environmental air):

1. Maintain all existing monitoring points.

2. Mixed air temperature at unit.

3. Outside air and return damper positions (% commanded open).

E. Duct Heater:

1. Setpoint.

2. Entering Air Temperature.

3. Leaving Air Temperature.

4. Percent commanded on (% of full).

F. VRF System: Integrate with the VRF system to allow for monitoring of VRF system operation, and for time scheduled setting.

3.3 START-UP

A. Calibration and Commissioning: As each part of the systems become operational, this Contractor shall calibrate all sensing and readout devices and shall test and observe the operation of each and every air moving and/or heating unit and shall adjust all controls so that the items function according to the intent of the specifications. The control contractor shall commission all controls prior to the work of Section 23 08 00 being done. This commissioning work shall include a point-to-point check of all devices, check of sequences, check of proper wiring, and documentation substantiating the work.

B. Report/Statement: After making all necessary system testing and adjusting, the Contractor shall submit a report to the Engineer indicating all testing/adjustment work done and comment on how system is operating. Such report shall be signed by the individual directly responsible for supervision of the installation of the control system. When the Contractor feels that the system is complete and ready for review by the Engineer, Contractor shall submit a written statement (signed by same individuals as for report) stating that the system is in compliance with the project requirements and ready for review.

C. Owner Instruction: See Section 23 05 00.

D. Documentation: Contractor shall provide a hard copy documentation of the software application program for each digital controller (TUC, NAC). Documentation provided shall include block software flow chart showing the interconnection between each of the control algorithms and sequences for systems utilizing program listings. A program listing shall be printed onto the same blueprint, along with the program flow chart, and description of the sequence of operation. A hard copy of this document shall be stored and maintained in each stand-alone digital controller panel. System acceptance shall not be completed until this documentation is provided and located in each panel.

END OF SECTION 25 50 00

SECTION 25 90 00 – INTEGRATED AUTOMATION CONTROL SEQUENCE

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 23 05 00 apply to this Section.

1.2 WORK INCLUDED

A. Control System Design.

B. Control System Sequence of Operation.

1.3 SUBMITTALS

A. General: Comply with Section 23 05 00.

B. Sequences: Submit complete description of sequence of operation for all systems. Sequence submitted shall not be a direct copy of the sequence specified herein, but shall be written to reflect the actual control sequences provided and to more closely match the actual programming used.

1.4 GENERAL REQUIREMENTS

A. Bidder Design: The control system is bidder designed subject to the requirements of the Contract Documents.

B. Modifications: Software, graphics, and sequences shall be revised and updated as necessary to reflect Owner or Engineer desired changes. Contractor to include in bid no less than 16 hours of control technician's/programmer's time to accomplish the required system modifications.

C. Sequence Terminology: Wherever the control sequences refer to an article, device or piece of equipment in the singular number, such reference shall mean to include as many of such articles, devices, or equipment as are shown on the plans, required for the sequence, or required to complete the installation. Wherever the control sequence refers to an operating stage in the singular number, such reference shall mean to include as many stages as are specified for the equipment and shall mean analog (i.e. proportional) type control where specified for the equipment (reference drawings and equipment specifications).

D. All DDC Control: All controls and sequences shall be provided by the Division 25 DDC control system, unless specifically noted otherwise. Where interval timer,

switch control, or a similar manual control is indicated, the control device shall provide an input to the DDC system with the DDC system providing an output for control. No line voltage controls or other controls which do not "pass through" the DDC control system are allowed, unless directly stated that is the method of control to be used. Exceptions to DDC Control: emergency shut-down and similar safety devices required (or noted) to be hard wired. Split system standalone AC and HP units shall be controlled by their own integral controls. VRF system is to be controlled by its own controls (with monitoring by the Division 25 system).

PART 2 – PRODUCTS - NOT USED

PART 3 - INSTALLATION

3.1 GENERAL

A. Complete System:

1. General: Provide complete control system design, all software, programming, wiring, and control devices as required to allow for automatic control of all mechanical equipment and other systems as indicated; with sequences of operation and features specified. Provide all control interconnections between indoor and outdoor units, all required control connections between equipment components, and to any other devices needed for proper operation. See also Section 25 50 00 for related requirements.

2. Various thermostats, motorized dampers, and other devices are not shown on the drawings but are required per the sequence of operation specified. Coordinate with Engineer for location of all such devices prior to installing. Indicate proposed locations on submittals.

B. Sequences:

1. Additional Sequences: See Section 25 50 00 for system requirements that relate to control sequences; see drawings for additional control sequences and requirements.

2. Control Action: Sequences which involve maintaining a setpoint in response to variable conditions shall use proportional-integral (PI) or proportional-integral-derivative (PID) control (unless noted otherwise). Sequences shall comply with the system performance requirements and other requirements of Section 25 50 00.

3. Missing Sequences: Where no sequence of operation is indicated submit a proposed sequence to the Engineer for review. Such sequences shall match the intended equipment use, code, and ASHRAE standards for the type of equipment and application. HVAC equipment shall have control of heating/cooling operation by area thermostats and control of unit components (i.e. fans dampers) to allow for distribution of heating/cooling

and control of ventilation air; fans and similar on/off items shall have time schedule and thermostat control (unless the application clearly implies a different method).

C. Settings:

1. Adjustability: All settings, setpoints, and differentials shall be adjustable. All setpoints indicated are initial settings.

2. Confirm Settings: Confirm with Owner all setpoints, all time schedules, and all other adjustable programming parameters before substantial completion.

3. Thermostat Setpoints: Shall be adjustable at operator's workstation, with initial settings as follows unless indicated otherwise:

Occupied Heating	70 degrees F
Unoccupied Heating	65 degrees F
Occupied Cooling	75 degrees F
Unoccupied Cooling	85 degrees F

D. Time Control: Maintain existing time control. Interface to new VRF system for time control of system.

E. Variable Speed Operation: On variable speed (including staged) equipment, start equipment low speed (or other appropriate speed as recommended by equipment manufacturer or system requirements) and control speed changes at a rate that is coordinated with other equipment to provide proper system operation without undesirable effects, nuisance trips and system alarms.

F. Alarms: Provide alarms for the following:

1. Equipment in alarm (where equipment alarm state is monitored).

2. Safety device alarm (where device is monitored by or connected to the control system).

3. Sensor failure (out of range).

G. Fire/Smoke Shutdown: Shut-down all air handling equipment when the building fire alarm system goes into alarm. Contacts in the fire alarm system are available for this purpose. This shut-down may be accomplished by use of control logic and is not required to be hardwired but shall be of a fail-safe nature so as to provide the necessary shut-down in case of control failure and the control components shall be rated for such purposes (as required by the AHJ).

H. Automatic Restart: Equipment shall automatically restart after being shut-off by a power outage, fire alarm, smoke detector, or similar alarm (or fault); upon clearing of the alarm (or fault). System shall revert to its normal operation for the conditions at the time of restarting.

I. Interlocks: May be accomplished by software rather than field hard wired relays or other devices, except for: fire alarm shut-down of equipment 2000 cfm and greater, freezestat shutdown, boiler and chiller emergency shut-off switches, where required by manufactures, where required by AHJ, and where noted to be hard-wired.

3.2 CHILLER

A. Water Temperature: Chiller staging and water temperature control shall be by integral controls furnished with chiller (see Section 23 64 00).

B. On/Off Sequence: Retain existing sequence.

C. OA Reset: Retain any existing reset of chilled water temperature.

3.3 ELECTRIC HEATERS – DUCT TYPE

A. General: Heater shall be controlled by a duct mounted temperature sensor and outdoor air temperature sensor. Heater capacity shall be varied to meet the supply air set point.

B. Operation:

1. Staged Heaters: Heater shall be allowed to operate once the outside air temperature has fallen below set point (initially set at 60°F) and duct air temperature (downstream of heater) has fallen below set point (initially set at 70°F) with staged control between on/off limits.

2. SCR Heaters: Heater shall be allowed to operate once the outside air temperature has fallen below set point (initially set at 60°F) and duct air temperature (downstream of heater) has fallen below set point (initially set at 70°F) with proportional control between on/off limits.

C. Interlock: Shall be hard-wire interlocked with the supply fan on the unit which serves the heater, to only allow heater operation when the unit's fan is proven on. Provide differential pressure switch or CT's at unit fan to provide interlock and proof of operation.

3.4 ENERGY RECOVERY VENTILATOR (DOAS)

A. General: VRF controls shall provide time schedule control of the Energy Recovery Ventilator (ERV or DOAS) in conjunction with the heat pump units. ERV mode shall match the mode for the VRF system served, except that when any heat pump (served by the ERV) is in the occupied mode, the ERV shall be on in the occupied mode.

B. Occupied Mode: Supply and exhaust fans are on.

C. Unoccupied Mode: Unit shall be off.

D. Warm-Up Mode: Unit shall be off.

3.5 REF FANS

A. On/Off: Fans shall be off unless the number of units served by the fan in the occupied mode exceeds the "units on" setpoint (initially set at four for the REF-1 and three for REF-2) and the average of their outdoor air damper positions is greater than the "open percent" setpoint initially set at 40%. Start fans in low speed with slow ramp up to controlled speed.

B. Speed Control: Fans shall be controlled by the static pressure in the return duct to the fan, initial setpoint to be minus 0.5-inches wc.

C. Dampers: Dampers with fans shall be open when fan is on and closed otherwise. Provide end switches on damper to confirm dampers are open prior to starting fans.

3.6 FAN COIL UNITS

A. General: retain existing fan coil sequence, except add the economizer sequence to the cooling operation.

B. Cooling: Unit shall have an outside air economizer as the first stage of cooling. Economizer shall be dry bulb or enthalpy type, using OA temperature sensor, Mixed Air, (MA) temperature sensor and supply air (SA) temperature control scheme. Economizer shall be enabled only when OA temperature (or enthalpy) is less than the units Return Air (RA) temperature (or enthalpy). The OA/RA dampers shall be modulated as required to satisfy the SA temperature control scheme and shall be limited by a MA sensor low limit setpoint (initial setpoint 54 degrees F.) Shall operate in the cooling mode as the final stage of cooling. Modulate cooling coil control valve to provide a supply air temperature that will satisfy space setpoint as the final stage of cooling.

C. OA Dampers: OA dampers shall be in the minimum position when unit is in heating and under economizer control when unit is in cooling. OA damper shall not close below the minimum airflow setting indicated on the plans; coordinate with balancer for minimum setting.

END OF SECTION 25 90 00

SECTION 26 01 00 – ELECTRICAL GENERAL REQUIREMENTS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Division 27 - Communications.

C. Division 28 - Electronic Safety and Security.

1.2 SECTION INCLUDES

A. General requirements specifically applicable to Division 26.

B. General requirements of this section also apply to Divisions 27 and 28.

1.3 SCOPE OF ELECTRICAL WORK

A. Provide electrical systems and Work described, identified, specified, referenced, and shown in the Project Documents that are covered under Divisions 26, 27, and 28 of the Construction Specifications Institute (CSI) and/or as otherwise regulated by national, state, and local electrical codes. Electrical Work includes providing all equipment, materials, devices, appurtenances, and accessories necessary to provide complete and operating systems according to the intent of Project Documents.

B. Electrical work is not limited to Division 26, 27 and 28 specifications and what is shown on the electrical drawings. The Contractor is responsible to review all Project Documents for additional Electrical Work and requirements and to include this work as part of their scope under the Contract.

1.4 REGULATORY REQUIREMENTS

A. Comply with requirements of the following codes as adopted and supplemented by authority having jurisdiction:

ANSI/NFPA 70 - National Electric Code (NEC)

NFPA 101 - Life Safety Code

International Building Code (IBC)

International Mechanical Code (IMC)

WAC 296-46B - Washington State Electrical Safety Standards, Administration, and Installation

Washington State Energy Code (WSEC)

B. Comply with additional codes and regulations referenced in other sections.

C. Comply with additional codes and regulations required by authority having jurisdiction.

D. Obtain and pay for permits, and inspections from authorities having jurisdiction over work included under applicable Division Sections.

E. Include all testing, shop drawings, and documentation required by the inspection authorities for permitting and final approval.

1.5 SUBMITTALS

A. Comply with requirements of Division 01. Unless otherwise specified, furnish product data and shop drawings to Architect/Engineer within 30 calendar days from date of contract signing as follows:

1. Product information sheets shall be neat, readable, 8.5 x 11 inch, submitted in PDF format. Generic product sheets with multiple products or product descriptions shall clearly highlight or otherwise indicate which product is being furnished. Product sheets shall be reasonably limited to not include entire catalog sections.

2. Furnish product submittals with a cover sheet and table of contents. Furnish a separate submittal and number for each section of the specifications. Cover sheet shall indicate name of the Project, Owner, Architect, Engineer, Contractor, and Date of Submittal. Product table of contents shall list each item submitted. Bookmark each submittal to facilitate browsing according to the type of products.

3. Furnish systems design shop drawings in PDF format. Title block shall include Project, Owner, Contractor, and Date of Submittal.

4. Furnish product data and shop drawings specifically indicating any conflict or deviation from requirements of contract documents.

5. Edited Content: Submittals shall indicate the equipment and options that are to be provided. Copies of an unedited catalog will be Rejected. Pages/items that are not applicable shall be deleted prior to submittal to the Engineer.

B. Confirm dimensions, ratings, and specifications of electrical materials, devices, fixtures, and equipment conform to project requirements prior to furnishing submittals. Coordinate electrical requirements with utilization equipment submitted under other sections and verify that voltage, phase, and rating are compatible with work shown in the electrical project documents.

C. Provide shop drawings showing proposed feeder and branch circuit wiring plan required under Section 26 05 00.

D. Do not order materials or commence Work until applicable submittal has been reviewed and the Architect/Engineer has accepted.

E. Re-Submittals: If submittals are marked 'Rejected' or 'Revise and Resubmit', the Contractor shall revise the submittal to satisfy the comments or conform to project requirements, and submit to the Engineer for review. Only those items that were rejected or required a resubmittal will be reviewed by the Engineer; All other items will not be reviewed. All re-submittals shall be at least one of the following:

1. Provide a 'Re-Submittal Summary Sheet' which indicates how each comment was addressed (it is acceptable to add the responses to a copy of the original submittal review comments).

2. Cloud (or otherwise clearly identify) the revised portions to indicate what is different from the original submittal.

1.6 SUBSTITUTIONS

A. Comply with requirements of Division 01. Products specified by naming one or more manufacturers establishes a basis for quality, styling, capacity, and function. Unless otherwise specified, written requests for substitution must be received at least 14 days prior to Bid Opening by Architect/Engineer who will determine acceptability of proposed substitution. Written acceptance must be obtained from Architect/Engineer prior to Bid Opening.

B. Substitution requests may be submitted for any manufacturer or named product unless specified as "no substitute".

C. Substitution approval does not relieve the Contractor of complying with the work requirements or the concept and intent of the project documents. Pay for any and all additional project costs that may be caused by Contractor requested substitutions, regardless of whether or not additional costs are overlooked, missed, or unforeseen, and regardless of when substitutions may be approved.

1.7 QUALITY ASSURANCE

A. Experience: All work shall be performed by individuals experienced and knowledgeable in the work they are performing, and experienced with the same type of systems and building type as this project. By virtue of submitting a bid, the Contractor is acknowledging that workers to be utilized on this project have such experience and knowledge. Upon request of the Engineer, submit resumes showing the work history, training, and types of projects worked on, for individuals assigned to this project.

B. Code: Utilize workers experienced and knowledgeable with codes pertaining to their work; verify code compliance through-out the project.

C. Quality Assurance Checks: Prior to ordering products and making submittals, confirm the following for each:

1. General: Product is suitable for the intended purpose and complies with the Contract Documents.

2. Manufacturer: Product's manufacturer is listed as an acceptable manufacturer in the Contract Document's or a substitution request (where allowed) has been submitted and the manufacturer has been listed as acceptable.

3. Electrical (for products requiring electrical power):

    a. Product is for use with the voltage/phase as indicated on the electrical plans (or for the electrical circuit the item will be connected to).

    b. Product's ampacity requirements (MCA) do not exceed that indicated on the electrical plans (or for the electrical circuit the item will be connected to).

4. Weight: Product's weight is no greater than that indicated.

5. Space Verification: Product will fit in the space available, and along the path available to install the item, will have adequate service clearances, and will not impede on any clearances required for other items in the space the item will be located.

6. Installation: A suitable method for installing the product has been selected which meets the project schedule and other requirements.

7. Anchorage/Support: The manufacturers recommended method of anchorage and support is consistent with the method indicated in the Contract Documents, and the item has provisions suitable for such anchorage/support.

8. Lead Time: The product's fabrication, shipping, and delivery period meets the project schedule requirements.

9. Substituted Equipment: Where equipment is not the basis of design confirm all requirements for substituted equipment have been met and shop drawings of construction revisions have been (or are being) prepared.

10. Controls: Item is compatible with the controls it will be connected to and has been coordinated with the firm providing the project control work to provide the specified (or required) sequence of operation.

11. Listing: Item is Listed when required to be as such. And if the item is to be installed as part of a Listed system or assembly, it is compliant with the Listing of the overall system or assembly.

12. Existing Buildings/Systems: Product size, weight, connecting services (i.e. electrical, controls, power, plumbing, etc.) are configured and suitable for existing items they connect to or interface with.

D. Check-Out: The Contractor shall be responsible to verify that proper installation and proper connections have been provided for all mechanical work. Contractor shall provide installation checkout, start-up services, and perform a thorough check of all mechanical systems to verify proper installation and operation. Contractor shall operate all items multiple times under varying conditions to confirm proper operation. Contractor shall submit a checklist listing all equipment, fixtures, and similar items furnished on this project, with a date and initials indicating when the item was checked, a list of what was checked, and by whom. Such check shall, as a minimum utilize documents provided by the equipment manufacturer. Such a check-out is in addition to any commissioning activities specified (unless noted otherwise).

1.8 RECORD DOCUMENTS

A. Comply with requirements of Division 01. Maintain at project site one set of clean, dry, and legible red-lined record drawings for submittal at Contract Close-out. Record information concurrently with construction progress.

B. Indicate electrical changes in the contract documents. Include change orders, revised branch circuit and feeder wiring layouts, revised circuit identification, pull & junction boxes added during construction, and actual dimensioned location and routing of each underground conduit on record drawings.

1.9 LABELING

A. Where labeling that includes room names and numbers is required for any system to identify devices or for programming purposes, use final room names and numbers determined during construction. Verify room names and numbers with Architect prior to manufacturing labels or programming software.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Comply with requirements of Division 01. Unless otherwise specified, furnish one labeled CD in PDF format and two duplicate hard copy printed sets of Operation and Maintenance Manuals prior to completion of contract. Submit hard copy manuals in labeled and indexed 3-ring binder(s).

B. Include the following information as applicable:

1. Names, addresses, and telephone numbers of the contractor, the installing sub-contractor, and the local representative for each system or equipment.

2. All approved product data and shop drawings.

3. Identify all manufacturer warranties which exceed one year.

4. Model number and serial number of each piece of equipment provided.

5. Data from test results performed under the Contract.

C. Operation and maintenance data shall include complete parts lists, installation and maintenance instructions, safety precautions, operation sequence describing start- up, operation, and shut-down, internal and interconnecting wiring and control diagrams with data to explain detailed operation and control, and testing methods for each system and item of equipment.

D. Furnish a draft copy of Operations and Maintenance Manual for Architect/Engineer review and incorporate comments prior to final submittal. Allow 14 days for Architect/ Engineer review.

1.11 CONFLICTS

A. Notify the Architect/Engineer of any conflicts or discrepancies before proceeding with any work or the purchasing of any materials related to the conflict or discrepancy until requesting and obtaining written instructions from the Architect/Engineer on how to proceed. Where conflicts occur, the most expensive and stringent requirement as judged by the Architect/Engineer shall prevail. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Architect/Engineer's instructions on how to proceed shall be done at the Contractor's expense.

1.12 WARRANTY

A. In addition to requirements covered under General Conditions or Division 01, include manufacturer product warranties that exceed one year. Assemble or list warranties that exceed one year in Operation and Maintenance Manuals indicating start date. Certificates of extended warranty shall identify the Owner as the beneficiary.

B. If the Electrical Contractor does not have offices located within 150 miles of the project, provide a service/warranty work agreement with a local electrical subcontractor approved by the Owner. The service/warranty work agreement shall extend for the contract warranty period, and a copy shall be included in the Operation and Maintenance Manuals.

1.13 INTENT OF PROJECT DOCUMENTS

A. Drawings and specifications are complementary and what is called for in either is binding as if called for in both.

B. The drawings are diagrammatic and show the general arrangement of the construction and do not attempt to show all features of work, exact construction details, or actual routing of conduit and cable. Provide all necessary supports, off-sets, bends, risers, fittings, boxes, wiring, and accessories which are required for a complete and operating installation. Determine locations for required electrical outlets and connections prior to rough-in base on equipment product and installation submittal data and/or review of equipment on site.

C. The level of design presented in the documents represents the extent of the design being furnished to the Contractor; any additional design needed to perform the

Work shall be provided by the Contractor. All design by the Contractor shall be performed by individuals skilled and experienced in such work, and where required by local code (or elsewhere in the documents) shall be performed by engineers licensed in the State where the project is located. Include in bid the costs of all such project design; including engineering, drafting, coordination, and all related activities and work. Contractor provided design services shall be included for but not limited to bidder design specifications, temporary electrical systems, layout routing to install the Work and share project space with other building systems, hanger and support systems, seismic bracing, preparation of shop drawings, locating and identifying requirements for equipment and fixture terminations, and methods/means of accomplishing the work.

1.14 COORDINATION

A. Examine architectural, civil, structural, and mechanical drawings and specifications and consult with other trades, as required to coordinate use of Project space and sequence of installation.

B. Arrange wiring and equipment to avoid interference with other work and to maximize accessibility for maintenance and repairs.

C. Coordinate with suppliers and installers to obtain product electrical data, shop drawings, and installation requirements for systems, equipment, and products furnished by Owner and/or other trades as required perform electrical work.

D. Contractor is responsible ensure that equipment, fixtures, and devices being furnished and installed shall fit the space available, taking into account connections, service access, and clearances required by product manufacturer and/or Code. Contractor shall make the necessary field measurements to ascertain the space requirements for proper installation, and shall furnish and/or install equipment so that final installation meets the intent of the Project Documents. If approval is received by Addendum or Change Order to use other than the originally specified items, Contractor shall be responsible for specified capacities and for ensuring that items to be furnished will fit the space available.

E. Contractor is responsible to review all the Project Documents and approved shop drawings provide under other divisions to identify and resolve conflicts between electrical systems and building construction, equipment, cabinets, counters, trim, and special finishes, prior to rough-in.

F. Facilitate coordination between low voltage system sub-contractors during construction. Include time for a minimum of one meeting with all sub-contractors prior to building rough-in to review requirements for each system per Section 26 05 30. Include a second meeting with all sub-contractors to review requirements for all systems utilizing IP structured cabling prior to cover.

1.15 REQUIREMENTS FOR EQUIPMENT FURNISHED UNDER OTHER SECTIONS OR BY OWNER

A. Provide power wiring, disconnect switches, electrical connection of equipment,

installation of furnished electrical controllers, parts, and accessories, and field wiring for systems, equipment, and products furnished under other divisions or by Owner. Install controllers, operator stations, and control devices such as limit and temperature switches furnished with equipment.

B. Review equipment submittals prior to electrical rough-in and installation. Verify location, rating, size, type of connections, and required space requirements. Coordinate field wiring requirements and details with supplier and installer. Notify Architect/Engineer of conflicts between requirements for actual equipment being furnished and equipment indicated in contract documents prior to commencing Work.

C. Provide motor controllers and operator stations unless otherwise indicated on the project drawings.

D. Make final connections to equipment. Provide cord and plug where required for plug-in connection.

E. Integrated automation systems covered under Division 25 are not included as part of electrical work.

1.16 DEFINITIONS

A. Electrical terms used in these specifications are as defined in NEC Art. 100 unless otherwise noted.

B. Abbreviations: Where not defined elsewhere in the Contract Documents, shall be as defined in RS Means Illustrated Construction Dictionary.

C. Accessible Ceiling: Signifies access that requires the removal of an access panel or similar removable obstruction.

D. The term "Architect," "Architect/Engineer" or "Engineer," means Hultz|BHU Engineers, 1111 Fawcett Avenue, Suite 100, Tacoma, WA, 98402.

E. As Required: As necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all codes.

F. Concealed: Hidden from view as in walls, trenches, chases, furred spaces, crawl spaces, unfinished attics, and above suspended ceilings.

G. Conduit: Includes conduit and tubing raceways.

H. Coordinate: Accomplish the work with all others that are involved in the work by directly discussing the work with them, arranging and participating in special meetings with them to discuss and plan the work being done by each, obtaining and completing any necessary forms and documentation required for the work to proceed, reaching agreement on how parts of the work performed by each trade will be installed relative to each other both in physical location and in time sequence,

exchanging all necessary information so as to allow the work to be accomplished with a united effort in accordance with the project requirements.

I. Equipment Connection: Make branch circuit connection, mount and connect control devices as required. Provide disconnect and overcurrent protection when required by NEC and IMC, if not otherwise indicated or furnished with equipment.

J. Exposed: Exposed to view in any room, hallway, passageway or outdoors.

K. Finished Areas or Spaces: Areas and/or spaces receiving a finish coat of paint on one or more wall surface.

L. Furnish: Obtain and/or prepare and deliver to the project.

M. Indicated: Shown, scheduled, noted, or otherwise called out on the drawings.

N. Install: Enter permanently into the project complete and ready for service.

O. Open Cable or Wiring: Conductors above grade not installed in conduit or raceway.

P. Panel: Distribution panelboard, lighting and appliance panelboard, load center, and/or low voltage cabinet.

Q. Provide: Furnish and install complete and ready for service.

R. Wiring: The assembly of conductors, raceways, an approved cable assembly, outlets, junction boxes, conduit bodies, fittings, and associated accessories.

S. Verify: Obtain, by a means independent of the project Architect/Engineer and Owner, the information noted and the information needed to properly perform the work.

1.17 SCHEDULE OF VALUES

A. Provide Schedule of Values for use by Architect/Engineer to evaluate progress payment requests during construction.

B. Submit Schedule of Values for review and approval. Include additional line items as requested.

PART 2 - PRODUCTS

2.1 MATERIALS, EQUIPMENT

A. General: Furnish only products that are new and free from defects with a manufacture date that is less than six months from date of installation. Where product and applicable software updates or upgrades are available from the manufacturer, furnish the latest version unless otherwise specified. Furnishing discontinued products and/or products of manufacturers who are no longer in business is not permitted.

B. Listing and Labeling: Furnish and install only products that are listed and labeled by one or more of the following testing laboratories as approved by the Authority Having Jurisdiction:

Underwriter's Laboratories, Inc.	(UL)
ETL Testing Laboratories, Inc.	(ETL)
Factory Mutual	(FM)

C. Each specified product and system to be furnished shall be from a single approved manufacturer. Providing multiple product brands or manufacturers for each type or category, or for multiple units of the same specified product and/or system, is not permitted.

D. Products shall be delivered, handled, and stored per manufacturer recommendations. Protect fixtures, materials, and equipment from rain, water, dust, dirt, snow, and damage. Do not install products that have marred, scratched, deformed, or otherwise damaged. Do not install products that have been wet or exposed to the weather prior to assembly and/or installation.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. Electrical work shall conform to requirements of ANSI/NECA 1-2015, Standard Practice of Good Workmanship in Electrical Construction.

3.2 INSTALLATION

A. Provide all electrical work as specified and shown in the Project Documents. Provide all labor, equipment, material, accessories, and testing for electrical systems complete and operating. Include all scaffolding, rigging, hoisting, and services necessary for delivery and installation of materials and equipment.

B. Include all required software applications, licensing and associated system programming for electronic products. Provide all software to owner for onsite programming and interfacing.

C. Provide as part of the Electrical Work all hangers, brackets, supports, framing, backing, accessories, incidentals, not specifically identified the project documents, but required to complete the system(s) in a safe and satisfactory working condition.

D. Quantity of materials and layout of the Work shall be provided based on field measurement of the actual project conditions and shall not be based on plan dimensions.

E. Provide all testing and documentation of electrical systems as required to demonstrate compliance with the Project Documents.

F. Provide testing, documentation, and filing required to comply with commissioning requirements of Section C408 of the Energy Code. Include documentation in

Operation and Maintenance Manuals.

3.3 CUTTING AND PATCHING

A. Provide cutting and patching to complete electrical work and to provide openings in elements of Work for electrical penetrations. Comply with requirements of Division 01.

B. Locate and execute cuts so as not to damage other work or weaken structural components. Core drill or saw cut rigid materials.

C. Patch to restore to original condition. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

END OF SECTION 26 01 00

SECTION 26 04 00 – EXISTING ELECTRICAL SYSTEMS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Demolition of systems applicable to Division 26.

B. Requirements for remodeling applicable to Division 26.

C. Requirements of this section also apply to Divisions 27, 28, and 33.

1.3 EXISTING CONDITIONS

A. The drawings show portions of existing electrical systems which are to remain, be removed, or be modified under the Contract. Concealed features of existing systems are based on field observation and existing record drawings. No guarantee is made as to their correctness.

B. Contractors shall visit the project site prior to bidding and become familiar with the existing conditions and all other factors which may affect the execution of the work. Include all costs related to existing site conditions in the initial bid proposal. Many systems may not comply with NETA or other maintenance standards and may require special precautions and procedures.

C. Failure to visit the project site prior to bid does not relieve the Contractor of the responsibility to provide all required work and a complete installation within the intent of the Contract Documents.

1.4 EXISTING UNDERGROUND UTILITIES

A. Existing utilities in areas of new construction must be identified and located by the Contractor prior to commencing Work. Location of underground utilities shown on plans, are diagrammatic and shall not be considered as a complete representation of all utilities that may exist on site.

B. Coordinate with Owner to identify and locate existing underground utilities including landscape irrigation in areas of Work.

C. Prior to excavation, contact and coordinate with local Utilities Underground Location Center to identify and locate existing underground public utility services in areas of Work, including power, water, sewer, telephone, gas, and cable TV.

D. Prior to excavation, obtain services of a utility locator service to scan areas of Work and to locate and mark where known and unknown private underground utilities or other interfering obstructions exist.

E. Hand excavate to expose located interfering underground utilities and interfering obstructions before trenching. Provide adequate means of support and protection of exposed utilities.

F. Existing active utilities damaged or interrupted by the Contractor during construction shall be replaced at the Contractor's expense. Repairs to power and signal systems using junction boxes or splices will not be accepted.

1.5 POWER AND SIGNAL OUTAGES

A. The facility will continue normal operations during the construction work. The Contractor shall schedule power outages with the Architect/Engineer in accordance with requirements of Division 01. Include coordination, identification of affected areas, work schedule, and re-energizing of electrical systems with minimal disruption to facility operations.

B. Unscheduled power or signal outages to Owner occupied areas and systems essential to facility operation or life safety shall not be permitted at any time. In the event that the Contractor's work causes or contributes to a power outage or other system fault, the Contractor is responsible for immediately correcting the problem.

C. Schedule power and signal outages for evenings, weekends, or holidays unless otherwise approved; include costs for overtime and work outside regular hours.

1.6 FIRE ALARM SYSTEM

A. Maintain and operate the existing fire alarm system during construction. Comply with alarm, incident response, and fire watch requirements of the Authorities Having Jurisdiction for all areas served by the system. Plan and provide fire watch and/or temporary wiring where new construction interrupts required system operation.

B. Provide dust protection for installed smoke detectors located within the work area. Clean detectors after work is completed and dust protection is removed.

C. Coordinate all planned shutdowns and tests of the fire alarm system with the Fire Department and Alarm Reporting Center. Notify the Alarm Reporting Center of false alarms that occur during construction as required to mitigate Fire Department response.

D. Provide investigation, correction, and required repairs to the alarm system for false alarms and system trouble that occur during the project and for system failures cause by the Work. Fines and penalties for excessive false alarms that occur during the Project shall be the responsibility of the Contractor.

E. The Owner shall provide reimbursement for expenses associated with false alarms, system trouble, and system failure if the contractor can satisfactorily demonstrate that the incidents are not related to the Project.

1.7 INTRUSION ALARM SYSTEM

A. Maintain and operate the existing intrusion alarm system during construction. Comply with alarm and incident response requirements of the monitoring agency and Owner for all areas served by the system. Provide temporary wiring where new construction interrupts required system operation.

B. Provide dust protection for installed motion sensors located within the work area. Clean detectors after work is completed and dust protection is removed.

C. Coordinate all planned shutdowns and tests of the alarm system with Alarm Reporting Center. Notify the Alarm Reporting Center of false alarms that occur during construction as required to mitigate police response.

D. Provide investigation, correction, and required repairs to the alarm system for false alarms and system trouble that occur during the project and for system failures cause by the Work. Fines and penalties for excessive false alarms that occur during the Project shall be the responsibility of the Contractor.

E. The Owner shall provide reimbursement for expenses associated with false alarms, system trouble, and system failure if the contractor can satisfactorily demonstrate that the incidents are not related to the Project.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. New and Replacement Materials and Equipment: As specified in applicable sections, except product manufacture shall match existing for minor construction and for accessories to equipment that remains.

B. Materials and Equipment for Patching: Match existing products.

C. In finished spaces provide surface metal raceway systems as specified in other sections where existing construction does not permit concealed installation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field verify wiring and cabling for existing power and signal systems back to source of supply as required to perform Work.

B. Disconnect electrical systems in walls, floors, and ceilings being removed.

C. Provide temporary wiring and connections to maintain existing systems interrupted by new construction.

D. Carefully remove, store, and reinstall existing removable ceiling tiles where access to perform work is required.

E. Carefully remove, store, and reinstall existing light fixtures where access to perform work is required. Provide additional fixture support and seismic bracing for reinstalled fixtures where required to meet current Code.

F. Cut and Patch conduit penetrations and required holes to access work at walls.

3.2 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing systems to accommodate new construction. For selective demolition, refer to architectural and mechanical plans and include electrical demolition to support removal and replacement work not otherwise indicated in electrical drawings.

B. Electrical demolition includes the disconnecting, removal, and disposal of fixtures, devices and equipment where indicated, along with associated wiring.

C. The following shall be considered as abandoned unless otherwise indicated:

1. Wiring to fixtures, devices, and equipment being removed or disconnected.

2. Conduit containing conductors or cable that have been disconnected from a source of supply or left empty by the removal of conductors.

3. Open conductors or cable that have been disconnected from a source of supply.

4. Fixtures, devices, equipment, and outlets located in walls, ceilings, and floors indicated to be removed.

5. Fixtures, devices, and equipment identified as being replaced.

D. Remove abandoned wire and cable for power and signal systems to source of supply.

E. Remove abandoned conduit, cable, and outlets where exposed and within accessible ceiling, attic, crawl, plenum, and opened wall spaces. Cut conduit flush with walls and floors; patch surfaces in finished spaces. Outdoors remove abandoned conduit and cable down to 24 inches below grade and restore site to its original grade and finish.

F. Disconnect abandoned outlets and remove devices. Provide blank covers for abandoned outlet boxes in floors, walls, and hard ceilings to remain.

G. Disconnect and remove abandoned switchboards, panelboards, distribution equipment, and electrical devices.

H. Disconnect power to utilization equipment being removed or abandoned in place.

I. Disconnect and remove abandoned light fixtures, including brackets, stems, hangers, pole base and other accessories.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Cut-in flush outlet boxes and fish conduit in existing construction of remodeled areas where conditions permit. Flexible conduit is approved where fishing of conduit is required. Where existing construction does not permit flush installation, use surface metal raceway.

L. Extend existing outlet boxes as required to accommodate new surface treatments or to extend wiring with surface raceway.

M. Maintain access to existing electrical systems to remain active. Modify installation or provide access panels as appropriate.

N. Replace, modify or extend existing outlet boxes to meet volume requirements. Cut surfaces as required to replace (or modify) existing outlet boxes and to install supports for new boxes and fixtures and patch to match adjacent surface.

O. Provide new supports for existing conduit and open cable accessed during construction and which is to remain or be reused, as required to comply with current Code. Comply with requirements of applicable signal system specifications for support of signal cables.

3.3 DISPOSITION OF MATERIALS

A. Prior to start of demolition, coordinate with Owner to identify materials and equipment for salvage. Disconnect and remove items to be salvaged and deliver to an area on site designated by the Owner. Disconnect, remove, and handle salvage material and equipment in a manner so as not to damage or otherwise render unusable.

B. Materials and equipment removed and not reused or salvaged to the Owner shall become the property of the Contractor unless otherwise indicated. Remove such material and equipment from the Owner's property and dispose legally off site.

3.4 CLEANING AND REPAIR

A. Luminaires: Clean interior and exterior surfaces, reflectors, and lens. Replace lamps, ballasts, and broken electrical parts.

3.5 NAMEPLATES AND CIRCUIT DIRECTORIES

A. Provide nameplates for existing distribution equipment to indicate new and revised equipment, circuit, and load designations.

B. Update panelboard and load center circuit directories to indicate changes and additions to each circuit. Updated and existing circuits shall be typewritten on new removable circuit index cards.

C. Nameplates and circuit directories shall comply with requirements of Section 26 20 00.

END OF SECTION 26 04 00

SECTION 26 05 00 – BASIC MATERIALS AND METHODS

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Section 26 01 00 - Electrical General Requirements.

C. Section 26 05 00 - Basic Materials and Methods.

1.2 SECTION INCLUDES

A. Conduit and Fittings.

B. Building Wire and Cable.

C. Wiring Connections and Terminations.

D. Boxes.

E. Wiring Devices.

F. Supporting Devices.

1.3 SUBMITTALS

A. Submit product data for conduit fittings, wire and cable, watertight connectors, and wiring devices.

1.4 OPERATION AND MAINTENANCE DATA

A. Include data for wiring devices in Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit (RGS): ANSI C80.1; hot dipped galvanized.

B. Intermediate Metal Conduit (IMC): Hot dipped galvanized.

C. Electric Metallic Tubing (EMT): ANSI C80.3; galvanized tubing.

D. Flexible Metal Conduit: Galvanized steel. Heavy wall except reduced wall may be used where concealed in building construction.

E. Liquid Tight Flexible Metal Conduit: Galvanized steel, PVC jacket.

2.2 FITTINGS

A. RGS and IMC Conduit: ANSI/NEMA FB 1; threaded type. Provide bushings, hubs and connectors with insulated throat, for conduit terminations.

B. EMT Conduit: ANSI/NEMA FB 1; steel, compression type. Crimp-on, drive-on, indenter, and set screw type prohibited. Provide connectors with insulated throat for conduit larger than 3/4-inch diameter. Provide raintight fittings for conduit installed outdoors.

C. Flexible Conduit: ANSI/NEMA FB 1; steel, single screw squeeze type.

D. Liquid Tight Flexible Conduit: ANSI C33.84, steel. Provide PVC coated fitting where installed outdoors.

E. Water and Vapor Conduit Sealants: Hydra-Seal S-50 conduit sealing putty or approved; Tyco/Rachem/TE blank duct plug or approved; Polywater FST conduit sealing foam system or approved.

F. Corrosion Protection: Zinc plated minimum indoors and hot dipped galvanized minimum outdoors and indoor wet locations for all metal fittings and accessories except use PVC coated or stainless steel for chlorine treatment rooms, agricultural buildings, within 100 feet of shoreline, and other corrosive environments.

2.3 WIRE AND CABLE

A. Copper Building Wire, Interior: Type THWN-2, 600 volt insulation; conductors 8 AWG and larger shall be stranded. Type XHHW-2 may be substituted for conductor sizes 4 AWG and larger.

B. Copper Building Wire, Outdoors: Type RHW/USE-2, 600 volt insulation; conductor 8 AWG and larger shall be stranded.

2.4 WIRE CONNECTORS

A. Connectors for Wire Size 10 AWG and Smaller: Insulated steel spring twist-on pressure connector with plastic cap. Outdoors use watertight type with prefilled sealant gel.

B. Connectors for Wire Size 8 AWG and Larger: Solderless mechanical or compression type with pre-formed or shrink sleeve insulated cover. Outdoors make watertight using shrink sleeve or pigtail cap and sealing mastic.

2.5 BOXES

A. Outlet Boxes: ANSI/NEMA OS 1; galvanized sheet steel, with 1/2-inch male fixture studs or plaster rings as required.

B. Junction and Pull Boxes: Outlet box with blank cover except boxes larger than 4 inch square shall be screw cover type, galvanized steel with grey enamel finish, NEMA 1 indoors and NEMA 3R outdoors, unless otherwise indicated.

C. Barriers: Provide permanent barriers in outlet boxes to separate adjacent wiring devices where voltage exceeds 300 volts. Provide permanent voltage separation barriers in outlet and junction boxes to separate wiring above 100 volts from wiring below 100 volts and where otherwise required by Code.

D. Color Coding of Device and Junction Boxes for Special Systems: Field painted or otherwise manufactured in the specified color, both inside and outside of box and cover. Provide color identification for the following electrical systems: Fire Alarm System - RED, Emergency Systems (NEC 700) - ORANGE.

E. Sound Attenuation Wrap: UL listed, 0 VOC, sound attenuating wrap for sealing around outlet boxes. SpecSeal SSP Putty Pad or approved.

2.6 WIRING DEVICES

A. Duplex Receptacles: Specification grade 5362 series, NEMA 5-20R, grounding type, as manufactured by Hubbell, Leviton, Pass & Seymour, Cooper. Color: Ivory.

B. Ground Fault Circuit Interrupter (GFCI) Receptacles: Same manufacture, rating, and color as duplex receptacles except devices shall comply with UL 943, Class A, with self test.

C. Duplex Receptacles, Weather Resistant for Damp and Wet Locations: Same manufacture, rating, and color as duplex and GFCI receptacles except devices shall be UL listed as weather resistant and permanent special purpose identification shall be visible on the device.

D. Flush Mounted Device Plates: Super heavy duty for high abuse application, rigid high impact thermoplastic, smooth finish, color to match device. Thermoset, phenolic, urea, nylon, and flexible polycarbonate not approved. Cooper PJ series manufacture or approved.

E. Surface Mounted Device Plates: Raised galvanized steel on steel boxes; cast or stamped sheet aluminum on cast boxes.

F. Damp and Wet Location Device Plates: ANSI/UL 514D; Commercial grade, low profile, lockable, die cast metal cover assembly, listed as weatherproof when in use and identified as extra duty. Hubbell/TayMac MX series or approved.

G. Cord and Plug Connectors: Hubbell Insulgrip, Leviton Spec-Master, Slater Metalist series, GE Gator Grip; premium specification grade grounding type cord connector and matching plug, NEMA configuration indicated. Provide with weatherproof boot in damp and wet locations.

2.7 SUPPORTING DEVICES

A. Metal Conduit Clamps and Straps: Steel, screw type; zinc or cadmium plated minimum indoors, hot dipped galvanized minimum outdoors.

B. Support Channel: Slotted 12-gauge steel channel with fittings, fasteners, brackets, clamps, floor plates, and accessories required; Pre-galvanized zinc coated (G90) indoors, ASTM 123 hot dipped galvanized outdoors.

C. Fasteners: Expansion anchors in concrete and solid masonry; toggle bolts in hollow masonry, plaster, or gypsum board wall construction; sheet metal screws in metal construction; wood screws in wood construction; set screw type beam clamps on steel columns and beams; U.L. listed clips for metal studs. Metal parts and accessories to be zinc or cadmium plated minimum indoors and hot dipped galvanized minimum outdoors.

D. Support Wires: Support wires above accessible ceiling grids, steel #12 AWG minimum.

E. Roof Supports: Do not install conduit exposed on roofs. Free standing, stackable, 7.5 inch square, one piece molded PVC pipe support with U shaped rolling cradle, MIRO Industries Pillow Block #24-R. Free standing molded thermoplastic pyramid style block with hot dipped galvanized channel strut support hardware, Erico Caddy ST series or approved.

2.8 ACCESSORIES

A. Pulling Wire:

1. Interior; continuous fiber pulling line, 190# tensile strength.

2. Below grade; Polyester measuring pulling tape 5/8 inch wide, 1800# tensile strength. Muletape.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. General:

1. Fixed wiring shall be conductors installed in conduit.

2. Conceal all wiring within construction unless otherwise noted on drawings or specifically authorized by the Architect/Engineer.

3. Where contractor wiring methods require the application of conductor ampacity adjustment or correction factors under NEC 310.15, the contractor shall submit calculations that show Code compliance, except the adjusted ampacity of the conductors installed shall not be less than the circuit overcurrent device rating shown or specified.

4. Conduit sizes shall not be reduced to smaller size than shown or otherwise noted on plans.

5. Feeders shown or otherwise noted on plans shall not be combined to share a common conduit homerun. Branch circuit homeruns shown or otherwise noted on plans shall not be combined to share a common conduit with other circuits.

6. Device Plates: It is the electrical contractor's responsibility to ensure that all line voltage and low voltage system faceplates and visible trim pieces are the same color. Exception: Where stainless steel device plates are used for line voltage systems, low voltage systems may use non-metallic plates of the same color.

B. Conduit Requirements:

1. Rigid Steel Conduit (RGS): May be used in all areas. Required at penetrations thru fire rated construction rated greater than 1 hour.

2. Intermediate Metal Conduit (IMC): May be used in all areas except where RGS is required or indicated.

3. Electrical Metallic Tubing (EMT): May be used in dry and damp locations where not subject to damage. May not be used in concrete, where in contact with earth, or where RGS is required or indicated. May not be used for service entrance conductors inside a building. Maximum trade size 2 inches.

4. Flexible Conduit: Required for final equipment connections (maximum length 36 inches) Use liquid tight in damp or wet locations.

C. Wire and Cable Requirements: Use copper conductors.

3.2 SUPPORT - GENERAL

A. Support wiring, conduit, raceways, boxes, equipment, and fixtures from building structural members. Provide additional framing, channel, or listed support attachments as required to span or support between structural members and to avoid interference from pipes, ducts, and other equipment.

B. Do not install support anchors to penetrate thru roof deck.

C. Do not violate the integrity or exceed the capacity of the building structure used for support. Provide/fabricate additional support elements to transmit loads to the floor or other parts of the building structure that can carry the load as approved by the Architect/Engineer.

3.3 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. Minimum conduit trade size 1/2-inch diameter except all homeruns and where installed below grade outdoors conduits shall be 3/4-inch minimum diameter.

Prewired 3/8 inch diameter flexible conduit not to exceed 72 inches in length may be used for fixture whips from an outlet box to recessed light fixture.

B. Arrange conduit to maintain headroom and present a neat appearance.

C. Route conduit parallel and perpendicular to walls and adjacent piping.

D. Maintain 12-inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

E. Locate holes in joists within center third of member depth measured from the edge and at least 24 inches from load bearing points. Maximum hole diameter one inch.

F. Support conduits from building structure with conduit straps or rods and hangers. #8 solid wire and CADDY clips may be used to hang 3/4-inch diameter conduit and smaller above accessible ceiling spaces.

G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

H. Do not support conduit with perforated pipe straps or tie wraps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

I. Do not bore holes in truss members or notch structural members.

J. Steel conduit installed as part of a 2 hour fire rated wiring assembly shall be supported 5 feet on center where required by the cable system installation requirements.

3.4 CONDUIT INSTALLATION

A. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp locations.

B. Use conduit bodies to make sharp changes in direction, as around beams.

C. Use factory elbows for PVC conduit and for bends in metal conduit larger than 1 inch. Conduit bends for signal systems that are greater than 45 degrees shall be minimum radius sweeps as follows:

Under 2 inches	Standard radius
2 inches - 3 inches	24 inch radius
Over 3 inches	36 inch radius

E. Install insulated bushings on each end of conduit larger than 1 inch.

F. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

G. Install pull wire in empty conduits.

H. Conduits at Roof Decks: Conduit installed within 1.5 inches of the nearest surface of metal corrugated roof decks and conduit concealed within roofing systems on top of roof decks shall be RGS or IMC conduit.

I. Install flexible conduit thru oversized bushed sleeve or cored opening where conduit crosses building wall expansion or seismic joints. Provide up to 54 inches of flexible wiring with 6 inches minimum of conduit slack each side of the wall assembly to allow for free movement across the joint.

J. Do not install conduit in concrete slab on grade.

K. Do not install conduit in direct contact with underside of roof deck.

L. Seal all underground conduits entering and terminating within a building or structure using approved non hardening duct seal putty or a sealing bushing. Seal spare conduits using a watertight blank plastic duct plug. Seal all underground conduits entering and terminating below grade, such as in a crawl space or basement, using an approved closed cell foam sealant system.

3.5 CONDUIT PENETRATIONS

A. Roof Penetrations: Provide sheet lead flashing (4 pounds per square foot) around each conduit which penetrates a roof. Extend 10" in all directions from conduit, and up 8" on conduit sized to match conduit diameter. Seal top of flashing around conduit with a weatherproof non-hardening mastic.

B. Exterior Walls: Core drill or cast sleeve for each conduit one size larger than conduit diameter. Seal all openings at each penetration with acrylic weatherproof caulking suitable for painting. Below grade seal with "Chase-Foam" silicone sealant or other approved method acceptable to Architect/Engineer.

C. Interior Walls and Partitions: Cut one size larger than conduit diameter. Seal all openings at each penetration with low VOC level general purpose interior sealant as specified in Division 07.

3.6 CONDUCTOR INSTALLATION

A. Minimum Conductor Size: #12 AWG, except #10 AWG minimum for outdoor and exterior building lighting circuits and #14 AWG minimum for control circuits and for lighting fixture taps not to exceed 72 inches.

B. Splice conductors only in junction or outlet boxes.

C. Arrange conductors neatly at termination such that a clamp-on ammeter may be used.

D. Clean conduit free of debris before conductor installation; install conductors using pulling lubricant.

3.7 CONDUCTOR IDENTIFICATION

A. Provide non-metallic wire markers on each conductor in panelboards and in junction boxes having more than 6 conductors. Identify branch circuit or feeder number for power and lighting circuits.

B. Color Coding of Insulated Equipment Ground: Solid green.

C. Color Coding of 208/120Volt System: Phase A - black, Phase B - red, Phase C - blue, Neutral - white.

D. Color Coding of 480/277 Volt System: Phase A - brown, Phase B - orange Phase C - yellow, Neutral - gray.

3.8 BOX LOCATIONS

A. Provide electrical boxes for outlets, junctions and equipment connections as shown and as required for splices, taps, wire pulling, and code compliance.

B. Electrical box locations shown are approximate unless dimensioned. Obtain equipment outlet locations from equipment manufacturer prior to rough-in. Coordinate outlet and wall switch locations with casework and finish elements shown on Architectural drawings. Install to fit conditions or as directed.

C. Change location of wall outlets, wall switches, and lighting outlets up to fifteen feet without charge when requested by Architect/Engineer prior to installation.

D. Height of outlets unless otherwise directed: See Drawings.

3.9 BOX INSTALLATION

A. Set wall outlet and wall switch boxes vertically.

B. Support boxes independently of conduit, piping, and ductwork; securely fasten in place.

C. Provide recessed outlet boxes in finished areas. Flush front edge of box or plaster ring even with finished surface.

D. Provide blank cover plate over all boxes that do not contain devices or are not covered by equipment.

E. Do not install flush boxes on opposite sides of a wall within the same stud space. Maintain 24 inch minimum box separation in fire rated wall assemblies.

3.10 WIRING DEVICES

A. Ground Fault Circuit Interrupter (GFCI) Protection: Provide for receptacles located outdoors, within 6 feet of sinks, in bathrooms, kitchens, indoor wet locations, locker rooms with associated shower facilities, elevator pits, elevator machine rooms, crawl spaces, garages, service bays, rooftops, at counters and work surfaces where food and/or beverage preparation occurs, water coolers, and as otherwise indicated. GFCI receptacles are not required where branch circuit is protected by GFCI circuit breaker.

Contract requirements.

3.11 LABELING

A. Outlets: Identify panel and circuit number on faceplate of convenience and special purpose outlets. Use self-adhesive, polyester or vinyl laminated labels with machine generated alpha-numeric circuit identification, 1/4-inch high black letters on clear background. Exception: Use white letters on black or brown color device plates.

B. Junction Boxes: Label or mark cover with panel and circuit number. Locate on inside of cover except locate on outside of junction box cover in attics, crawl spaces, equipment rooms and above accessible ceilings.

3.12 TESTS

A. Perform continuity test on all feeder and branch circuit conductors. Verify proper phasing and that no short circuits or accidental grounds exist.

B. Check all convenience outlets for correct wiring connections using a polarity circuit tester. Test AFCI and GFCI circuits for proper operation with an approved tester.

C. Torque test conductor lug terminations to manufacturers recommended values.

END OF SECTION 26 05 00

SECTION 26 05 26 – GROUNDING

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Power System Grounding.

B. Electrical Equipment and Raceway Grounding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mechanical Connectors at Ground Connections: Heavy duty, solderless, bolted pressure or compression type connectors or clamps labeled as being suitable for the purpose. Manufacturer's standard grounding lug when furnished as part of panelboards and other equipment.

B. Ground & Bonding Conductors: Bare, soft drawn copper; stranded for 8 AWG and larger, unless otherwise indicated or specified. Equipment grounding conductors may be insulated with green color identification per Code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ground electrical service system neutral per Code. Size grounding electrode conductor, main bonding jumper, equipment bonding jumpers, and supplemental electrode bonding connections per applicable paragraphs of NEC Article 250 except when larger size is shown or specified. Minimum of two (2) NEC 250.52 permitted grounding electrodes must be installed and shall include a concrete encased electrode where concrete building foundation is provided.

B. Equipment Grounding Conductor: Provide separate insulated green equipment grounding conductor in feeders and in branch circuits to plug-in outlets. Provide equipment grounding conductor in non-metallic conduits and flexible conduit. Size equipment grounding conductors per NEC 250.122 unless larger size is shown or specified.

C. Provide grounding locknuts on each end of feeder conduits serving panelboards. Exception: Provide grounding bushing with bonding jumper where conduit is used as equipment ground.

D. Ground exposed non-current carrying metal parts of equipment fastened in place or connected by permanent wiring and likely to become energized per Code. In MDF and in IDF rooms, bond cable trays and equipment racks to terminal board ground bus using #6 minimum AWG conductor.

END OF SECTION 26 05 26

SECTION 26 20 00 – ELECTRICAL DISTRIBUTION

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Panelboards and Circuit Breakers.

B. Disconnect Switches.

C. Fuses.

D. Compression Lugs.

1.3 SUBMITTALS

A. Submit product data for circuit breakers.

B. Coordinate dimensions of equipment with site and project space dimensions to verify equipment will fit, conform to indicated layout, and meet NEC and manufacturer clearance requirements.

1.4 OPERATION AND MAINTENANCE DATA

A. Include data for circuit breakers and fuses in Operation & Maintenance Manuals.

1.5 SPARE PARTS

A. Fuses: Furnish to Owner 3 spare fuses of each type and rating installed.

B. Fuse Pullers: Furnish 2 fuse pullers to the Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Circuit Breakers and Disconnects: Square 'D', Siemens, Cutler-Hammer, General Electric - ABB.

B. Fuses: Bussman and Littelfuse.

2.2 POWER DISTRIBUTION PANELBOARDS

A. Circuit Directory: Index card under plastic with metal frame holder on each branch switch.

B. Circuit Breakers: UL 489; molded case, thermal magnetic trip, AIC rating greater than available symmetrical short circuit amperes. Multi-pole breakers shall be single handle with common pole operation. Feeder circuit breakers required to selectively coordinate shall have LI or LSI solid state trip. Circuit breakers rated 1000 amps and larger shall have LSI solid state trip.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Circuit Directory: Index card under plastic with metal framed holder on inside door.

B. Circuit Breakers: UL 489; molded case, thermal magnetic trip. Multi-pole breakers shall be single handle with common pole operation.

1. Provide type HACR circuit breakers for air conditioning equipment, refrigeration equipment, and surge protection devices (SPD).

2. Provide approved manufacturer handle ties between single pole circuit breakers serving branch circuits sharing a common neutral (disconnecting means for multiwire branch circuits).

3. Provide approved manufacturer handle padlock attachment on circuit breakers serving branch circuits for permanently connected appliances without local disconnecting means and where otherwise indicated.

4. Provide combination-type arc-fault circuit interrupter protection (AFCI) circuit breakers for branch circuits where indicated.

5. Provide ground fault circuit interrupter protection (GFCI) circuit breakers for branch circuits where indicated.

6. Provide ground fault equipment protection (GFEP) circuit breakers for pipe heat trace and for deicing and snow melting equipment.

2.4 DISCONNECT SWITCHES

A. Safety Switches: NEMA KS 1; heavy duty, quick make, quick break, handle with lock out / tag out provisions. Provide rating, number of poles, and fusing required for load served.

B. Toggle Switches for Small Motors and Appliances: NEMA WD 1; horsepower rated 20 ampere general use snap switch with lock-out attachment.

C. Switch Enclosures: NEMA ICS 6; Type 1 for dry locations, Type 12 for industrial locations, Type 3R for damp or outdoor locations.

2.5 FUSES

A. Approved Fuses, 600 Amperes and Less, for Branch Circuits and Power Distribution:

1. ANSI/UL 198C Class J low peak with time delay unless otherwise indicated except ANSI/UL 198E Class RK5 may be used in safety switches for protection of motors and transformers.

2. For Protection of Circuit Breakers: Fuses must comply with NEC 240.86 series rating requirements for load side circuit breakers that are not rated for the available fault current. Coordinate series rating requirements with published manufacturer's listings for circuit breakers installed.

2.6 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, white letters on black background, affixed with stainless steel screws, adhesive acceptable in dry locations. Use black letters on yellow background for series combination rating identification.

B. Letter Height: 1/2 inch for series combination rating identification. 1/4 inch for switchboards, panelboards, motor control centers, circuit breakers, switches, and disconnecting means; 1/8 inch for motor starters, contactors, time switches, and equipment served.

2.7 COMPRESSION LUGS (ALUMINUM CONDUCTOR)

A. Where aluminum conductor is substituted for copper conductor under Section 26 05 00, compression lugs shall be provided in lieu of mechanical lugs for terminating conductors.

PART 3 - EXECUTION

3.1 PANELBOARDS

A. Provide typewritten circuit directory for each panelboard listing load description for each circuit. Use final room names and numbers as verified with the Owner.

3.2 DISCONNECTS

A. Provide a disconnect in addition to the controller disconnecting means at installed motor loads that are not in sight of motor controller as required by NEC 430.102(B).

B. Safety Switches for Variable Frequency Drives (VFD): Provide two (2) #12 600 volt rated conductors with the motor feeder between VFD and load side motor disconnect interlock to disable controller operation when the safety switch handle is operated to the open position.

3.3 FUSES

A. Install fuses in fusible switches.

B. Size fuses for motor loads at 150% of nameplate full load amperes; size fuses for air conditioning and refrigeration equipment at maximum recommended nameplate rating.

3.4 CIRCUIT BREAKERS

A. Install circuit breakers in accordance with manufacturer instructions and recommendations.

B. Set adjustable breakers to comply with the approved protective device coordination study or as directed by the Engineer.

3.5 NAMEPLATES AND LABELS

A. Switchboards, Panelboards: Provide nameplate to identify equipment designation, voltage, and source of supply for each, e.g. Panel A, 208/120V, Fed from Panel M. Provide arc flash protection label. Provide series combination rating nameplate where such rating is applicable.

B. Individual Circuit Breakers, Switches, and Motor Starters Installed in Switchboards, Distribution Panelboards Without Circuit Index: Provide nameplate to identify circuit source, circuit number, and load served.

C. Individual Enclosed Circuit Breakers, Safety Switches, and Disconnecting Means: Provide nameplate to identify load served and circuit source and circuit number.

D. Equipment Served: Provide nameplate to identify equipment designation corresponding with nameplate of serving overcurrent device, disconnect switch, or controller when there is more than one of same type of equipment being served, e.g. Air Handler No. 2. Coordinate with Architect/Engineer to assign numbers when not designated in equipment schedules.

E. Nameplate and Label Location: Secure to equipment fronts, except recessed panelboards in finished locations secure nameplates and labels to inside face of door.

3.6 TESTS

A. Motors and Compressors: Record all nameplate data. Measure actual voltage and running amperes for each phase. Record manufacturer and catalog number of overload thermal units installed.

B. Equipment Ground Fault Protection Systems: Test prior to being placed into service to verify proper installation and operation of the system as determined by the equipment manufacturer's published instructions. Set pick up for 300 amps and time delay for zero (instantaneous) unless otherwise indicated or directed. Record test results.

END OF SECTION 26 20 00

SECTION 28 31 00 – FIRE ALARM AND ALARM SYSTEM

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disconnection and reconnection of HVAC equipment fire detection and alarm system, bidder design.

1.2 RELATED SECTIONS

A. Section 26 01 00 - Electrical General Requirements

B. Section 26 04 00 - Existing Systems

C. Section 26 05 00 - Basic Materials & Methods

D. Section 26 05 26 - Grounding & Bonding

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of Washington State Fire Marshal's office and local Fire Marshal.

B. Conform to requirements of following publications in addition to requirements of 26 01 00:

IFC	International Fire Code
NFPA 72	National Fire Alarm Code

Local fire alarm code adopted by the jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Salvage and reuse existing components.

PART 3 - EXECUTION

3.1 EXISTING SYSTEM

A. See Section 26 04 00, Existing Systems, for additional requirements.

3.2 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Comply with requirements of Section 26 05 00.

C. Coordinate quantity, location, and access for duct smoke detectors and sampling tubes with Division 23 Contractor. Furnish sampling tube/detector housing assemblies for installation by ductwork installer. Do not locate sampling tubes less than 6 duct widths from return air inlet, bend in duct, or other obstruction in duct. Locate sampling tube/detector housing assemblies for smoke dampers on the damper housing where recommended by smoke damper manufacturer.

D. Wiring: Install conductors in conduit dedicated for fire alarm, consistently color coded per shop drawings. Wiring shall not share conduits with other systems.

E. Fan Shut-Down: Provide conduit, wire, relays and connection for shutdown of air moving equipment per IMC.

F. Adjust sensitivity for each smoke detector based on the application and type of space being protected as recommended by the product installation instructions.

3.3 TESTING

A. Test system in accordance with NFPA 72 and Fire Marshal requirements.

END OF SECTION 28 31 00