STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

Request For Bids For Construction Services
Two-Stage Bidding Process

Stage II
Invitation to Bid

June 22, 2005

HVAC UPGRADE
WASHBURN BUILDING

SNOW COLLEGE SOUTH

Richfield, Utah

DFCM Project No. 04225710

WHW Engineering

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at http://dfcm.utah.gov or are available upon request from DFCM:

DFCM General Conditions dated May 25, 2005
DFCM Application and Certificate for Payment dated May 25, 2005

Technical Specifications:
Drawings:

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at http://dfcm.utah.gov

INVITATION TO BID

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I ARE ALLOWED TO BID ON THIS PROJECT

The State of Utah - Division of Facilities Construction and Management (DFCM) is requesting bids for the construction of the following project:

WASHBURN BUILDING HVAC UPGRADE
SNOW COLLEGE SOUTH, RICHFIELD, UTAH
DFCM PROJECT NO. 04225710

This project includes the addition of exhaust air and make-up air handlers to nail salon, cosmetology area and air brush painting area. Construction cost estimate: $179,614.

Company	Contact	Fax
• SR Mechanical Inc	Steve Roberts	(435)529-7851
• KOH Mechanical Contractors	Jim Hansen	(801)234-6374
• Tod R Packer Heating & Air Cond	Tod Packer	(801)849-1314

The bid documents will be available on Wednesday, June 22, 2005 from DFCM at 4110 State Office Building, Salt Lake City, Utah 84114, telephone (801)538-3018 and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Jeff Reddoor, Project Manager, DFCM, at (801)971-9830. No others are to be contacted regarding this project.

A **MANDATORY** pre-bid meeting and site visit will be held at 2:00 PM on Tuesday, June 28, 2005 at the Washburn Building at Snow College South in Richfield, Utah. All short listed prime contractors wishing to bid on this project must attend this meeting.

Bids must be submitted by 3:30 PM on Thursday, July 7, 2005 to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. Note: Bids must be received at 4110 State Office Building by the specified time. The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction & Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of the State.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
SUSAN L. SMITH, CONTRACT COORDINATOR
4110 State Office Bldg., Salt Lake City, Utah 84114
Telephone: (801) 538-3260

STAGE II BIDDING PROCESS

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I ARE ALLOWED TO BID ON THIS PROJECT

1. Invitational Bid Procedures

Invitation to Bid: DFCM will notify each short-listed firm via e-mail and/or fax when a project is ready for construction services.

Bid Documents: Bidding documents including plans and specifications (if applicable) may be obtained by accessing DFCM's web page at http://dfcm.utah.gov or at DFCM's office 4110 State Office Building, Salt Lake City, Utah 84114.

Mandatory Pre-Bid Site Meeting: If required, the schedule contained in this document will indicate the date, time, and place of the mandatory pre-bid site meeting. At this meeting, contractors will receive additional instructions about the project and have an opportunity to ask questions about project details. If a firm fails to attend a pre-bid site meeting labeled "Mandatory" they will not be allowed to bid on the project.

Written Questions: The schedule contained in this document will indicate the deadline for submitting questions in writing to the DFCM Representative pertaining to this project.

Final Addendum: The schedule contained in this document will indicate the deadline for DFCM issuing the final addendum clarifying questions and changes to the scope of work. Contractors are responsible for obtaining and responding to information contained in the addenda.

Submitting Bids: Bids must be submitted to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114 by the deadline indicated on the schedule contained in this document. Bids submitted after the deadline will not be accepted. Bids will be opened at DFCM on the date, time, and place indicated on the schedule. (Additional information pertaining to bidding is contained later in this document). It is your responsibility to allow for the time needed to park on Capitol Hill as recent construction activity has made the parking more difficult. Identification is required to enter the building.

Subcontractors List: The firm selected for the project must submit a list of all subcontractors by the deadline indicated on the schedule contained in this document. (Additional information pertaining to subcontractor lists is contained later in this document)

2. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Notice to Contractors.

3. **Bids**

Before submitting a bid, each bidder shall carefully examine the Contract Documents; shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Notice to Contractor's prior to the published deadline for the submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.

If the bid bond security is submitted on a bid bond form other than the DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **Note: A cashier's check cannot be used as a substitute for a bid bond.**

4. **Contract and Bond**

The Contractor's Agreement will be in the form bound in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the Contract Sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for Subcontractors will be specified in the Supplementary General Conditions.

5. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractor's List Form", which are included as part of these Contract Documents. The subcontractors list shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contract for a period of up to three years.

6. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Representative a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by Addenda duly issued and a copy of such Addenda will be mailed or delivered to each person or entity receiving a set of documents. Neither DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

7. Addenda

Any Addenda issued during the time of bidding shall become part of the Contract Documents made available to the bidders for the preparation of the bid, shall be covered in the bid, and shall be made a part of the Contract.

8. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. The DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

9. **DFCM Contractor Performance Rating**

DFCM will evaluate the performance of the Contractor. This evaluation may include comments from the User. The Contractor will have an opportunity to review and comment on the evaluation. Evaluations, including the Contractor's comments, may be considered in future selection in the evaluation of the Contractor's past performance.

10. **Licensure**

The Contractor shall comply with and require all of its Subcontractors to comply with the license laws as required by the State of Utah.

11. **Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

12. **Time is of the Essence**

The completion deadline for this project is **November 7, 2005.** Failure to meet the completion deadline may result in a poor performance rating from DFCM which may have a negative impact on your firm's ability to obtain future work with the state of Utah and may also result in liquidated damages being assessed. Time is of the essence in regard to all the requirements of the Contract Documents.

13. **Withdrawal of Bids**

Bids may be withdrawn on written request received from bidders within 24 hours after the bid opening if the contractor has made an error in preparing the bid.

14. **Product Approvals**

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed

the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued Addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

15. **Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

Contractors shall respond promptly to any inquiry in writing by the DFCM to any concern of financial responsibility of the Contractor, Subcontractor or Sub-subcontractor.

16. **Debarment**.

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by the DFCM as part of the requirements for award of the Project.

PROJECT SCHEDULE
Stage II = Two-Stage Bidding Process

PROJECT NAME:	**WASHBURN BUILDING HVAC UPGRADE SNOW COLLEGE SOUTH, RICHFIELD, UTAH**			
DFCM PROJECT #	**04225710**			
Event	**Day**	**Date**	**Time**	**Place**
Stage II Bidding Documents Available	Wednesday	June 22, 2005	10:00 AM	DFCM, 4110 State Office Bldg, SLC, UT and DFCM web site *
Mandatory Pre-bid Site Meeting	Tuesday	June 28, 2005	2:00 PM	Washburn Building, Snow College South, Richfield, UT
Last Day to Submit Questions	Thursday	June 30, 2005	4:00 PM	DFCM, 4110 State Office Bldg, SLC, UT
Final Addendum Issued	Tuesday	July 5, 2005	4:00 PM	DFCM, 4110 State Office Bldg, SLC, UT or DFCM web site*
Prime Contractors Turn in Bid and Bid Bond / Bid Opening in DFCM Conference Room	Thursday	July 7, 2005	3:30 PM	DFCM, 4110 State Office Bldg, SLC, UT
Subcontractors List Due	Friday	July 8, 2005	3:30 PM	DFCM, 4110 State Office Bldg, SLC, UT
Project Completion Date	November 7, 2005			

*** DFCM's web site address is http://dfcm.utah.gov**

BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the Request for Bids for the **WASHBURN BUILDING HVAC UPGRADE, SNOW COLLEGE SOUTH, RICHFIELD, UTAH** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

BASE BID:

_____ DOLLARS ($_____)
(In case of discrepancy, written amount shall govern)

ADDITIVE ALTERNATE #1 (Modular Wall):

_____ DOLLARS ($_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **November 7, 2005** after receipt of the Notice to Proceed, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$500.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

BID FORM
PAGE NO. 2

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____._____

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within time set forth.

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

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Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

BID BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and_____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of $_____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the_____ _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____ .

Principal's name and address (if other than a corporation):

_____

_____

By:_____

Title: _____

Principal's name and address (if a corporation):

_____

_____

By:_____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ____ day of _____, 20_____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.
My Commission Expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone:

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

INSTRUCTION AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

PROJECTS UNDER $500,000 - ALL SUBS $20,000 OR OVER MUST BE LISTED
PROJECTS $500,000 OR MORE - ALL SUBS $35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A.Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

(1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
(2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
(3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
(4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
(5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
(6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #
ELECTRICAL	ABCD Electric Inc.	$350,000.00	123456789000
LANDSCAPING	"Self"	300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: 350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCNTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

SUBCONTRACTORS LIST

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____ SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

FUGITIVE DUST PLAN

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

Utah Division of Air Quality
April 20, 1999

GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.

2. Address or location of your operation or construction site.

3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.

4. Lengths of the project, if temporary (time period).

5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.

6. Type of material processed or disturbed.

7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.

9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).

10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

Description of Fugitive Dust Emission Activities
(Things to consider in addressing fugitive dust control strategies.)

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).

2. List type of equipment generating the fugitive dust.

3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.

4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads "on" and "off" property.

5. Vehicle miles travels on unpaved roads associated with the activity (average speed).

6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)

7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

Description of Fugitive Dust Emission Controls on Site

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.

2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).

3. Method of application of dust suppressant.

4. Frequency of application of dust suppressant.

5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).

6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

Description of Fugitive Dust Control Off-site

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place "off" property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).

2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Fugitive Dust Control Plan Violation Report

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the course must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.

2. Time and duration of dust episode.

3. Meteorological conditions during the dust episode.

4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.

5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the sources dust control plan.

6. Reasons for failing to control dust from the dust generating activity or equipment.

7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.

8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Attachments: DFCM Form FDR R-307-309, Rule 307-309

CONTRACTOR'S AGREEMENT

FOR:

_____
_____
_____

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____ _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ _____ DOLLARS AND NO CENTS ($_____.00), which is the base bid, and which sum also includes the cost of a 100%

Performance Bond and a 100% Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete within _____ (___) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of $_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Notice to Contractors, Instructions to Bidders/Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the

Contractor requests payment and agrees to safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

_____
Signature Date

Title: _____

_____
Please type/print name clearly

State of _____)
)
County of _____)

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

_____
Notary Public

(SEAL)

My Commission Expires _____

APPROVED AS TO AVAILABILITY OF FUNDS:

_____
Financial Manager, Date
Division of Facilities Construction and Management

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
_____ Date
Manager -
Capital _____

APPROVED AS TO FORM:
ATTORNEY GENERAL
May 25, 2005
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee, " in the amount of _____ _____ _____ DOLLARS ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ _____ Dollars ($_____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20_____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____ (Seal)

Attorney-in-Fact

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20___, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

DFCM FORM 7b-2 012405

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____ _____, a corporation organized and existing under the laws of the State of _____authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ _____ Dollars ($_____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, l953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20_____, personally appeared before me _____ _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

DFCM FORM 7b-2 012405

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CHANGE ORDER #_____

CONTRACTOR:

ARCHITECT:

AGENCY OR INSTITUTION:
PROJECT NAME:
PROJECT NUMBER:
CONTRACT NUMBER:
DATE:

CONSTRUCTION CHANGE DIRECTIVE NO.	PROPOSAL REQUEST NO.	AMOUNT		DAYS	
		INCREASE	DECREASE	INCREASE	DECREASE

	Amount	Days	Date
ORIGINAL CONTRACT			
TOTAL PREVIOUS CHANGE ORDERS			
TOTAL THIS CHANGE ORDER			
ADJUSTED CONTRACT			

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor:_____
Date

Architect/Engineer:_____
Date

Agency or Institution:_____
Date

DFCM: _____
Date

Funding Verification:_____
Date

Page _____ of _____page(s)

DFCM FORM 7b-2 012405

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

_____

_____

_____

A list of items to be completed or corrected is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof.

The Contractor shall complete or correct the Work on the list of items appended hereto within _____ calendar days from the above date of issuance of this Certificate.

_____

CONTRACTOR (include name of firm) DATE

_____

A/E DATE

_____

USING INSTITUTION OR AGENCY DATE

_____

DFCM DATE

cc: Using Agency

SNOW COLLEGE SOUTH CAMPUS
WASHBURN BUILDING
ART STUDIO AND NAIL SALON
HVAC UPGRADES
RICHFIELD, UTAH

DFCM PROJECT # 04225710

State of Utah—Department of Administrative Services

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

4110 State Office Building / Salt Lake City, Utah 84114 / 538-3018

SPECIFICATIONS

PREPARED BY

WHW ENGINEERING INC.
1354 EAST 3300 SOUTH, SUITE 200
SALT LAKE CITY, UTAH 84106
PHONE: (801) 466-4021
FAX: (801) 466-8536

FEBRUARY 2005

WHW Engineering Project #04036

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SECTION 01100 - SUMMARY OF THE WORK

PART 1 - GENERAL

1.1 Descriptive Summary of the Work:

A. Without force and effect on the requirements of the Contract Documents, the description of the work of the Contract is summarized as follows:

1.2 Scope of the Work:

A. Includes –
1. Provide make-up air units for Art Studio and Nail Salon.
2. Provide canopy exhaust hoods and associated fans in Art Studio.
3. Provide exhaust fans and ductwork in Nail Salon.
4. Modify ceiling and existing fire sprinkler and air lines as necessary to accommodate new hoods and equipment.
5. Furnish all labor, materials, and equipment necessary for completion of the project.
6. Furnish and install all motors specified and be responsible for the proper operation of electrical powered equipment furnished by this project.
7. Provide all additional electrical requirements.
8. Mechanical Contractor shall obtain the services of independent Test and Balance Agency.
9. Placing the air conditioning, heating, ventilating, and exhaust systems into full operation and continuing their operation during each work day of testing and balancing.
10. Making changes in pulleys, belts, and dampers, or adding dampers, as required for the correct balance as recommended by Balancing Contractor at no additional cost to Owner.
11. Air balance, final adjustment and test run.
12. The satisfactory performance of the completed systems is a requirement of this specification.
13. Any existing items which are damaged by the contractor shall be restored to their original or better condition to the satisfaction of the Owner.

1.3 Contractor use of Premises:

A. General: During the Construction period, the Contractor will have full use of the designated portions of the Owner's property necessary to perform the work, store a reasonable amount of materials, placement of temporary facilities, and similar uses. The Contractor's use of the premises is limited insofar as Owner operations in existing facilities is concerned.
1. The existing building, property and parking area will remain fully operational throughout the Construction Period. This work must be conducted in such a manner that no interference with such operations or with the safety of Owner’s employees, or the public.

1.4 Permit Fees:

A. DFCM does not require fees or permits and is the Governing Authority on this project.
B. Other incidental fees required by other municipal agencies or utility companies are the responsibility of the Contractor.

1.5 Interruption of Existing Utilities:

A. Whenever the work of this contract requires the temporary shutdown of any existing utilities, notify Physical Facilities Director 72 hours in advance and obtain written permission from him before shutting off any existing utilities. Minimize the interruption of existing mechanical, communications and electrical services which may affect other portions of the College operations.

1.6 Construction Documents:

A. The Working Drawings which are listed in the following "Schedule of Drawings" constitute the visual construction guide.
B. Working Drawings and Specifications are complimentary to each other and what is called for by one is as binding as if called for and defined by both. In case of conflict between the two, the Specifications take precedence unless they are obviously in error. Figured dimensions take precedence over scale measurements.
C. In no case are manufacturer's or supplier's shop drawings to nullify, take precedence of, or supplant the Working Drawings.
D. The following schedule lists the Drawings which are included as part of the Construction Documents:

GENERAL

MECHANICAL

M-101	General Mechanical Notes and Legend
MD-101	Mechanical Demolition Plan
ME-101	Mechanical Remodel Plan
ME-501	Mechanical Details
ME-502	Mechanical Details
ME-601	Mechanical Schedules

ELECTRICAL

E-101	Electrical Plans and Schedules

E. Specification Divisions are divided into the standard sixteen construction industry major divisions with all work being categorized into one such division. Individual elements of the work are subdivided into sections within each division. Such assignment of the work is not intended to limit the manner in which the Contractor chooses to assign the work.

1.7 Owner Occupancy:

A. Partial Owner Occupancy: The Owner reserves the right to occupy completed areas of the building, prior to Substantial Completion provided that such occupancy does not interfere with completion of the work. Occupancy shall not constitute acceptance of the total work. All unaffected areas of the building shall remain in full use during construction.

1.8 Guarantee/Warranty:

A. Notwithstanding other guarantees or warranties for specific components of the work, the entire work included in this contract shall be guaranteed for a period of one (1) year from the date of issuance of the Certificate of Substantial Completion against all defects in equipment, material, or workmanship.

B. Furnish and pay for all labor, equipment, and material required to correct defects and deficiencies in the work without additional cost to the Owner and as approved by the Engineer.

C. In addition to the general project warranty, specific project warranties are required. Requirements of the warranties are noted in the indicated Specification Sections.

PART 2-PRODUCTS
(Not Used)

PART 3-EXECUTION
(Not Used)

END OF SECTION 01100

SECTION 01200 - DEFINITIONS AND STANDARDS

PART 1-GENERAL

1.1 Definitions:

A. General: Except as specifically defined otherwise, the following definitions shall supplement definitions of the Contract, General Conditions, Supplementary Conditions and other general contract documents, and apply generally to the work.

B. General Requirements: The provisions of Division-1 sections, General Requirements, apply to the entire work of the Contract.

C. Indicated: Shown on drawing by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "schedules", and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.

D. Directed, Requested, Approved, Accepted, etc.: These terms imply "by the Architect/Engineer", unless otherwise indicated.

E. Approved by Architect/Engineer: In no case releases Contractor from responsibility to fulfill requirements of contract documents.

F. Project Site: Space available to Contractor at location of project, either exclusively or to be shared with separate contractors, for performance of work.

G. Furnish: Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar subsequent requirements.

H. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar requirements.

1. Provide: Furnish and install, complete and ready for intended use.

I. Installer: Entity (firm or person) engaged to install work, by Contractor, subcontractor or sub-sub contractor. Installers are required to be skilled in work they are engaged to install.

J. Specification Text Format: Underscoring facilities scan reading, no other meaning. Imperative language is directed at Contractor, unless otherwise noted.

K. Overlapping/Conflicting Requirements: Most stringent (generally) requirement written directly into the contract documents is intended and will be enforced, unless specifically detailed language written into the contract documents clearly indicates that a less stringent requirement is acceptable. Refer uncertainties to the Architect/Engineer for a decision before proceeding.

1. Where optional requirements are specified in a parallel manner, option is intended to be Contractor's unless otherwise indicated.

L. Minimum Requirements: Indicated requirements are for a specific minimum acceptable level of quality/quantity, as recognized in the industry. Actual work must comply (within specified tolerances), or may exceed minimums within reasonable limits. Refer uncertainties to Architect/Engineer before proceeding.

M. Abbreviations, Plural Words: Abbreviations, where not defined in contract documents, will be interpreted to mean the normal construction industry terminology, determined by recognized grammatical rules, by the Architect/Engineer. Plural words will be interpreted as singular and singular words will be interpreted as plural where applicable for context of contract of documents.

N. Testing laboratory: An independent entity engaged for the project to provide inspections, tests, interpretations, reports and similar services.

1.2 Standards and Regulations:

A. Industry Standards: Applicable standards of construction industry have same force and effect on performance of the work as if copied directly into contract documents or bound and published therewith. Standards referenced in contract documents or in governing regulations have precedence over non-referenced standards, insofar as different standards may contain overlapping or conflicting requirements. Comply with standards in effect as of date of contract documents, unless otherwise indicated.

1. Abbreviations: Where abbreviations or acronyms are used in contract documents, they mean the well recognized name of entity in building construction industry; refer uncertainties to Architect/Engineer before proceeding, or consult "Encyclopedia of Associations" by Gale Research Co.

PART 2-PRODUCTS
(Not Used)

PART 3-EXECUTION
(Not Used)

END OF SECTION 01200

SECTION 01300 - PROCEDURES AND CONTROLS

PART 1 - GENERAL

1.1 ADMINISTRATION AND SUPERVISION:

A. Coordination: Coordinate various elements of the work and entities engaged to perform work; and coordinate the work with existing facilities/conditions, and with work by separate contractors (if any) and by Owner.

1.2 CONSTRUCTION PROGRESS DOCUMENTATION:

A. Contractor shall maintain an overall general project schedule, as well as a detailed 3 week look ahead schedule. The schedules will be regularly updated and modified throughout the project. Updates and modifications shall be given to the Owner and Engineer.
B. The Contractor shall maintain a record of all submittals, RFI's proposal requests, change orders, and all other written communications with Owner and Engineer.

1.3 SURVEY/RECORDING:

A. General: Calculate dimensions and measure for layout of work; do not scale the drawings. Record deviations (if any) from drawing information on existing conditions, and review with Engineer at time of discovery.

1.4 INSPECTION AND TESTING:

A. General: Provide required inspection and testing services specified to be by independent agencies, where not indicated specifically as Owner's responsibility (this provision supplements General Conditions). Neither inspection and test results nor failure thereof to disclose deficiencies relieves Contractor of responsibility to comply with requirements of contract documents. Provide services to inspection and testing agencies (Owner's and Contractor's), including taking and delivery of samples, patch work and similar assistance. Require engaged agencies to perform indicated testing and submit records promptly; and to report significant observations having an important bearing on the work, to the Architect/Engineer by the most expeditious means possible.

1.5 INSTALLATION, GENERAL:

A. Comply with manufacturer's instructions and recommendations to extent printed information is more detailed or stringent than requirements contained directly in contract documents.
B. Timing: Install work during time and under conditions which will ensure best possible results, coordinated with required inspection and testing. Timing is of the up most importance.
C. Anchor work securely in place, properly located by measured line and level, organized for best possible uniformity, visual effect, operations efficiency, durability, and similar benefit to Owner's use. Isolate non-compatible materials from contact, sufficiently to prevent deterioration.

1.6 CLEANING AND PROTECTION:

A. General: Clean each element of work at time of installation. Provide sufficient maintenance and protection during construction to ensure freedom from damage and deterioration at time of substantial completion.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION 01300

SECTION 01330 - PROJECT MEETINGS

PART 1-GENERAL

1.1 PRECONSTRUCTION CONFERENCE:

A. Engineer will schedule preconstruction conference and organizational meeting at Project site or other convenient location by 15 days after issuance of Notice To Proceed. Engineer will conduct meeting to review responsibilities and personnel assignments.

B. Attenders - Owner, Engineer, and their consultants, Contractor and his superintendent, major Subcontractors and other concerned parties shall each be represented at conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda - Discuss items of significance that could affect progress including such topics as
   1. Tentative construction schedule.
   2. Critical Work sequencing.
   3. Designation of responsible personnel.
   4. Procedures for processing interpretations and Modifications.
   5. Procedures for processing Payment Requests.
   6. Distribution of Contract Documents.
   7. Submittal of Product Data, Shop Drawings, Samples, Quality Assurance/Control submittals.
   8. Preparation of record documents and O & M manual.
   9. Use of the premises.
   10. Office, work, and storage areas.
   11. Equipment deliveries and priorities.
   12. Safety procedures.
   13. First aid.
   14. Security.
   15. Housekeeping.
   16. Working hours.
   17. Resolving current problems.
   18. Further orientation as to requirements of Contract Documents.
   19. Architect's responsibility to Owner for inspection.
   20. Working out general schedule of Architect's inspection.

D. Engineer will record significant discussions and agreements and disagreements of each meeting and distribute minutes of meeting to everyone concerned, including Owner, within three working days.

1.2 PROGRESS MEETINGS:

A. Engineer will conduct progress meetings at Project site at regularly scheduled intervals.

B. Owner, Engineer, Contractor, and each Subcontractor concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings by persons familiar with Project and authorized to conclude matters relating to progress.

C. Agenda -

1. Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
2. Progress since last meeting will be reviewed. Where each activity is in relation to Contractor's Construction Schedule, whether on time or ahead or behind schedule, will be determined. How construction behind schedule is to be expedited will be decided and commitments secured from parties involved to do so. Schedule revisions required to ensure that current and subsequent activities will be completed within Contract Time will be discussed.
3. Present and future needs of each entity present will be discussed, including such items as -
   a) Interface requirements.
   b) Time.
   c) Sequences.
   d) Deliveries.
   e) Off-site fabrication problems.
   f) Access.
   g) Site use.
   h) Temporary facilities and services.
   i) Hours of work.
   j) Hazards and risks.
   k) Housekeeping.
   l) Quality and Work standards.
   m) Modifications.
   n) Documentation of information for Payment Requests.

D. Engineer will include brief summary, in narrative form, of progress since previous meeting. By three days after each progress meeting date, Engineer will distribute copies of minutes of meeting to each party present and to parties who should have been present, including Owner.

E. Revise Contractor's Construction Schedule after each progress meeting where revisions to schedule have been made or recognized. Issue revised schedule by three days after each progress meeting date, to each party present and to parties who should have been present, including Owner.

PART 2-PRODUCTS
(Not Used)

PART 3-EXECUTION
(Not Used)

END OF SECTION 01330

SECTION 01400 - PROJECT CLOSEOUT

PART 1-GENERAL

1.1 Related Documents:

A. Drawings and general provisions of contract, including General and Supplementary Conditions and other division 1 specification sections shall apply to this section.

1.2 Summary:

A. This section specifies administrative and procedural requirements for project closeout, including but not limited to:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operating and maintenance manual submittal.
   4. Submittal of warranties.
   5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate sections in division 2 through 16.

1.3 Substantial Completion:

A. **Preliminary Procedures:**
   1. Before requesting inspection for certification of substantial completion, complete the following. List any exceptions in the request.
   2. In the application for payment that coincides with, or first follows, the date substantial completion is claimed, show 100 percent completion for the portion of the work claimed as substantially complete. Include supporting documentation for completion as indicated in these contract documents and a statement showing an accounting of changes to the contract sum.
      a) If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

B. Advise Owner of pending insurance change-over requirements.

C. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

D. Obtain and submit releases enabling the owner unrestricted use of the work and access to services and utilities.

E. Submit record drawings, maintenance manuals, and other similar final record information.

F. Deliver spare parts, extra stock, and similar items.

G. Complete testing of new system and instruction of the Owner's operating and maintenance personnel. Remove all construction tools, and similar elements.

H. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore new and existing marred exposed finishes.

1.4 Inspection Procedures:

A. On receipt of a request for inspection, the Engineer will either proceed with inspection or advise the contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the contractor of construction that must be completed or corrected before the certificate will be issued.
   1. The Engineer will repeat inspection when requested and assured that the work has been substantially completed.
   2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.5 Final Acceptance:

A. Preliminary Procedures
   1. Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

B. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

C. Submit an updated final statement, accounting for final additional changes to the contract sum.

D. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer.
   1. Submit consent of surety of final payment.
   2. Submit a final liquidated damages settlement statement.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

1.6 Reinspection Procedure:

A. The Engineer will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Owner and Engineer.
   1. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance, or advise the contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance. If necessary, reinspection will be repeated.

1.7 Record Document Submittals:

A. General:
   1. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

1.8 Record Drawings:

A. Maintain a clean, undamaged set of blue or black line white prints of contract drawings and shop drawings. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
   1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.
   2. Mark new information that is important to the Owner, but was not shown on the contract drawings or shop drawings.
   3. Note related change order numbers where applicable.
   4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

1.9 Final Cleaning:

A. General cleaning during construction is required by the General Conditions.
   1. **Cleaning:** Employ experienced workers or professional cleaners for final cleaning. Comply with manufacturer's instructions.

1.10 Removal of Protection:

A. Remove temporary protection and facilities installed for protection of the work during construction.

1.11 Compliance:

A. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
   1. Where extra materials of value remain after completion of associated work arrange for disposition of these materials as directed.

PART 2-PRODUCTS
(Not Used)

PART 3-EXECUTION
(Not Used)

END OF SECTION 01400

SECTION 01740 - WARRANTEES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the contract, including Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
   1. Refer to the General Conditions for term of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
   2. Division 1 Section "Contract Closeout" specifies contract closeout procedures.
   3. Division 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.
   4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on products warranties do not relieve the Contractor of the warranty on the Work that incorporated the products. Manufacturer's disclaimers and limitations on products warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS:

A. Standard products warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide grater rights for the Owner.

1.4 WARRANTY REQUIREMENTS:

A. Related Damages and Losses: When correcting failed or damages warranted construction, remove and replace construction that has been damages ad a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written

endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination the Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements for the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Woke, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entitles required to countersign such commitments are wiling to do so.

1.5 SUBMITTALS:

A. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

1. When a designated portion of the Work is completed a occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contain appropriate terms and identification, read for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Engineer, for approval prior to final execution.

1. Refer to Division 2 through 16 Sections for specified content requirements and particular requirement for submitting special warranties.

D. Form a Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty document into an orderly sequence based on the table of contents of the Project Manual.

E. Bind warranties and bonds in operation and maintenance manuals.

1.6 PRODUCTS

A. Commencement of Warranties.
   1. Warrantee shall start at date of substantial completion or at a date thereafter when the piece of equipment or system is demonstrated to be properly operating and is accepted by Owner.

PART 2-PRODUCTS
(Not Used)

PART 3-EXECUTION
(Not Used)

END OF SECTION 01740

DIVISION 15
MECHANICAL SPECIFICATION

15000 GENERAL

15010 GENERAL REQUIREMENTS

15050 BASIC MATERIALS AND METHODS

15051 BASIC MATERIALS AND METHODS GENERAL REQUIREMENTS
15070 VIBRATION ISOLATION AND SEISMIC RESTRAINT
15075 PIPE AND EQUIPMENT IDENTIFICATION

15080 MECHANICAL INSULATION

15081 DUCT INSULATION
15088 HOT WATER HEATING AND RETURN PIPE INSULATION

15100 BUILDING SERVICES PIPING

15101 PIPE AND PIPE FITTINGS
15181 CONDENSATE DRAIN PIPING
15182 HYDRONIC PIPING AND SPECIALTIES
15196 NATURAL GAS PIPING

15700 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

15738 GAS FIRED, REFRIGERANT COOLED, MAKE-UP AIR UNIT
15761 HYDRONIC WATER COILS

15800 AIR DISTRIBUTION

15805 EXHAUST HOODS
15812 ROUND STEEL DUCTWORK
15813 MEDIUM VELOCITY DUCTWORK
15816 RECTANGULAR STEEL DUCTWORK
15818 FLEXIBLE DUCT
15819 DUCTWORK TESTING
15820 DUCTWORK ACCESSORIES
15821 FIRE DAMPERS
15822 DUCT LINER
15823 ROUND DUCT LINER
15836 CENTRIFUGAL TYPE EXHAUST FANS
15841 PRESSURE INDEPENDENT VAV BOXES
15851 REGISTERS, GRILLES AND DIFFUSERS
15861 AIR FILTERS (THROW AWAY TYPE)

15900 HVAC INSTRUMENTATION AND CONTROLS

15910 DDC CONTROLS

15950 TESTING, ADJUSTING AND BALANCING

15960 AIR SYSTEM TEST AND BALANCE
15970 WATER SYSTEM TEST AND BALANCE

SECTION 15010 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL:

A. General Conditions and Division 01 apply to this Division.

1.2 SCOPE:

A. Includes -
1. Provide make-up air units for Art Studio and Nail Salon.
2. Provide canopy exhaust hoods and associated fans in Art Studio.
3. Provide exhaust fans and ductwork in Nail Salon.
4. Modify ceiling and existing fire sprinkler and air lines as necessary to accommodate new hoods and equipment.
5. Furnish all labor, materials, and equipment necessary for completion of the mechanical work for the project.
6. Furnish and install all motors specified in this Division and be responsible for the proper operation of electrical powered equipment furnished by this Division.
7. Furnish exact location of electrical connections and information on motor controls to Division 16.
8. Mechanical Contractor shall obtain the services of independent Test and Balance Agency.
9. Placing the air conditioning, heating, ventilating, and exhaust systems into full operation and continuing their operation during each work day of testing and balancing.
10. Making changes in pulleys, belts, and dampers, or adding dampers, as required for the correct balance as recommended by Balancing Contractor at no additional cost to Owner.
11. Air balance, final adjustment and test run.
12. The satisfactory performance of the completed systems is a requirement of this specification.
13. Any existing items which are damaged by the contractor shall be restored to their original or better condition to the satisfaction of the Owner.

B. Related Work Specified Elsewhere -
1. Conduit, line voltage wiring, outlets, and disconnect switches specified in Division 16.
2. Magnetic starters and thermal protective devices (heaters) not a factory mounted integral part of packaged equipment are specified in Division 16.

1.3 SITE INSPECTION:

A. The Contractor shall examine the site and understand the conditions which may affect the performance of work of this Division before submitting proposals for this work.
B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions.

1.4 DRAWINGS:

A. Mechanical drawings show general arrangement of piping, ductwork, equipment, etc; however, locations are to be regarded as shown diagrammatically only. Follow as closely as actual building construction and work of other trades will permit.

B. Because of the small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate existing structural and finished conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

C. If changes in location of piping, equipment, ducts, etc. are required due to lack of coordination of work under this division, such changes shall be made without charge. Contractor shall review drawings with local and state agencies having jurisdiction and any changes required by them shall be brought to the attention of the Engineer Architect Contracting Officer prior to bidding or commencement of work.

1.5 SHOP DRAWINGS: (NOT EQUIPMENT SUBMITTALS)

1.6 CODE REQUIREMENTS, FEES, AND PERMITS:

A. The work shall be installed in accordance with the following applicable codes, ordinances and standards unless otherwise specified. The codes and standards shall include but not be limited to and be of the latest and current editions.

1. American Boiler and Affiliated Industries (AB and AI)
2. American Gas Association (AGA)
3. Air Movement and Control Association (AMCA)
4. American National Standards Institute (ANSI)
5. Air Conditioning & Refrigeration Institute (ARI)
6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
7. American Society of Mechanical Engineers (ASME)
8. American Society of Testing Materials (ASTM)
9. American Standards Association (ASA)
10. American Water Works Association (AWWA)
11. American Welding Society (AWS)
12. Associated Air Balance Council (AABC)
13. Heat Exchange Institute (HEI)
14. Hydraulic Institute (HI)
15. IBR
16. National Electrical Code (NEC)
17. National Fire Protection Association (NFPA)
18. Sheet Metal and Air Conditioning contractors National Association (SMACNA)
19. Underwriters Laboratories (UL)
20. International Building Code (IBC) 2003 Ed
21. International Mechanical Code (IMC) 2003 Ed
22. International Plumbing Code (IPC) with Utah Amendments 2003 Ed
23. Utah State Safety Orders (OSHA/UOSH)
24. Utah Fire Rating Bureau

25. Utah Boiler and Pressure Vessel Law
26. Utah Air Conservation Regulations/Waste Disposal regulations.
27. ASHRAE Ventilation STD.62-2001.
28. Energy Code for Commercial and High Rise Building ASHRAE/IES NA 90.1-2001.

B. Should drawings conflict with any code, the code shall govern. If drawings and specifications establish a quality exceeding the code, the drawings and specifications shall govern. If conflicts do exist among the drawings, specifications and codes, the same shall be brought to the attention of the Engineer Architect Contracting Officer in writing prior to bidding, otherwise Contractor shall comply with applicable codes.

C. The latest edition of all codes shall be used.

D. Contractor shall give all notices, obtain all necessary permits, file necessary plans, prepare documents and obtain approvals, and pay all fees required for completion of the mechanical and plumbing work outlined in this Division of the specifications and shown on the Mechanical Drawings.

1.7 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS:

A. Upon completion of work and before final payment, Contractor shall furnish and deliver to the Owner, through the Engineer Architect Contracting Officer, three (3) sets of installation, operating and maintenance manuals and instructions for all new materials and mechanical equipment used in the building. The Contractor shall also provide 3 cd's with electrical copies of manual in PDF format. Electronic O & M shall be organized in the same manner as the hard copy with the same sections and tabs.

B. Bind Operation and Maintenance Manual for Mechanical Systems in a hard-backed piano hinge loose-leaf binder with strong sturdy cover. The following lettering shall be stamped on front and spine of each binder:

OPERATION
AND
MAINTENANCE
MANUAL
for MECHANICAL SYSTEMS of DFCM # 04225710
Snow College South Campus – Washburn Building
Art Studio and Nail Salon HVAC Upgrades
Richfield, Utah
WHW Engineering Inc.

C. The first section is to contain the following information.
1. First page shall be a table of contents including name of project, date awarded and date of substantial completion.
2. Second page shall contain the names, phone numbers and addresses of Architect, Consulting Engineers, and Associates.
3. Third page shall contain a list of names, addresses and phone numbers of contractors and all sub-contractors and work to which each was assigned.
4. Final page or pages shall contain an equipment list. The list shall contain each item of equipment or material for which a submittal was required giving ID or tag no as contained on the drawings make and model No.

Serial No. Identification No. Location in building, function and name address and phone number of supplier.

D. The second section shall contain
   1. Description of each operating system included location of switches, breakers thermostats control devices. Provide a single line diagram, showing set points, normal operating parameters for all loads, pressures, temperatures and flow check points; Describe all alarms and cautions for operation.
   2. Provide schematic control diagrams, panel diagrams, wiring diagrams etc (blue line prints) for each separate fan system, chilled water system, hot water system, exhaust air system, pumps, etc. each control diagram shall show a schematic representation of mechanical equipment and location of start-stop switches, insertion thermostats, thermometers, pressure gauges, automatic valves etc. The correct reading for each control instrument shall be marked on the diagram.

E. The third section shall contain a comprehensive lubrication list and maintenance schedule for equipment with moving parts. If bearings are sealed equipment shall still be included and a statement to indicate no lubrication or maintenance required.

F. The fourth section shall contain a complete air and water test and balance report. The report shall contain name, address and phone number of agency. Name and certification of their mechanical engineer, list of equipment with date of last calibration.
   1. Floor plans showing all air openings and thermometer location clearly marked and cross reference with data sheets. Formatted may be 8 1/2 x 11 or 11x14 if legible.
   2. Data sheets showing amount of air handled at each setting see section 15960 and 15970.

G. The fifth section shall contain data on plumbing fixtures and equipment.
   1. Section shall contain general product catalog cuts, approved submittal sheets and exploded view drawings with parts lists for all valves and other items with multiple parts.

H. The final sections shall be one for each individual item for which a submittal sheet was required. Each section shall include:
   1. Equipment descriptions
   2. Detailed installation instruction, operating and maintenance instructions (provided more than just product operations and maintenance instructions provided with unit where required. Instructions should be written in a step by step manner identifying start-up, operating, shutdown and emergency action sequence sufficiently clear so a person unfamiliar with the equipment could perform its operations.
   3. Equipment drawings, performance curves, operating characteristics, etc.
   4. Name addresses and phone number of manufacturer, fabricator and local vender clearly printed or stamped on cover.
   5. Complete parts listing which include catalog number, serial number, contract number or other accurate provision for ordering replacement and spare parts.
   6. Certified drawings, where applicable, showing assembly of parts and general dimensions.
   7. General product and approved submittal sheets.

I. Drawings and reproducible masters of drawings as required in individual specification sections, are not to be bound in volumes but are to be delivered separate with the maintenance manuals.
J. Equipment to be covered:
   1. Mechanical equipment
   2. Automatic controls and sensing systems
   3. Any other item for which a submittal is required.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Contractor shall instruct building maintenance personnel in the operation and maintenance of the installed mechanical systems utilizing the Operation and Maintenance Manual when so doing.
B. Minimum instruction periods shall be as follows -
   1. Mechanical – Four Hours
   2. Control – Six Hours
C. Instruction periods shall occur before final inspection when systems are properly working and before final payment is made.
D. None of these instructional periods shall overlap each other.
E. An additional four hours of instruction will be provided by each contractor, after 60 days of system operation by owner to insure proper system operation and answer questions.

1.9 RECORD DRAWINGS:

A. Contractor shall keep an up-to-date set of mechanical and plumbing drawings in his custody showing all changes in red, clearly defined and neatly drafted by him. At the end of construction, he shall turn these drawings over to the Engineer Architect Contracting Officer. Record drawings must be completed and submitted prior to final inspection.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION 15010

SECTION 15051 - BASIC MATERIALS & METHODS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL:

A. Division 15010 General applies to this Section.

1.2 COORDINATION OF WORK:

A. It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for the installation of systems according to the true intent and meaning of the Contract Documents. Anything not clear or in conflict will be explained by making application to the Engineer in writing. Should conditions arise where certain changes would be advisable, secure Owner's and Engineer approval for these changes before proceeding with work.

B. Coordinate work of various trades in installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences in a manner approved by Engineer. Changes required in work specified in Division 15 caused by neglect to secure approval shall be made at no cost to Owner.

C. Arrange piping, ductwork, and equipment to permit ready access to valves, unions, starters, motors, control components, and to clear openings of doors and access panels. Contractor shall provide all necessary access doors and/or panels to provide complete access to all mechanical equipment, dampers, or accessories. Doors for dampers, etc. shall be minimum 12" x 12" and doors for mechanical equipment shall be minimum 24" x 24".

D. Furnish and install inserts and supports required by Division 15 unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions involved in sufficient time to be built into the construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne by Contractor.

E. Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterwards to satisfaction of Owner and Architect. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

1. Patch and repair walls, floors and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
2. This Division shall bear expense of cutting, patching, repairing, and replacing of work of other Divisions because of its fault, error, tardiness, or because of damage done by it.
3. Provide the necessary cutting, patching, repairing, and replacing pavements, sidewalks, etc. to permit installation of work of this Division.]

F. Adjust locations of piping, ductwork, equipment, etc, to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and cut prior to fabrication.

1. Make offsets, transitions, and changes in direction of piping, ductwork, and electrical raceways as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.

G. Slots and openings through floors, walls and roofs shall be provided by this Division.
H. This Contractor shall schedule his work, store his equipment and materials, and work in harmony with other Contractors so as to not delay or jeopardize the construction.
I. This Division shall coordinate with electrical contractor to insure that all required components of control work are included and fully understood. Any discrepancies shall be called to the attention of the Engineerbefore completion of bids. No additional cost shall accrue to the Owner as a result of lack of such coordination.

1.3 EQUIPMENT & MATERIALS:

A. Requests for substitution shall be received in writing a minimum of seven days prior to bidding. Prior acceptance shall be by Manufacturer's name only. Items not listed in this specification or subsequent addendums shall not be considered. No oral approvals will be acceptable. Manufacturers listed in this specification are acceptable only for items listed. All other items manufacturer wishes to bid must be prior approved. All equipment shall be subject to final review in accordance with "Project Submittals".
B. Product Approvals -
   1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
   2. In the event other than specified equipment is used and will not fit job site conditions, this Division assumes responsibility for replacement with items named in Specification.
C. Use domestic made pipe, pipe fittings, and motors on Project.
D. Motor and equipment name plates as well as applicable UL labels shall be in place when Project is turned over to Owner.
E. Insure that items to be furnished fit spaces available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. Do not scale off drawings.
F. All materials shall be of the best commercial quality obtainable, consistent with specified materials and for the purpose or function intended. Materials shall be new unless specifically excepted.
G. Equipment catalog or model numbers shown define the basic equipment types and quality standard only. Catalog numbers shall not be considered as all inclusive and shall be verified to include all devices, controls, operators, and appurtenances necessary for the satisfactory and complete operation of the equipment.
H. Follow manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.
   1. Promptly notify Architect] [Engineer] [Contracting Officer] in writing of conflicts between requirements of Contract Documents and Manufacturer's directions and obtain Architect's] [Engineer's] [Contracting Officer's] written instructions before proceeding with work. Contractor shall bear all expenses arising from correcting deficiencies of work that does not comply with Manufacturer's directions or such written instructions from .

I. Deliver equipment and material to site and tightly cover and protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls) in a dry, heated space.

1.4 PROJECT SUBMITTALS:

A. Furnish complete catalog data for manufactured items of equipment to be used in the Work to for review within 15 days after award of Contract.

B. Submittal shall include, but not be limited to the following:
   1. equipment scheduled
   2. balancing contractor
   3. insulation
   4. grilles, and diffusers
   5. automatic temperature controls
   6. certificates of guarantee
   7. valves
   8. any item for which more than one manufacturer is mentioned

C. Submit a minimum of five copies of data in binders and index in same order and name as they appear in Specification.
   1. State sizes, capacities, brand names, motor HP, electrical requirements, accessories, materials, gauges, dimensions, and other pertinent information.
   2. List on catalog covers page numbers of submitted items.
   3. Underline or highlight applicable data.

D. If material or equipment is not as specified or submittal is not complete, it will be rejected.

E. Catalog data or shop drawings for equipment which are noted as being reviewed by shall not supercede Contract Documents.

F. Review comments of shall not relieve this Division from responsibility for deviations from Contract Documents unless attention has been called to such deviations in writing at time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

G. Check work described by catalog data with Contract Documents for deviations and errors.

H. All items other than first named specified equipment shall show and state all exceptions and deviations taken and shall include design calculations and drawing layouts.

I. The Contractor shall review the submittals prior to submission to the to make sure that the submittals are complete in all details. No submittal will be reviewed which does not bear the contractor's notation that such checking has been made.

J. No partial submittals will be considered unless approved by the

K. Manufacturers' names shall be mentioned as acceptable prior to bidding.

L. Contractor shall verify equipment dimensions to fit the spaces provided with sufficient clearance for servicing the equipment.

M. Contractor shall review equipment submittals for compliance with schedules, specifications, and drawing plans and details. Equipment submittal shall show the proper arrangements to suit installation and maintenance such as motor location, access doors, filter removal, piping connections, etc.

N. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment. Submittals shall clearly indicate name of manufacturer of each item.
O. For unacceptable items, the right shall be reserved to require the first named specified items.
P. Where submittals are sent to with any of the above listed information missing or are incomplete they will be returned to the contractor unchecked to be completed and resubmitted. No additional time or money shall be allowed for failure to provide complete submittals on the first review.
Q. If an item requiring submittal review is ordered, purchased, shipped, or installed prior to the submittal review and is subsequently disapproved the item shall be removed from the job site and replaced with an approved item at contractors expense.

1.5 CLEANING & FINISHING:

A. Contractor shall, at all times, keep the premises free from waste material and rubbish. Upon completion of this Section of the work, Contractor shall remove all surplus materials and rubbish; clean all spots resulting from the mechanical work from hardware, floors, glass, walls, etc.; do all required patching up and repair all work of other trades damaged by Contractor under this Section of the work, and leave the premises in a clean orderly condition. Clean heating and cooling coils, internally and externally, and replace all air filters prior to final mechanical inspection. Remove rust, plaster, dirt, grease and oil before painting, insulating, or exposing to view the equipment, piping, ductwork, etc. in completed structure. Refinish any damaged surfaces and leave in proper working order at final completion.

1.6 EQUIPMENT SERVICING:

A. Prior to starting mechanical equipment, all motors, bearings and moving parts shall be properly oiled, greased and lubricated as required. Full and adequate maintenance service shall be given and upon completion all equipment shall be cleaned and checked and placed in perfect condition for the Owner.
B. Provide lubrication for the following:
   1. Make-up Air Units
   2. Exhaust fans
   3. Damper motors
   4. VAV boxes
C. Amount and type of lubricant shall be per manufacturer's specification.

1.7 SUPERVISION:

A. The Contractor shall supervise and direct the work with his best skill and attention. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor will be responsible to see that the finished work complies accurately with the Contract Documents.

1.8 SAFETY REGULATIONS:

A. Contractor shall provide equipment, supervision, construction, procedures, and everything necessary to assure safety of life or property.
B. Refer also to General Condition and Special Conditions for protection clauses.

1.9 LEAK DAMAGE:

A. Contractor shall be responsible for damages to the work of other Contractors or to the building, or to its contents, people, etc., caused by leaks in any of the equipment or piping installed by him through equipment or material failures, leaking joints or disconnected pipes, fittings, or by overflows and shall make at his own expense all repairs to fixtures, building interior, contents, paint, rugs, furniture, ceiling tile, and equipment so damaged.

1.10 TOOLS AND STORAGE OF EQUIPMENT:

A. The Contractor shall furnish all necessary tools, staging and whatever may be necessary for the installation of this work and shall at all times protect this work and others, and the materials to be used therein from damage by the weather, accident and other causes, and shall repair and make good any damage thus occurring.

1.11 WORKMANSHIP:

A. Workmanship shall be the best quality of its kind for respective industries, trades, crafts and practices and shall be acceptable in every respect to the Owner and Engineer. Nothing contained herein shall relieve the Contractor from performing good work, perfect in all details of construction.

1.12 BELT GUARDS:

A. Shall be provided, properly enclosing each belt drive system. Guards shall be easily removable, constructed of expanded metal with suitable frames corresponding with SMACNA standard and with tachometer openings. Coordinate with equipment suppliers to avoid duplication of belt guards supplied with equipment. Guards shall comply with OSHA Regulations.

1.13 ELECTRICAL WORK:

A. Power wiring to all electrically driven apparatus shall be done under the electrical contract. See Electrical Specifications.
B. Unless specifically noted otherwise on documents, Electrical Contractor shall furnish and install all magnetic starters including properly sized heaters, and disconnect switches as indicated on drawings or required by code.
C. The Contractor shall verify the proper operation of equipment furnished by him. Costs for repair, replacing, re-wiring and retesting shall be borne by the Contractor without additional costs to the Owner.
D. Motors shall be as specified in Section 15055.

1.14 INSPECTION NOTICE:

A. The following is a basic list of guideline items so that the Architect, district building inspector/Owner's representative can be at job site for these inspections as the building progresses. Mechanical Contractor shall inform these people one week in advance of test time.
   1. Pressure tests on hot, chilled, and condenser water supply and return piping.
   2. All duct work prior to installation of finished ceilings, including ductwork pressure testing.
   3. The initial start-up of mechanical equipment, etc.
   4. Any changes or problems occurring at job site.
   5. Periodic inspection at their discretion will be made to insure compliance to Contract Documents and codes. Contractor shall provide ladders, access and other assistance as requested during inspections.
   6. Final inspection before giving approval for final payment.

1.15 WARRANTY GUARANTEE:

A. The Contractor shall warrant all materials and equipment to be of quality consistent with specifications as represented by manufacturer's published data.
B. The Contractor shall guarantee that the installation and operation of the equipment shall be free from defects for a period of one year beginning at date of substantial completion and acceptance. The Contractor shall replace or repair any part of the installation that is found to be defective or incomplete within the guarantee period.
C. The one year guarantee on equipment and systems shall commence when equipment has been demonstrated to work and has been accepted. (Example: If an equipment item fails to perform and it takes 9 months after substantial completion to correct, then the guarantee shall commence after the item has been demonstrated to perform and has been accepted.)
D. Substantial completion and acceptance in no way relieves the Contractor from providing the systems and equipment as specified.

1.16 COMPLETION SCHEDULE:

A. Start-up and verification of basic equipment items shall be done prior to the date of substantial completion with sufficient time to allow balancing and adjusting to be performed.
B. At the time of the final inspection a date shall be agreed upon for completion of any remaining items. At least double the estimated cost of the work will be withheld from the Contractor's payment.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION 15051

SECTION 15070 VIBRATION ISOLATION AND SEISMIC RESTRAINT

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section consists of furnishing engineering and materials necessary for vibration isolation and seismic restraints for equipment contained herein for the project.
   1. Other Sections of DIVISION 15 for a part of this section. Refer to all sections for a complete description of the work
   2. Section 15101 – Pipe and Pipe Fittings
   3. Section 15182 – Hydronic Piping
   4. Section 15196 – Natural Gas Piping

B. All mechanical equipment .75 HP and over listed in the equipment schedule shall be mounted on vibration isolators to prevent the transmission of objectionable vibration and vibration induced sound to the building structure.
   1. All isolation materials, flexible connectors and seismic restraints shall be of the same manufacturer and shall be certified using published or factory certified data. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.
   2. The contractor and manufacturer of the isolation and seismic equipment shall refer to the isolator and seismic restraint schedule which lists isolator types, isolator deflections and seismic restraint type. Vibration isolators shall be selected in accordance with the equipment, pipe or ductweight distribution so as to produce reasonably uniform deflections.

C. Unless otherwise specified, all mechanical, electrical, and plumbing equipment, pipe, and duct shall be restrained to resist seismic forces. Restraints shall maintain equipment, piping, and duct work in a captive position. Restraint devices shall be designed and selected to meet the seismic requirements as defined in the latest issue of the IBC or local jurisdiction building code.
   1. For this project all systems shall be considered to be essential with an IPO=1.5

1.2 SEISMIC RESTRAINT SHALL NOT BE REQUIRED FOR THE FOLLOWING

A. Rigidly floor mounted mechanical, electrical, and plumbing components in all seismic design categories, where Ip=1.0 and flexible connections between the components and associated ductwork, piping and conduit are provided, that are mounted at 4 feet (1219 mm) or less above a floor level and weight 400 pounds (1780) or less and are not critical to the continued operation of the structure. Suspended, wall mounted and flexibly mounted equipment are not included in this exclusion.

B. Hanging, wall mounted, and flexibly supported mechanical, plumbing and electrical components that weigh 20 pounds (89 N) or less, where Ip=1.0 and flexible connections are provided between the components and associated duct work, piping and conduit.

C. Piping supported by individual clevis hangers where the distance, as measured from the top of the pipe to the supporting structure, is less than 12 inches (305mm) for the entire pipe run and the pipe can accommodate the expected deflections. Trapeze or double rod hangers where the distance from the top of

the trapeze or support to the structure is less than 12 inches for the entire run. Hanger rods shall not be constructed in a manner that would subject the rod to bending moments (swivel, eye bolt, or vibration isolation hanger connection to structure).

D. High deformability piping (steel, copper, aluminum with welded, brazed, ground, or screwed connections) and limited deformability piping (cast iron, FRP, PVC) designed with an Ip=1.0 and a nominal pipe size of 1 inch and less in the mechanical equipment room, or 2" and less outside the mechanical equipment room.

E. PVC or other plastic or fiberglass vent piping.

F. HVAC ducts suspended from hangers that are 12 inches (305 mm) or less in length from the top of the duct to the supporting structure and the hangers are detailed to avoid significant bending of the hangers and their connections. Duct must be positively attached to hanger with minimum #10 screws within 2" from the top of the duct.

G. HVAC ducts with an Ip=1.0 that have a cross sectional area of less than 6 square feet (0.557 m2)

1.3 MANUFACTURER'S RESPONSIBILITIES: Manufacturer of vibration and seismic control products shall have the following responsibilities.

A. Determine vibration isolation and seismic restraint sizes and locations.

B. Provide piping, ductwork and equipment isolation systems and seismic restraints as scheduled or specified.

C. Provide installation instructions and shop drawings for all materials supplied under this section of the specifications.

D. Provide calculations to determine restraint loads resulting from seismic forces presented in local building code or IBC, Chapter 16 latest edition. Seismic calculations shall be certified by a licensed engineer licensed in the State of Utah in the employ of the seismic equipment manufacturer with a maximum 5 years experience. Provide calculations for all floor or roof mounted equipment 400lbs (1780 N) or greater (20lbs (89 N) or greater for Ip=1.5), all suspended or wall mounted equipment 20lbs (89 N) or greater, and vibration isolated equipment 20lbs (89 N) or greater.

E. Seismic restraint load ratings must be certified and substantiated by testing or calculations under direct control of a registered professional engineer licensed in the State of Utah.

F. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compassive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.

1.4 QUALITY CONTROL

A The isolators and seismic restraint systems listed herein are as manufactured by:

1. Amber/Booth.
2. Mason Industries
3. Korfund
4. Vibration Mounting and Controls

Manufacturer must be a member of the Vibration Isolation and Seismic Control Manufacturers Association (VISCMA)

B. Steel components shall be cleaned and painted with industrial enamel. All nuts, bolts, and washers shall be zinc-electroplated. Structural steel bases shall be throughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

C. All isolators, bases, and seismic restraints exposed to the weather shall utilize cadmium plated, epoxy coat or PVC coated springs and hot dipped galvanized steel components. Nuts, bolts, and washers may be zinc-electroplated. Isolators for outdoor mounted equipment shall provide adequate restraint for the greater of either wind loads required by local codes or withstand a minimum of 30 lb. /sq. Ft. applied to any exposed surface of the equipment.

D. Provide a written quality control procedure that outlines complete compliance of attachment and cabling restrains to brackets. For swaged connections, provide a gage to verify swage. For screw/clamp connection, provide torque values for attachment fasteners.

1.5 SUBMITTALS

A. Submit shop drawings of all isolators, seismic restraints and calculations provided (para 1.3)

B. The manufacturer of vibration isolation products shall submit the following data for each piece of isolated equipment: clearly identified equipment tag, quantity and size of vibration isolators and seismic restraints for each piece of rotating isolated equipment. Submittals for mountings and hangers incorporating spring shall include spring diameter and free height, rated deflections, and solid load. Submittals for bases shall clearly identify locations for all mountings as well as all locations for attachment points of the equipment to the mounting base. Submittals shall include seismic calculations signed and checked by a qualified licensed engineer licensed in the State of Utah in the employ of the manufacturer of the vibration isolators. Catalog cut sheets and installation instructions shall be included for each type of isolation mounting or seismic restraint used on equipment being isolated.

C. Submit quality assurance procedures as required under 1.4.D at time of isolator/seismic submittals. Submitals must be stamped by a registered professional engineer licensed in the State of Utah who is responsible for the seismic restraint design. All vibration isolation/seismic submittals not complying with this certification will be rejected.

D. Provide shop drawings indicating location of all specification SC cable restraints (section 2.3.B) required for pipe and ductwork. Drawing must be stamped by manufacturer's registered professional engineer licensed in the State of Utah.

E. Mechanical, electrical and plumbing equipment manufacturers shall provide certification that there is capability of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic restraints.

F. Provide a certification from the seismic design engineer that the seismic restraints will comply with the applicable code requirements. Certification must be stamped by a registered profession engineer licensed in the State of Utah.

G. Provide a Certificate of Completion from the manufacturer's representative upon completion of the job.

END OF SECTION 15070

SECTION 15075 - PIPE AND EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE:

A. Piping Identification
   1. All pipes shall be labeled and color coded with contents clearly identified and arrows indicating direction of flow. This applies to piping run above the ceilings as well as pipe exposed in equipment rooms and finished areas. Pipes shall be identified at the following locations:
      a. Adjacent to each valve.
      b. At every point of entry and exit where piping passes through a wall or floor.
      c. On each riser and junction.
      d. A maximum of every 50 feet on long continuous lines fully exposed to view. Less spacing if one cannot see one code from the adjacent.
      e. Adjacent to all special fittings or devices (regulating valves, etc..
      f. Connection to equipment.

B. Duct Identification
   1. Ductwork shall be identified at or near the fan.

C. Equipment Identification
   1. Identify all equipment including gauges, meters, thermostats, mechanical equipment, ATC panels, junction boxes, and all other devices.

PART 2 - MATERIALS

2.1 PIPING IDENTIFICATION:

A. Labels and markers shall be of the self-sticking, all-temperature permanent type as manufactured by W. H. Brady Co., 727 West Glendale Ave., Milwaukee, Wisconsin; or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.

B. Pipe color coding shall be uniform throughout the building and comply with requirements of ANSI A13.1.

C. All paint to be Enamel, Moore Impervo and Iron Clad.

D. Letters of identification legend and directional flow arrows shall be 2" high for pipes 3" and larger, and 1" high for pipes 2-1/2" and under.

E. Proposed identification system shall be approved by Owner and Architect prior to installation.

2.2 DUCT IDENTIFICATION:

A. Ductwork shall be identified at or near the fan, with stenciled signs or by engraved laminated plastic signs secured with rust proof screws. Sign shall indicate area served and direction of air flow.

2.3 EQUIPMENT IDENTIFICATION:

A. Equipment shall be identified with signs made of laminated plastic with 1/8" or larger engraved letters. Signs shall be securely attached by rust proof screwed or some other permanent means (no adhesives).
B. Information on signs shall include name of equipment, identification on plans and schedules, rating maintenance instructions and any other important data not included on factory attached name plate.

PART 3 - EXECUTION

3.1 PIPING IDENTIFICATION:

A. Markers shall be installed in strict accordance with manufacturer's instructions. Use vinyl tape first and stick markers over tape. This procedure assures that the tape will not fall off.
B. On chalky and loose insulation, soft, porous, fiber-filled or fiberglass covering, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.
C. On bare pipes, painted pipes, and pipes insulated with a firm covering pipe banding tape matching the background color of the marker shall be used. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or banding tape.
D. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance, that is that stenciling is applied over a background color. If stenciling, is used, letter heights, background colors, banding and arrows shall be as specified above. Submit sample to Owner before proceeding with work.
E. Apply markers so they can be read from floor.

3.2 DUCT IDENTIFICATION:

A. Identify all ducts exposed in mechanical equipment room. A sample duct identification shall be as follows: Supply air VAV System Administration offices.

3.2 EQUIPMENT IDENTIFICATION:

A. Signs shall be attached to equipment so they can be easily read. Attachment shall be by screws or rivets. Glue shall not be used.
B. A sample identification sign for equipment shall be as follows: AH-1 Air handler single zone Gymnasium 8000 cfm.
C. NOTE: Avoid using only the engineers designations as used on plans; identify equipment as to area or zone served.

3.3 REMOVABLE AND NON-REMOVABLE CEILING TILE:

A. Where valves, VAV boxes, fire dampers, adjustment controls, etc. are located above ceiling tile, an identification on the lay in tile tee bar shall be provided to indicate the tile to be removed for access to a particular item. In general, 1/2 inch high black stick on or stencil letters are to be used indicating the device such as VAV for VAV box, CWV for cold water valve, FD for fire damper, E for other

electrical devices, etc. The code used shall be provided in the operations and maintenance manual.

B. For non-accessible ceiling and ceilings without tee bars, provide hinged access doors at each valve, fire damper, damper operator and VAV box.

END OF SECTION 15075

SECTION 15081 - DUCT INSULATION

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Insulating of concealed round above grade supply air ducts that are not lined. All ductwork routed outside of building insulation envelope.
   2. Insulation shall have surface burning characteristics as determined by ASTM E84 with a flame spread rating of 25 and a smoke developed of 50.

B. Related Work specified Elsewhere -
   1. Acoustical insulation inside air ducts is specified in Section 15822.
   2. Insulated flex duct specified in Section 15818.

PART 2 - PRODUCTS

2.1 INSULATION:

A. 1-1/2 inch thick fiberglass with aluminum foil scrim kraft facing and have a density of one lb/cu ft.

B. Approved Manufacturers:
   1. Johns-Manville Microlite FSK
   2. CSG Type IV standard duct insulation
   3. Owens-Corning FRK-25
   4. Knauf (Duct Wrap FSK)

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install duct wrap in accordance with Manufacturer's recommendations.

B. Do not compress insulation except in areas of structural interference.

C. Joints shall be completely sealed.

END OF SECTION 15081

SECTION 15088 - HEATING HOT WATER PIPE INSULATION

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Insulating of heating hot water supply and return piping and fittings and valves.

PART 2 - PRODUCTS

1.2 INSULATION:

A. Snap-on glass fiber pipe insulation with surface burning characteristics as determined by ASTM E84 with a flame spread rating not to exceed 25 and smoke developed not to exceed 50 when tested to UBC Standards.
B. Concealed areas; fiberglass sectional pipe insulation with ASJ jacketing.
C. Exposed areas; Owens-Corning Fiberglass 25; H-P pipe insulation with pre-sized glass cloth cover.
D. Approved Manufacturers -
   1. Owens-Corning
   2. Johns-Manville
   3. CSG
   4. Knauf
E. Thickness shall be as noted in table 2.

1.3 COVERING:

A. Where piping is susceptible to damage, provide with heavy duty PVC jacket.
   1. Jacket material shall be a minimum of .030 inches thick and white in color unless directed otherwise by Architect.
      a. Approved Manufacturers
         1) Ceel-Tite 320 by Ceel Co.
         2) Prior approved equal

PART 3 - EXECUTION

3.1 PIPING:

A. General
   1. Pipe insulation shall be continuous through the sleeve.
   2. A PVC jacket shall be provided over the insulation wherever caulking is required.
   3. Insulation shall be continuous through hangers.
   4. Support points such as hangers or rollers shall have a calcium silicate block at support point. See section 15101.
   5. Insulation shall be applied to clean, dry pipe with joints tightly butted.
   6. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided for circumferential joints.

7. Laps and butt strips shall be secured with adhesive and stapled on 4-inch centers. Adhesive may be omitted where pipe is concealed.
8. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as noted for butt strips. Patch shall extend not less than 1-1/2 inches past the break.
9. The run of the line pipe insulation shall have the ends brought up to the item.

3.2 FITTINGS:

A. Insulate fittings with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in or Tapered.
B. Cover insulation with one piece "Zeston" PVC fitting cover or equal by Ceel Co. secured by stapling or taping ends to adjacent pipe covering.
C. Alternate Method -
   1. Insulate fittings with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending two inches onto adjacent insulation.

TABLE 2

Thickness of Pipe Insulation for Heating Hot Water Piping

Pipe Size	1" and less	1-1/4" to 2"	2-1/2" to 4"
Thickness	1"	1"	1-1/2"

NOTE: PIPING ROUTED OUTSIDE OF BUILDING INSULATION ENVELOPE SHALL HAVE INSULATION THICKNESS INCREASED 1/2"

END OF SECTION 15088

SECTION 15101 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Division 15010 General applies to this Section.

1.2 SCOPE:

A. Includes -
   1. General piping installation, materials and procedures for all piping systems.
B. Related Work Specified Elsewhere -
   1. Type of pipe and fittings for culinary water, heating hot water, chilled water, condenser water, drainage, etc. shall be specified in that particular Section.

PART 2 - PRODUCTS

2.1 HANGERS:

A. Provide one of the following types of hangers for horizontal piping. Comparable products of Grinnell, Globe Pipehanger, B-Line, Michigan Hanger, Superstrut or Piping Technology and Products (PTP) considered equal.
B. Except as otherwise specified hereinafter: Clevis type, B-Line Fig. B3100.
C. Where pipe exceeds maximum loading recommended for Clevis type Hangers, provide steel pipe clamp, B-Line Fig. B3140 or Fig. B3142, depending on loading.
D. Provide trapeze hangers where several pipes can be installed parallel and at the same level. Trapeze hangers shall consist of 2 steel channels bolted back to back spaced for rod hangers at each end. Use roller chairs B-Line B3120 pipe roll stands B-Line B3117 SL where provision for expansion is required.
E. Supporting rods shall be attached to concrete by inserts placed before concrete is poured for pipes up to 8 inches.
F. Supporting rods over 18 inches long shall be braced at every fourth hanger with diagonal bracing attached to slab or beam.
G. Spring hangers shall be used for support of pipe within 100 diameters distance of coils, or pumps, as needed to isolate vibration. Springs shall be sized 1" static deflection. Vibrex type HXAP-PC adjustable spring hangers.
H. For copper tubing use copper hanger; or dielectrically isolate.

2.2 WALL SUPPORTS:

A. Provide one of the following means of supporting horizontal piping from wall:
B. B-Line B-200 pipe clamp.
C. For hanger suspension, 750 pound maximum loading, light welded steel bracket with hole for one rod, 3/4 inch diameter. B-Line Fig. B3068.
D. For pipe roll stand support, welded-steel bracket, light for 700 pound maximum loading, B-Line Fig. B3063, medium for 1500 pound maximum loading Fig. B, heavy for 3000 pound maximum loading Fig. B3067.

2.3 ROOF-MOUNTED PIPING SUPPORTS

A. For Gas Piping
   1. Pillow block type stand made to sit directly on roof.
   2. Support shall be made of polycarbonate resin.
   3. Approved manufacturers
      a. Miro Industries of Salt Lake City, Utah, Model M-02
      b. Equal product by Portable Pipe Hangers Inc. of Houston, Texas
      c. Prior approved equal
   4. Multiple stands must be stacked together as per manufacturer for height adjustment so piping is run level across roof, or the adjustable height stands specified below for refrigerant piping may be used.

2.4 CLAMPS:

A. Beam clamps shall be malleable iron, B-Line Fig. B442 for 1/4 inch hanger rods; forged steel beam clamp, B-Line B321 for hanger rod up to 1-1/2 inches.

2.5 PIPE COVERING PROTECTION:

A. Provide calcium silicate blocks in the bottom 1/2 diameter of pipe to protect insulation at areas of contact with hangers and supports. Material shall be 8 inches long for pipes up to 3 inches and 12 inches long for pipes 3-1/2 inches and larger. Insulation manufacturer supplied inserts shall be acceptable.

2.6 WALL AND CEILING PLATES:

A. Fit pipes passing through walls, floors, and ceiling with wall plates of proper size to cover openings around pipes. Plates will not be required at floor slabs where sleeves project above floor and space between pipe and sleeve is caulked and sealed. Plates shall be equal to Beaton and Cadwell No. 10, pressed steel plates. Floor plates shall be chromium plated. Wall and ceiling plates shall be prime coated.

2.7 UNIONS AND COUPLINGS:

A. Unions: Malleable iron, brass to iron seat, ground joint, same materials as pipe. Crane, Walworth, or approved equal.
B. Dielectric Unions: Mechanical Contractor shall install dielectric union or couplings whenever copper pipe connects to steel pipe or other items of equipment. Couplings and unions shall be as manufactured by the Water Vallot Company of Detroit, Michigan, or approved equal.

2.8 PIPING SPECIALTIES:

A. Provide thermometers, pressure gages, vents, tank fittings, and other miscellaneous piping specialties as shown on drawings, or as may be required by usual good practices for a complete system.
B. Thermometers shall be 9" scale, red reading, glass covered, immersion type with separable sockets. Marshall-Town, Moeller, Trerice, Weskler, or Weiss, with neck extension to accommodate insulation.

C. Pressure gages shall be 4-1/2" diameter dial, molded case dust proof, phosphor bronze, bourdon tube type installed with integral check screw or pressure snubber. Marshalltown 224, U.S., Ashcroft, Trerice or Marsh.
D. Manual air vents shall be installed at all high points in piping system and drain valves at system low points. Manual air vents shall be 3/8" globe valves on 6" long pipe nipple with 1/4" copper tubing to near floor. Drain valves shall be fitted for 3/4" hose connection with vacuum breaker. Provide access for valves.

2.9 STRAINERS:

A. Walworth 3699 - 1/2 Sarco SB; bronze, smaller than 2-1/2 inches. Bailey 125 pound No. 100; Zurn 125 pound No. 540 FPS; or Crane No. 989-1/2, cast iron 2-1/2 inches and larger. Water straining element shall be perforated 20 mesh monel screen. Strainers shall be designed for the same working pressure as the control valves. Provide strainer blowoff port with line size hose bibb and vacuum breakers.

2.10 VALVES:

A. Provide on each valve a name plate showing manufacturer, valve size, grade, and pressure temperature service rating.
B. See specific piping system sections for valves to be used in that system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All drainage of existing piping and new fill including chemical treatment shall be the responsibility of this contractor. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.
B. Properly support piping and make adequate provision for expansion, contraction, slope, and anchorage.
   1. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.
   2. Do not use pipe hooks, chains, or perforated metal for pipe support.
   3. Remove burr and cutting slag from pipes.
C. Piping shall not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings. Provide accessible, ground joint unions in piping at connections to equipment.
D. Make connections of dissimilar metals with insulating couplings.
E. Provide sleeves around pipes passing through floors, walls, partitions, or structural members.
   1. Seal sleeves with plastic or other acceptable material.
   2. All piping passing through floors and outside walls and foundations shall have a water tight sleeve and water tight caulking around pipe. Extend pipe sleeve minimum of 3 inch above floor.
F. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of systems. Do not use plugs of rags, wool, cotton waste, or similar materials.

G. Install piping systems so they may be easily drained.
H. Do not place water piping within building perimeter in contact with earth.
I. Valves of same type shall be of same Manufacturer.
J. Do not use reducing bushings, street elbows, or close nipples.
K. Make changes in direction with proper fittings. Bending of pipe is not approved.
L. Hanger rods shall be of a diameter adequate to support pipe size.
M. Install additional supports as required.
N. Suspend all piping in building except that underground. Laying of piping on any building member is not allowed.
O. Design all hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to General Requirements specified in sub-paragraph.
P. Horizontal Piping Support Schedule: Support horizontal piping of steel, cast iron, plastic, and copper as follows:

HORIZONTAL PIPING SUPPORT SCHEDULE

Pipe Size	Rod Diameter	Maximum Spacing
Up to 1-1/4"	3/8"	8'-0"
1-1/2" and 2"	3/8"	10'-0"
2-1/2" and 3"	1/2"	10'-0"
4" and up	5/8"	12'-0"

Q. Piping with nonpressure type joints such as Soil and Waste Piping shall be supported with a minimum of two hangers per pipe section.
R. Support horizontal lines of copper tubing with hangers. Space not more than 8 feet center to center.
S. Cutting or other weakening of the building structure to facilitate installation will not be permitted. The Contractor shall demonstrate that no weight or stress is placed upon the equipment by the piping and that piping and connection of equipment are in perfect alignment. When so directed, disconnection and reconnection of piping shall be done by Contractor for designated pipe section to properly demonstrate stress; this shall be at no cost to Owner.
T. Flanges or unions as applicable for the type of piping specified shall be provided in the piping at connections to all items of equipment. All piping shall be installed to insure noiseless circulation. All valves and specialties shall be placed, packed and adjusted at the completion of the work before final acceptance.
U. Operating Valves shall be accessible for operation from floors or platforms where feasible, and handwheels shall not be more than 4'-6" above the floor or platform. In other cases, valves and cocks shall be equipped with chain operated handwheels or extension stems, or other suitable means of remote control.
   1. Tighten glands and add additional gland packing as required before final inspection.

V. Provide sufficient clearance for insulated piping and fittings to permit application of insulation without cutting either pipe line covering or fitting coverings.

3.2 PIPE PROTECTION:

A. Do not run piping in outside wall, or where freezing may occur. Piping in attic spaces shall be run on the interior side of building insulation.
B. No water piping in building shall be in contact with earth.
C. All piping as installed shall be plugged or capped until equipment has been permanently connected.

3.3 GRADE AND DRAINAGE:

A. All piping shall be erected to insure proper draining. Grade soil, waste, and drainage lines not less than 1/4" per foot unless noted otherwise on drawings. Grade rain water lines minimum 1/8" per foot.
B. Heating water, chilled water, condenser water and domestic hot and cold water lines shall be graded so as to drain system with as few drains as possible. Drains shall be located in convenient and accessible places. All drainage piping shall extend to floor drains.

3.4 DIELECTRIC FITTINGS:

A. Shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

3.5 PIPE JOINTING:

A. All steel pipe shall be joined by flanged, or screwed connections or by welding. Where welding is employed, welding type fittings with beveled ends shall be used. The mitering of pipes to form elbows and the notching of straight runs to form tees will not be allowed. All galvanized pipe shall be screwed. Copper pipe shall be soldered. All piping shall be cut to length by hack-saw or pipe cutter. Cutting of pipe with a torch will not be allowed.
B. Threaded Piping:
   1. Threading shall be American-Standard taper pipe threads. Ream pipe ends and remove burrs after threading. Limit number of threads so that not more than two (2) threads will show beyond fitting.
   2. All pipe joints shall be properly sealed with thread coatings applied to the male thread. Sealer for culinary water piping shall be Teflon tape. Sealer for steel pipe in heating, waste and vent lines shall be powdered graphite and Linseed oil or plumage and linseed oil or "Type-Unyte", or Teflon tape.
C. Soldered Piping:
   1. Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for sweated fittings shall be made with a non-corrosive paste flux and solid wire solder. Use 95-5 or 96-4 Tin-Antimony solder. Cored solder will not be permitted.
D. Welding:

1. Welders shall be certified-
   a. Welders shall be certified and shall bear evidence of certification within 30 days prior to commencing work on this project.
   b. If there is any doubt as to the proficiency of the welder, the Owner may require the welder to take another test. This shall be done at no additional expense to the Owner.
   c. Welders shall be certified in accordance with section IX of the ASME Boiler and Pressure Vessel Code by Pittsburgh Testing Laboratories or other Testing Agency acceptable to the Owner.
2. Piping 2" and larger, and gas piping over 5 psi except plastic underground piping shall be welded. Welding shall be done using either gas or electric welding equipment. No electric welding shall be done when the atmospheric temperature is below 40 degrees F. without first preheating the ends of the pipe. Thoroughly clean all piping surfaces before welding. The width of circumferential welds shall be 2-1/2 times the wall thickness of the pipe. Piping shall be securely aligned and spaced. The deposited metal shall form a gradual increase in thickness from the outside surface to the center of the weld. Make welds in at least two beads. Each shall be cleaned using stiff wire brushes or pointed descaling tools. The final beads shall be similarly cleaned for inspection.
3. Fittings -
   a. All fittings shall be ASA Standard fittings and shall be of standard pipe thickness.
   b. All elbows shall be long radius.
   c. Wherever tee connections are made to piping systems on the main run, welding sockets shall be installed for the branch connections up to one half the size of the main run, welding tees shall be used.
   d. The use of fittings formed from welded pipe sections and or notching of pipe will not be permitted. Changes in pipe size shall be made with tapered fittings.
   e. Connection to equipment shall be flanged using std 150 psi weld neck flanges or flanges rated for pressure of system encountered. Gaskets shall be non-asbestos type of material suitable for temperature, pressure and substance in system.
   f. All welding fittings used in welding system shall be manufactured by Tube Turns Inc., Taylor Forge and Pipe Works, Midwest Piping and Supply Co., or Bonney Forge and Tool Works, for “Weld-O-Lot” or Thread-O-Lot”, or approved equal fittings and shall match the pipe in which they are installed.
4. Safety precautions -
   a. The contractor shall provide a fire proof mat or blanket to protect the structure, and adequate fie protection at all locations where welding is done.
5. Testing and acceptance -
   a. Engineer and Owners Representative shall at their disgression shall inspect welds. If welds are found to be suspect, contractor shall provide testing of questionable welds at contractor’s expense.
   b. Testing shall be by radiograph, ultrasonic, sectioning or a combination of these methods at the option of the Owner.

c. The contractor shall test a minimum of 6 welds up to a maximum of 1/4 of all welds on project as selected by Engineer.
d. Tests shall be preformed by a recognized independent testing agency acceptable to all parties. Agency shall submit a test report.
e. If defective joints are discovered Owner shall have right to require all welds removed and redone or remaining welds tested and all defective welds replaced. All work to test, remove and replace welds shall be at contractor's expense.

3.5 FLASHINGS:

A. Wherever roof is pierced by work installed by this Contractor, he shall furnish proper flashings to be installed by the Roofing Contractor. All piercings of roof shall be sealed air and water tight.
B. Provide proper flashings, counter flashings, metal collars or other work as required to make weather tight seal at all fan connections, duct piercings, etc., as shown and/or required for work installed under this Contract.
C. All pipes passing through the roof shall be neatly flashed with Stonemen Stormite four pound seamless lead flashing assembly, with reinforced conical boot, complete with vandal-proof hooded cast iron counter flashing and Permaseal waterproofing compound. Hood shall have a minimum of 2 to 1 free area to vent pipe size. Flashing flanges shall be an 18 inch square base. Coordinate work with Roofing Contractor to avoid duplication of flashings and work.
D. 16 oz sheet copper flashings may be used in lieu of lead. Flashing shall be fitted snugly around pipe. Caulk between flashing and pipe to seal. Make water and air tight using a flexible waterproof compound. Base shall be 24" square.
E. Roof drains shall have a 36"x36" lead pan.

3.6 PIPE TESTING:

A. Test all piping prior to painting, insulating, backfilling or other concealment. Valve off or isolate controls, fittings, equipment or other piping which may be damaged by testing pressures. Provide relief valves set to avoid bursting pressure during test.
B. Soil, waste, rainwater and vent systems shall be filled to roof level with water and show no leaks over a 24 hour period.
C. Domestic water, chilled water supply and return, and heating hot water supply and return piping shall be hydrostatically tested at 100 psi with less than a four percent drop in pressure over a six hour period.
D. Natural gas piping see Section 15192.

END OF SECTION 15101

SECTION 15181 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install condensate drain piping as described in Contract Documents.

B. Related Sections
   1. Section 15051 - General Mechanical Requirements

PART 2 - PRODUCTS

2.1 MATERIALS

A. Condensate Drains
   1. Schedule 40 PVC for condensate drains from make-up air units.
   2. 3 inch deep seal, vented water trap adjacent to cooling coil connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensate Drains
   1. Support piping and protect from damage.
   2. Route to nearest roof drain.

END OF SECTION 15181

SECTION 15182 - HYDRONIC PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Furnishing and installing the low temperature heating hot water system and specialties.
   3. Furnishing and installing the chilled water cooling system and specialties including installing of Thread-o-Lets and Weld-o-Lets, valves etc. supplied by control contractor.
   3. Furnishing and installing the cooling water cooling system and specialties.
   4. Furnishing and installing the condenser water system and specialties

B. Related Sections -
   1. Sections 15010, 15051, and 15101 apply to this section.
   2. Control valves specified in section 15910.

PART 2 - PRODUCTS

2.1 PIPE ALL SYSTEMS:

A. Black steel schedule 40 pipe for supply and return.
   1. ASTM-A53
   2. ASTM-A106

B. Fittings
   1. Low temperature heating hot water system fittings shall be
      a. Steel 150 lb rated threaded or welded.
      b. Flanges standard steel 150 lb.
   2. Chilled and cooling water systems fittings shall be:
      a. Steel 150 lb rated threaded or welded.
      b. Flanges 150 lb standard steel.
   3. Condenser water systems fittings shall be:
      a. Steel 150 lb threaded or welded
      b. Flanges 150 lb standard steel.
   4. High temperature hot water systems fitting shall be.
      a. Steel 300 lb welded steel
      b. Flanges 300 lb steel
      c. Valves rated for 300 lb

2.2 VALVES

A. Valves
   1. Provide on each valve a name plate showing manufacturer, valve size, grade, and pressure temperature service rating. Valve fluid bore shall match pipe size. All valves shall have renewable seats and discs, large deep stuffing boxes, packing glands and back seat on stem for repacking under pressure. Valves 1-1/2" and smaller shall be screwed or soldered connections. Valves 2" and larger shall be flanged.

B. Butterfly Valves -

1. Operable in any quadrant, shall operate properly with flow in either direction, and fully suitable for throttling and tight shut-off service.
2. Pressure drops at valve flows shall not exceed that for Centerline valves.
3. 150 psi working pressure and -40 to 275 Deg F.
4. Body - Ductile iron lug-wafer type with lugs tapped on both sides.
5. Seat - EPT Nordel, rubber lined.
6. Stem -
   a. 304 or 316 stainless steel.
   b. Diameter not to be reduced at bearings.
7. Disc - Bronze or NDI (nylon coated ductile iron), bubble tight at 150 psig.
8. Bushings -
   a. Reinforced teflon, nylon, or olitie.
   b. Provide bearings at both ends of stems.
9. Operating Mechanisms - Infinite throttling handle with provision for locking in any position and with position stop.
10. Approved Manufacturers -
    a. Bray - Series 30
    b. Centerline - Series 200
    c. Crane - ‘Monarch’ Series
    d. Milwaukee - ML233E
    e. Norris/O’Bannon - R Series
    f. Pratt - Model 2FII
    g. Watts BF-03
    h. Hammond
    i. Nibco Inc
    j. Kitz

C. Check Valves
1. Non-Slam Check Valves -
   a. Silent, spring loaded.
   b. 125 psi swp
   c. Silent, semi-steel body.
   d. Bronze trim and discs.
   e. Bronze seats with center guide and renewable with reseating with special tools.
   f. Guided spring.
   g. Operable in horizontal, vertical, angular, or upside down position.
   h. Approved Manufacturers -
      1) Bell & Gossett ITT or equal by
      2) Milwaukee
      3) Mueller
      4) Nibco Inc.

D. Ball Valves
1. Designed for shut off service.
2. Type 2, Class A rated at 150 lb steam working pressure and 350 deg F maximum temperature.
3. Two piece bronze body construction with full port, vented ball, screwed end connections, teflon seats, and blow-out proof stem.
4. Provide extended stem on insulated line.
5. Approved Manufacturers -
   a. ConBraco - Apollo - 70-100 or equal by
   b. Hammond

c. Milwaukee
d. Nibco
e. Watt
f. Kitz

E. Balancing Valves
1. Combination balancing valve and flow metering device with provision for connecting differential meter. Each meter connection shall have positive shut-off valves.
2. Valve shall be of non-ferrous construction and globe style design or proportional flow ball valve.
3. Valve shall be capable of being installed either direction in the flow and not affect flow measurement.
4. Unit shall -
a. provide precise flow measurement.
b. have precision flow balancing.
c. have positive shut-off with no-drip seat.
5. Approved Manufacturer -
a. Bell and Gossett
b. Armstrong CBV
c. Flow-set
d. HCI

2.3 COCKS:

A. Gauge Cocks -
1. Brass Tee Handle
2. Approved Manufacturers -
a. Ashcroft - 1092
b. Ernst - 123
c. Trerace - 865
d. Walworth - 557

2.4 MANUAL AIR VENT BALL VALVE:

A. Designed for use as a high point vent.
B. Rated for 150 lb working pressure water, oil, gas, and steam.
C. Bronze body with solder end connections, teflon stem & seats, and bubble tight shut-off. 3/8 inch size with tee handle.
D. Approved Manufacturers -
1. ConBraCo Appollo - 70-200.
2. Hammond - 806
3. Jenkins - 1100T
4. Milwaukee - BA150-TH
5. Nibco S580

2.5 COMBINATION BALL VALVE, HOSE CONNECTION, & CAP:

A. Approved Manufacturer -
1. ConBraCo - Apollo 78-100

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 15101 for general piping installation procedures.
B. Install unions or flanges on downstream side of shut-off valves, specialty valves, and inlet and outlet to coils, pumps, and equipment.
C. Install thermometers on inlet and outlet of coils, pumps, and where shown on the drawings.
D. Install balancing valves as shown on the drawings.
E. TESTING:
   1. Conduct tests in presence of Engineer and before piping is covered.
   2. Tests shall be as described in Section 15101of the specifications.

END OF SECTION 15182

SECTION 15196 NATURAL GAS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install gas piping and fittings within building as described in Contract Documents.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

1.2 REFERENCES

A. American Society For Testing And Materials
   1. ASTM A 53-96, 'Standard Specification for Pipe, Steel and Hot-Dipped, Zinc-Coated, Welded and Seamless'
   2. ASTM A 234-96b, 'Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature Service'
   3. ASTM D 2513-96a, 'Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings'

1.3 QUALITY ASSURANCE

A. Qualifications
   1. Welders shall be certified and bear evidence of certification 30 days before commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority. See Section 15101

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Valves
   1. 125 psi bronze body ball valve, UL listed
      2. Approved Manufacturers & Models -
      a. ConBraCo - 'Apollo' series 80-100
      b. Jenkins - FIG-30-A
      c. Jomar - Model T-204
      d. McDonald - 3410
      e. Milwaukee - BCI-100T (with tee handle)
      f. PGL Corp - 'Red Cap' gas ball valve
      g. Watts - Model B-6000-UL

B. Gas Regulators
   1. Gas regulators of capacity required to reduce gas pressure from 1 to 2 PSI to 4 oz.

2. Regulators shall be of self ventilating type suitable for interior installation and in space venting where indicated on drawings.
3. Units shall be approved by Questar Gas for use intended.
4. Approved Manufacturers
   a. Fisher
   b. Rego
   c. Other manufacturers approved by Questar Gas

2.2 COMPONENTS

A. Above-Ground Pipe & Fittings - Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of ASTM A 53. Welded forged steel fittings meeting requirements of ASTM A 234 or standard weight malleable iron screwed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Steel pipe installed through air plenums, in walls, and pipes 2-1/2 inches and larger shall have welded fittings and joints. Other steel pipe may have screwed or welded fittings.
B. Install gas cocks on lines serving gas-fired equipment adjacent to equipment, on outside of equipment cabinet, and easily accessible.
C. Install 6 inch long minimum dirt leg, with pipe cap, on vertical gas drop serving each gas-fired equipment unit.
D. Use fittings for changes of direction in pipe and for branch runouts.

3.2 FIELD QUALITY CONTROL

A. Site Tests - Before pipes are buried or concealed from view, test systems in Architect's presence at 60 psig for 4 hours and show no drop in pressure.

END OF SECTION 15196

SECTION 15738 - GAS-FIRED REFRIGERANT COOLED MAKE-UP AIR UNIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This section includes make-up air unit with heating and cooling.
B. Related Sections
   1. Section 15910 – DDC Controls

1.3 SUBMITTALS:

A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities of selected model clearly indicated; dimensions; required clearances; shipping installed, and operating weights; furnished specialties; accessories; and installation and start-up instructions.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
   1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and field installed wiring.
C. Start-up Reports: Indicate results of start-up and testing requirements. Submit copies of checklists.
D. Maintenance Data: Maintenance manuals specified in Section 15010.
E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE:

A. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
B. Energy Efficiency Ration: Equal to or greater than prescribed by ANSI/ASHRAE/IESNA 90.1, 2001 "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
C. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.
   1. The make-up air shall be certified in accordance with UL Standard 1995 and ANSI Standard Z21.47.
   2. The rooftop unit(s) shall be safety certified by an accredited testing laboratory and the nameplate shall carry the label of the certification agency.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver make-up air units as factory-assembled units with protective crating and covering as recommended by the manufacturer.
B. Coordinate delivery of units in sufficient time to allow movement into building.
C. Handle make-up air units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

1.6 COORDINATION:

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations with roof construction. Roof specialties are specified in Division 7 Sections.

1.7 WARRANTY:

A. General Warranty: The special warrant specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to , and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
B. Special Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials of workmanship, within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.
   1. Warranty Period: Compressors: Provide with 5 year warranty.
   2. Warranty Period: All other compnents: Provide with 1 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: subject to strict compliance with the requirements of this specification, provide products by the following:
   1. Make-up Air:
      a. AAON Inc, model RM
      b. Or equal by Dectron
      c. McQuay
      d. Mammoth
      e. GovernAire

2.2 MAKE-UP AIR:

A. Description: Factory assembled and tested; designed for roof installation; and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, gas heater, economizer, filters, and dampers.
B. Construction:
   1. Unit shall be completely factory assembled, piped and wired and shipped in one section.
   2. Unit shall be specifically designed for outdoor roof top application with a fully weatherproof cabinet.

3. Cabinet shall be constructed entirely of G90 galvanized steel with the interior construction of 20 gauge or heavier material. Cabinet shall be double wall.
4. Paint finish shall be capable of withstanding at least 2000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
5. The unit roof shall be sloped or cross broken to assure drainage.
6. Unit specific color coded wiring diagrams shall match the unit color coded wiring and will be provided in bot point to point and ladder form.
7. Diagrams shall also be laminated in plastic and permanently affixed inside the control compartment.
8. Access to filters, blower, heating section, and other items needing periodic checking or maintenance shall be through hinged access doors with quarter turn latches. Door fastening screws are not acceptable.
9. Access doors shall have stainless steel hinges and full perimeter gasketing.
10. All openings through the base pan of the unit shall have upturned flanges of at least ½" in height around the opening through the base pan.
11. Air side service access doors shall have rain break overhangs.
12. All access doors shall have an internal metal liner to protect the door ½ inch thick, 1 ½ lb. Density fiberglass insulation.
13. The interior air side of the cabinet shall be entirely insulated on all exterior panels with 1 inch thick 1 ½ lb. density fiberglass insulation.
14. Unit shall have decals and tags to indicate unit lifting and rigging, service areas and caution areas. Installation and maintenance manuals shall be supplied with each unit.

C. Supply Fans:
1. Blower(s) shall be entirely self contained on a slide deck for service and removal from the cabinet.
2. All belt drive blower(s) shall have backward inclined airfoil blades.
3. Adjustable V-belt drive shall be provided with a minimum rating of 140% of the motor nameplate brake horsepower when the adjustable pulley is at the minimum RPM.
4. Blowers, drives and motors shall by dynamically balanced.

D. Outside Air Options:
1. Shall be 3 position economizer with multistage integrated economizer and compressor operation controlled by the conditioned space controller for maximum benefit. The economizer shall consist of a motor operated outdoor air damper and return air damper assembly constructed of extruded aluminum, hollow core, air foil blades with rubber edge seals and aluminum end seals, Damper blades shall be gear driven and designed to have no more than 25 CFM of leakage per sq. ft. of damper area when subjected to 2 in. w.g. air pressure differential across the damper. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure. Damper positioning to be interlocked with kitchen exhaust fans.

E. Condenser Options:
1. Air Cooled Condenser Section:
   a. The condensing section shall be equipped with vertical discharge axial flow direct drive fans. Direct drive fans shall be directly connected to and supported by the motor shaft.

b. The condenser coils shall be sloped at least 30 degrees to protect the coils from damage.
c. Condenser coils shall be copper tubes with aluminum fins mechanically bonded to the tubes.
d. Condenser coils to be sized for a minimum of 10°F of refrigerant sub-cooling.

F. Filters: 2 inch thick, fiberglass, throwaway with an ASHRAE efficiency of 30%.

G. Evaporator Coils:
1. Evaporator coils shall be copper tube with aluminum fins mechanically bonded to the tubes.
2. Evaporator coils shall have galvanized steel end casings.
3. Evaporator coils shall have equalizing type vertical tube headers.
4. Evaporator coils shall be furnished with a thermostatic expansion valve.
5. Evaporator coils shall be furnished with a double sloped drain pan for the positive drainage of condensate.
6. Coils shall be intertwined type.

H. Refrigeration System:
1. Dual compressors shall be scroll tube with internal thermal overload protection and mounted on the compressor manufacturer's recommended rubber vibration isolators. Each compressor shall have independent refrigerant circuits.
2. All units over 7 tons shall be multiple stage and shall have a minimum of 2 stages of capacity control.
3. Compressors shall be mounted in an isolated compartment to permit operation of the unit without affecting air flow when the door to the compartment is open.
4. Compressors shall be isolated from the base pan and supply air to avoid any transmission of noise from the compressor into the building area.
5. System shall be equipped with thermostatic expansion valve type refrigerant flow control.
6. System shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant controls.
7. Unit shall be equipped with Schrader type service fittings on both the high side and low pressure sides of the system.
8. Unit shall be equipped with refrigerant liquid line driers.
9. Unit shall be fully factory charged with refrigerant.
10. Options:
a. Hot gas bypass shall be provided on each refrigerant circuit.
b. Each compressor shall be individually staged for capacity control.
c. All circuits shall be equipped with liquid line sight glasses.
d. Unit shall be equipped with a 5 minute anti-short cycle delay timer for each stage.
e. Unit shall be equipped with 20 second between stage delay timers for each stage.
f. First stage cooling shall be provided to allow operation to 55°F.

I. Gas Heat Section:
1. Unit shall heat using natural gas fuel.
2. Unit shall be provided with a gas heating furnace consisting of an stainless steel heat exchanger with multiple concavities, an induce draft blower and an electric pressure switch to lockout the gas valve until the combustion chamber is purged and combustion air flow is established.

Drum type heat exchangers or heat exchanger tubes with separate internal turbulators are not acceptable.

3. Unit shall be provided with a gas ignition system consisting o an electronic ignitor to a pilot system, which will be continuos when the heat is operating, but will shut off the pilot when heating is not required.
4. Unit shall have gas supply piping entrances in the unit base for through the curb gas piping and in the outside cabinet wall for across the roof gas piping.
5. Unit shall be equipped with Stainless Steel tubular heat exchanger with a 25 year non pro-rated warranty.

J. Power Exhaust:
1. Provide with power exhaust and return air bypass. Control off space static. See Section 15910.

2.3 ROOF CURBS:

A. Roof curbs shall be constructed of galvanized steel. Curbs are to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit.
Options:
1. Unit shall be provided with heavy duty, one piece vibration isolation curb. Each curb shall have the following features:
   a. 1 g seismic restraint and 200 mph wind restraint.
   b. Access ports for inspection and adjustment at each spring.
   c. 4” deflection springs.
   d. High frequency noise isolation.
   e. Supply and return duct support hardware.
   f. Galvanized steel curb with wood nailer.

2.4 ADDITIONAL ACCESSORIES AND OPTIONS:

A. Unit shall be supplied with the following accessories and options:
1. Sight glasses on refrigerant circuits.
2. 20 second timer between compressor starts.
3. 5 minute compressor time delay.
4. Adjustable compressor lockout thermostat each circuit.
5. Manual reset high and auto thermostat.
6. Low pressure switches.
7. Four stage gas heating with 16 GA type 304 stainless steel heat exchanger.
8. Heating/cooling lockout interlock.
9. Low leaving air temperature lockout.
10. Fan cycling head pressure control.
11. Bird screen on outside air inlet.
12. All controls for complete and operating system including interlocks with hood exhaust fans.
13. Gurnish for field mounting T874 D thermostat with Q674 subbase with locking cover.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install per manufacturer's recommendation.

3.2 START-UP:

A. Provide factory certified technician to supervise set-up and start-up procedures.

END OF SECTION 15738

SECTION 15761 - HYDRONIC WATER COILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Requirements of the following Division 15 Sections apply to this section:
   1. 15010 - “General Requirements”.
   2. 15051 - “Basic Materials and Methods General Requirements”.

1.2 SUMMARY

A. This Section includes chilled water coils, for indoor installations.
B. Related Sections: The following Sections contain requirements that relate to this section:
   1. Section 15918, DDC "Control Systems" for control devices.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Section 15051 and Division 1 Specification Sections.
B. Product data for each coil unit indicated, including the following:
   1. Certified coil performance ratings at
      a. system operating conditions indicated.
      b. half airflow and half water flow conditions.
C. Shop drawings from manufacturer detailing dimensions, required clearances, components, and location and size of each field connection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, Temtrol is the basis of design for the plans. If another vendor listed below or by addendum is desired to be used by the contractor, a price deduct shall be given to the owner at the time bids are turned in.
   1. Temtrol.
   2. U.S. Air Coil
   3. Webco.
   4. Pace Company.
   5. Air Systems.
   6. Colmac
   7. Trane
   8. Carrier

2.2 COILS

A. Coils shall be mounted on primed with Zinc rich chromate primer and painted angle iron or stainless steel racks manufactured to allow coils to slide out individually.
B. Drain pans shall be 16 gage, 304 stainless steel. Intermediate drain pans shall be interconnected with 1 inch copper drain lines.
C. Coils shall be designed for chilled water service with a minimum 5/8" diameter tubing.
D. Coils shall be certified in accordance with ARI Standard 410.
E. Coils shall be hydrostatically tested at 400 Psig, and shall be suitable for working pressures and temperatures up to 200 Psig and 220 degrees F. Coil tube thickness shall be 0.035 inch minimum thickness. Fin thickness shall be 0.008 inch minimum. Coils must have brazed U-bend return bends. Hairpin construction type coils will not be accepted.
F. Pipe connections shall be on the same end, and shall be threaded.
G. Coils shall be fully drainable by removing a single threaded plenum for each coil row. Intermediate drain headers with drain stubouts extended to the casing exterior shall be provided.
H. Coil face velocity shall not exceed 500 FPM.
I. Coils with turbulators will not be accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.
B. Examine rough-in hydronic, and condensate drain piping to verify actual locations of connections prior to installation.
C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install coils in accordance with manufacturer's written instructions. Maintain manufacturer's recommended clearances.
   1. Support coils from floors, ceilings, and walls as required.
B. Arrange installation of units to provide access space around coils for service and maintenance.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 sections. The Drawings indicate the general arrangement of piping, valves, fittings, and specialties. The following are specific connection requirements:
B. Arrange piping installations adjacent to coils to allow unit servicing, clearances, and free air flow.

C. Connect condensate drain pans using Type L copper tubing. Extend to the nearest floor drain.

3.4 ADJUSTING, CLEANING, AND PROTECTING

A. Adjust water coil flow, with control valves to full coil flow, to indicated gpm.

END OF SECTION 15761

SECTION 15805 - EXHAUST HOODS

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Exhaust hoods H-1, H-2, and H-3.

1.2 CODES:

A. Hoods shall be designed and tested with all applicable local and national codes including ASHRAE 110 - 1995, BS 7258, and DIN 12 924.

PART 2 - PRODUCTS

2.1 CANOPY EXHAUST HOOD:

A. General:
   1. Hood shall be single wall type vent hood for non grease applications or for the removal of fumes, vapor, etc. Hood shall have size, shape and performance specified on drawings.

B. Hood Construction:
   1. Construction shall be type 304 stainless steel with a #3 or #4 polish where exposed.
   2. Hood shall be wall type with full length hanging angles with 9/16" holes prepunched in 1 ½” X 1 ½" angle iron at the factory to allow for hanger rod connection by others.

C. Accessories and Options:
   1. The hood manufacturer shall supply complete submittal drawings including hood sections view(s) and hood plan view(s). These drawings must be available to the engineer, and owner for their use in construction, operation and maintenance.
   2. Exhaust duct collar to be 4" high with 1" flange. Duct sizes, CFM and static pressure requirements shall be as shown on drawings.
   3. Hood shall be recognized by NFS.

2.2 APPROVED MANUFACTURERS:

A. Captive Aire
B. Econ-Air
C. Prior approved equal

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install per manufacturer’s recommendations.
B. Coordinate with make-up air unit and all other disciplines.

END OF SECTION 15805

SECTION 15812 - ROUND STEEL DUCTWORK

PART 1 - GENERAL

1.1 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 MATERIAL -

A. Ducts -
1. Fabricate of zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 527-80, "Sheet Steel Zinc Coated (Galvanized) by the Hot-Dip Process, Lock Forming Quality", with Type G coating.
2. Use of aluminum or non-metal ducts is forbidden.
3. Duct shall be constructed to SMACNA Pressure Class ½" to 2" standards.

B. Joints
1. Mechanical type joints shall be sealed with:
   a. Hardcast
   b. Design Polymetrics 1010
   c. Mon-Eco Industries 4452
2. Welded joints are acceptable.
3. Joints shall be as recommended in SMACNA HVAC Duct Construction Standards for round duct.

C. Fittings:
1. Ducts shall be provided with 45 and 90 degree elbows of 2 piece die stamped construction.

2.2 Ductwork shall be shop fabricated or spiral ductwork manufactured by a manufacturer regularly engaged in the manufacture of this type of ductwork. Ductwork shall meet all requirements of SMACNA and manufacturer be prior approved.

2.3 Standing seam duct may be used in lieu of spiral duct if properly constructed for velocity and pressures encountered.

2.4 Duct take-offs and volume dampers. See Section 15821.

PART 3 - EXECUTION

3.1 PERFORMANCE -

A. Ducts
1. Straight and smooth on inside with joints neatly finished unless otherwise directed.

END OF SECTION 15812

SECTION 15813 - MEDIUM VELOCITY DUCTWORK (PRESSURE CLASS 2" & 3" SEAL)

PART 1 - GENERAL

1.1 RELATED SECTION:

A. Division 01 General and Section 15010 and 15051 are part of this section.

PART 2 - PRODUCTS

2.1 Supply air ductwork shown upstream of VAV boxes shall be spiral acoustical duct consisting of an externally pressure-tight metal sheet, a layer of fire resistant fiber glass insulation, an internal liner next to the air flow and a perforated galvanized steel liner. All fittings shall have solid, perforated steel liners. All other round above grade supply and return air ductwork as described in Section 15812 shall be wrapped with insulation.

2.2 Equal to United Sheet Metal Acoustic K-27.

2.3 Manufacturers shall be those regularly engaged in the manufacturers of this product. Approved manufacturers, United Sheet Metal, Dee's, Metco, or prior approved equal.

2.4 As an alternative standing seam ductwork may be used in leiu of spiral duct as long as it is constructed for velocity and pressures encountered.

2.5 Joint Sealer
A. Mon-Eco 44-52
B. Prior Approved Equal

PART 3 - EXECUTION

3.1 Duct installation and sealing shall be in strict accordance with SMACNA HVAC duct construction standards and HVAC air duct leakage test manual.

END OF SECTION 15813

SECTION 15816 - STEEL DUCTWORK

PART 1 - GENERAL

1.1 SCOPE -

A. Includes -
   1. Furnish and install the ½" to 2" wg ductwork and related items specified below and shown on the Drawings.
   2. Ductwork shall be installed in strict accordance with SMACNA Standards (latest edition) for exterior installation.

B. Related Work Specified Elsewhere -
   1. General Division 01 and Section 15010 and 15051 are a part of this Section.

PART 2 - PRODUCTS

2.1 DUCT MATERIAL -

A. Fabricate of zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 527-80 with Type G coating.

B. Use of aluminum or non-metal ducts is forbidden.

PART 3 - EXECUTION

3.1 DUCTS -

A. Straight and smooth on inside with joints neatly finished unless otherwise directed.

B. Duct panels through 48 inch dimension having acoustic duct liner need not be crossbroken or beaded.

C. Brace and install ducts so they shall be free of vibration under all conditions of operation.

D. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on drawings.

E. Ducts shall be large enough to accommodate inside acoustic duct liner.

F. Install internal ends of slip joints in direction of flow. Make joints air tight using mastic type duct sealer.

G. Cover horizontal and longitudinal joints on all ducts with two layers of hardcast tape installed with hardcast HC-20 adhesive according to manufacturer's recommendations, or equivalent by Duro Dyne Corporation or H.B. Fuller Company.

H. Paint duct the color approved by an architect.

3.2 Install flexible inlet and outlet duct connections to terminal units, fan coils, air handlers and exhaust fans.

3.3 Provide each duct take-off with an adjustable volume damper to balance that branch -

A. Anchor dampers securely to duct.

B. Install dampers in main ducts within insulation.

C. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.

3.4 Install grilles and diffusers.

3.5 AIR TURNS -

A. Permanently installed, consisting of curved metal blades or vanes arranged to permit air to make abrupt turn without appreciable turbulence, in elbows of supply and above ground return ductwork.
B. Air turns shall be quiet and free from vibration when system is in operation.

END OF SECTION 15816

SECTION 15818 - FLEXIBLE DUCT

PART 1 - GENERAL

1.1 DESCRIPTION -

A. Includes But Not Limited To -
   1. Supply air branch duct runouts to diffusers where indicated on Drawings.

B. Related Work Specified Elsewhere -
   1. Volume dampers and sheet metal duct specified in Section 15 812.

1.2 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 MATERIAL -

A. Ducts -
   1. Formable, flexible, circular duct which shall retain its cross-section shape, rigidity, and shall not restrict air flow after bending.
   2. Nominal 1-1/2 inches thick, 3/4 lb/cu ft density fiberglass insulation with air-tight, see-through polyester core, sheathed in seamless vapor barrier jacket factory-installed over flexible assembly.
   3. Each individual component in assembly, including insulation, ductwork and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
   4. Approved Manufacturers -
      a. Flexmaster
      b. Thermaflex
      c. Wiremold

PART 3 - EXECUTION

3.1 INSTALLATION -

A. Install duct in fully extended condition free of sags and kinks, using 6'-0" maximum lengths.

END OF SECTION 15818

SECTION 15819 - DUCTWORK TESTING

PART 1 - GENERAL

1.1 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION

3.1 PROCEDURE

A. All ductwork shall be tested prior to concealing or other work which may prevent repair of ductwork. Refer to "Inspection Notice", Section 15051.

B. Duct testing shall consist of pressurizing the duct system either with the main blower or in sections using a portable blower. Each portion of ductwork to be tested shall be sealed at all openings. The ductwork shall be subjected to an internal pressure not less than 2" W.G or 1-1/2 times working pressure whichever is larger. All ductwork shall be surveyed for audible leaks, and structural stability. Leaks shall be sealed, weak joints repaired, vibrations eliminated. A log shall be kept by the contractor indicating date, conditions, repairs made, and name of individual(s) performing the test. A copy of the log shall be retained for possible observation at the request of the Owner or architect. Ductwork shall maintain test pressure with not more than 10% variation over the period of the test.

END OF SECTION 15819

SECTION 15820 - DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install duct accessories in specified ductwork as described in Contract Documents.

B. Related Sections
   1. Section 15051 - General Mechanical Requirements
   2. Section 15920 - Temperature control dampers actuators and actuator linkages

1.2 REFERENCES

A. American Society for Testing and Materials
   1. ASTM A 653-96, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'
   2. ASTM C 665-96, 'Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing'
   3. ASTM C 1071-91, 'Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)'

PART 2 PRODUCTS

2.1 COMPONENTS

A. Flexible Equipment Connections
   1. 30 oz closely woven UL approved glass fabric, double coated with neoprene.
   2. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant temperatures of 200 deg F.
   3. Approved Manufacturers -
      a. Cain - N-100
      b. Duro Dyne - MFN
      c. Elgen - ZLN
      d. Ventfabrics - Ventglas

B. Duct Access Doors
   1. Factory built insulated access door with hinges and sash locks. Construction shall be galvanized sheet metal, 24 ga minimum.
   2. Fire and smoke damper access doors shall have a minimum clear opening 12 inches square or as shown on Drawings to easily service fire damper.
   3. Approved Manufacturers -
      a. AirBalance - Fire/Seal FSA 100
      b. Cesco-Advanced Air - HAD-10
      c. Elgen - Model 85 A
      d. Flexmaster - Spin Door

e. Hercules
f. Kees Inc - ADH-D
g. Pottorff - 60-HAD
h. Ruskin - ADH-24
i. Safe-Air - SAH

C. Dampers & Damper Accessories
1. Volume Dampers -
a. Factory-manufactured 16 gauge galvanized steel, single blade and opposed blade type with 3/8 inch axles and end bearings. Blade width 8 inches maximum. Blades shall have 1/8 inch clearance all around.
1) Damper shall operate within acoustical duct liner.
2) Provide channel spacer equal to thickness of duct liner.
b. Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
c. Approved Manufacturers -
1) American Warming
2) Arrow
3) Cesco
4) Daniel
5) Greenheck
6) Pottorff
7) Ruskin
8) UTEMP
9) Safe-Air
10) Air-Rite

D. Air Turns
1. Single thickness vanes with one inch trailing edge. Double thickness vanes not acceptable.
2. 4-1/2 inch wide vane rail. Junior vane rail not acceptable.

E. Branch Tap for Round and Flexible Ductwork (High efficiency type)
1. Factory-manufactured rectangular-to-round or round-to-round 45 degree leading tap fabricated of 24 ga zinc-coated lockforming quality steel sheets meeting requirements of ASTM A 653, with G-90 coating.
2. One inch wide mounting flange with die formed corner clips, pre-punched mounting holes, and adhesive coated gasket.
3. Manual Volume Damper -
a. Single blade, 22 ga minimum
b. 3/8 inch minimum square rod with brass damper bearings at each end.
c. Heavy duty locking quadrant on 1-1/2 inch high stand-off mounting bracket attached to side of round duct.
4. Approved Models & Manufacturers – Approved Products
a. HETD-L by Daniel Manufacturing, Ogden, UT (801) 622-5924
b. STO by Flexmaster USA Inc, Houston, TX (713) 462-7694
c. HET by Sheet Metal Connectors Inc, Minneapolis, MN (612) 572-1100
d. Hercules
e. Air-Rite
f. Prior approved equal

F. Motorized Outside Air Dampers -
1. Low leakage type. AMCA certified.
2. Damper Blades -
a. Steel or aluminum airfoil type with mechanically locked blade seals, 8 inch blade width maximum measured perpendicular to axis of damper.
b. Jamb seals shall be flexible metal compression type.
c. Opposed or single blade type.
3. Make provision for damper actuators and actuator linkages to be mounted external of air flow.
4. Approved Manufacturers And Models -
a. Air Balance - AC 526
b. American Warming - AC526
c. Arrow - AFD-20
d. C & S - AC50
e. Cesco - SCDS and SDI
f. Honeywell - D-643
g. Pottorff - CD-52
h. Ruskin - CD-60

G. Duct Sealer For Interior Ducts
1. Approved Products Approved Manufacturers and products-
a. Duct Butter or Butter Tak by Cain Manufacturing Co Inc, Pelham, AL (800) 554-0342 or (205) 663-2200 http://www.cainmfg.com or (714) 432-0600
c. S2 by Duro Dyne, Farmingdale, NY (800) 899-3876 or (516) 249-9000
d. Versa Grip 102 by Hardcast Inc, Wylie, TX (800) 527-7092 or (972) 442-6545
e. 15-325 by Kingco, King Adhesive Corp, St Louis, MO (800) 233-8171 or (314) 772-9953
f. 44-41 by Mon-Eco Industries Inc, East Brunswick, NJ (800) 899-6326 or (908) 257-7942
g. Airseal #11 by Polymer Adhesive Sealant Systems Inc, Irving, TX (888) 721-7325
h. Multipurpose Duct Sealant by Trans-Continental Equipment Co,
i. Water Base Duct Sealer by United McGill Corp, Columbus, OH (800) 624-5535 or (614) 836-9981

2.1 FABRICATION

A. Air Turns
1. Permanently install vanes arranged to permit air to make abrupt turn without appreciable turbulence, in 90 degree elbows of above ground supply and return ductwork.
2. Quiet and free from vibration when system is in operation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install flexible inlet and outlet duct connections to each vav box, fan coil unit, and air handling unit.

B. Access Doors In Ducts
   1. Install at each manual outside air damper and at each motorized damper. Locate doors within 6 inches of installed dampers.
   2. Install within 6 inches of fire dampers and in Mechanical Room if possible.

C. Dampers & Damper Accessories
   1. Provide each take-off with an adjustable volume damper to balance that branch.
      a. Anchor dampers securely to duct.
      b. Install dampers in main ducts within insulation.
      c. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
      d. Where concealed ceiling damper regulators are installed, provide cover plate.

D. Install motorized dampers.

E. Magnehelic Gauge
   1. Install on each air-handling unit housing adjacent to filters.
   2. Provide pressure sensing tips with connecting tubing on each side of filter.

END OF SECTION 15820

SECTION 15821 - FIRE DAMPERS

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install fire dampers described in Contract Documents.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies
   1. Dampers shall conform to NFPA and SMACNA requirements and bear UL label.
   2. Dampers shall be approved by fire authorities having jurisdiction where so required.
   3. Wall and floor fire dampers shall conform to UL 555 'Fire Damper Test Standard'

1.3 MAINTENANCE

A. Extra Materials - Leave six fusible links of each rating type used on Project with Owner.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Fire Dampers
   1. Walls & Floors
      a. Type 'B', blades out of airstream
      b. Include integral sleeve
      c. 165 deg F link unless otherwise indicated on Drawings
      d. Approved Manufacturers & Models -
         1) Air Balance Inc - Model 119BLX
         2) Greenheck - Model FD150XB
         3) Potorff - Model VFD-10 NSB
         4) Ruskin - Model IBD20B
         5) Safe Air Inc - Model 150B Sleeved
         6) Equals by Cesco or Prefco as approved by Architect before bidding. See Section 01600.
   2. Ceilings
      a. Radiation type ceiling fire damper with 165 deg F link unless otherwise indicated on Drawings.
      b. Approved Manufacturers & Models -
         1) Air Balance Inc - Model 229
         2) Cesco - Model CRD-A
         3) Greenheck - Model CRD-60B

4) Potorff - Model CFD-20
5) Ruskin - Model CFD-LDS Series
6) Safe Air Inc - Thermo / Guard Model 410
7) Ultra Safe - Model 253A

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fire dampers as follows
   1. Install fire dampers in ducts where ducts penetrate fire rated walls and floors. Install at registers, grilles, and diffusers penetrating fire rated assemblies.

END OF SECTION 15821

SECTION 15822 - ACOUSTICAL DUCT LINER

PART 1 - GENERAL

1.1 SCOPE -

A. Includes -
   1. Acoustical lining of all rectangular supply and return air ductwork -

B. Insulation materials, adhesives, coatings, and other accessories shall have surface burning characteristics as determined by ASTM E 84 not to exceed 25 for flame spread and 50 for smoke developed. Flame proofing treatments subject to deterioration due to the effect of moisture or high humidity are not acceptable.

1.2 Duct dimensions shown on drawings are for inside of duct liner and does not include liner insulation.

1.3 RELATED SECTIONS -

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

PART 2 - PRODUCTS

2.1 DUCT LINER -

A. One inch thick, 1-1/2 lb density fiberglass.

B. Approved Manufacturers -
   1. CSG Ultralite OR Tough guard
   2. Johns-Manville Lina-Coustic
   3. OCF Aeroflex
   4. Knauf Type M

2.2 ADHESIVE -

A. Approved water base products- Approved Products
   1. Cain - Hydrotak
   2. Design Polymerics - DP2501 or DP2502 (CMCL-2501)
   3. Duro Dyne - WSA
   4. Hardcast - IA-901
   5. Kingco - 10-568
   6. Miracle - PF-101
   7. Mon-Eco - 22-67
   8. Polymer Adhesive - Glasstack #35
   9. Techno Adhesive - 133
   10. United McGill - Uni-tack

2.3 MECHANICAL FASTENERS -

A. Conform to Mechanical Fastener Standard MF-19/1.

B. Pins that attach to ductwork with adhesives are not allowed.

C. Approved Manufacturers -

1. Duro Dyne
2. Omark dished head "Insul-Pins"
3. Grip nails may be used if each nail is installed by "Grip Nail Air Hammer" or by "Automatic Fastener Equipment" in accordance with Manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with a continuous 100% coat of adhesive and with mechanical fasteners spaced as shown on drawings. Pin all duct liner.

B. Accurately cut liner and thoroughly coat exposed edges of duct liner, including diffuser drop cut-outs with adhesive to seal fibers. Butt joints tightly. Top and bottom sections of insulation shall overlap sides.

C. Keep duct liner clean and free from dust. At completion of project, vacuum duct liner if it is dirty or dusty.

D. If insulation is installed without horizontal, longitudinal, and end joints butted together and properly treated, installation will be rejected and work removed and replaced with work that conforms to this specification. See drawings for detail of joint treatment.

END OF SECTION 15822

SECTION 15823 ROUND DUCT LINER

PART 1 GENERAL

1.1 SUMMARY -

A. Includes but not limited to -
   1. Furnish and install above-grade round ductwork acoustic liner and related items as described in Contract Documents.

B. Related Section -
   1. 15000 and 15050 - General Requirements

PART 2 PRODUCTS

2.1 MATERIALS -

A. Preformed fiberglass liner 1" thick with black acrylic polymer airstream side coating.
B. R-Value shall not be less than 4.3.
C. Coating shall contain EPA Registered Anti-Microbial Agent.
D. Shall meet the requirements of -
   1. UL 181, no detectable fiber loss
   2. ASTM G-21 and G-22, show no microbial growth.
   3. NFPA 9A and 9B and UL 723 for combustibility and surface burning characteristics.
   4. ASTM D5116-90 emissions of volatile organic compounds.

2.2 APPROVED MANUFACTURERS -

A. Schuller Permacote Spiracoustic preformed round liner and super seal coating, repair and edge seal materials.
B. Prior Approved Equal.

2.3 In lieu of this duct liner, Contractor may install medium velocity, spiral, accousitcal, double walled ductwork equal to United Sheet Metal K-27 Duct.

PART 3 EXECUTION

3.1 INSTALLATION -

A. Shop install in duct sections according to manufacturer's instructions.
B. Inspect each duct section after installation of liner and after installation of duct for voids or gaps, tears, or abrasions in liner air side coating and thorough coating of liner edges. Repair using manufacturer supplied products all items found.
C. If any section of duct is found to be installed without liner edge being thoroughly treated or that the duct liner sections are not tightly butted together and voids filled, installation shall be rejected and the Contractor shall be required to remove ductwork and replace with acceptable materials.

END OF SECTION 15823

SECTION 15836 - EXHAUST FANS

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install exhaust fans as described in Contract Documents.
B. Related Sections
   1. Section 15010 - General Mechanical Requirements

1.2 QUALITY ASSURANCES

A. Requirements of Regulatory Agencies - Bear AMCA seal and UL label.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Roof Mounted Exhaust Fans
   1. Direct drive or have adjustable pitch V-belt as noted on Drawings.
   2. Wheels shall be backward curved and housing shall be removable or hinged aluminum.
   3. Isolate motor with vibration dampeners.
   4. Provide quiet type back-draft dampers.
   5. Approved Manufacturers -
      a. Acme
      b. Breidert
      c. Carnes
      d. Cook
      e. Greenheck G, GB
      f. Jenn-Air
      g. Penn Domex
      h. Captive Air

2.2 ACCESSORIES

A. Curbs for Roof-Mounted Exhaust Fans
   1. Insulated, pre-fabricated metal roof curb for roof configuration shown on Drawings.
   2. Approved Manufacturers -
      a. Sound Attenuating Curbs -
         1) Penn
         2) Carnes
         3) Breidert
         4) Greenheck
         5) Jenn-Air
         6) Acme
         7) Captive Aire

PART 3 EXECUTION

3.1 INSTALLATION

A. Anchor fan units securely to structure or to curb.

END OF SECTION 15836

SECTION 15841 - PRESSURE INDEPENDENT VAV BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Variable volume terminal units
B. Integral heating coils.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Box linkage, actuators, controllers etc that interface with the ATC contractor shall be furnished and installed under section 15950.

1.3 RELATED SECTIONS

A. Section 15950 - Building Automation and Control Systems
B. Division 16 - Equipment Wiring Systems: Electrical supply to units.

1.4 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
B. UL 181 - Factory-Made Air Ducts and Connectors.
C. ARI 880 - Air-Conditioning and Refrigeration Institute Standard Rating Conditions for Air Terminals
D. ASTM A 527 (Steel Sheet, Zinc Coated Galvanized)
E. NFPA 90A, Lining

1.5 SUBMITTALS

A. Submit shop drawings and product data sheets indicating configuration, general assembly, and materials used in fabrication.
B. Submit product data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate air flow, static pressure, and radiated sound power levels (2nd through 7th octave bands) at design maximum operating conditions. Also submit Radiated Sound NC values ARI 885-90.
C. Submit manufacturer's installation instructions.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data provide to mechanical contractor for inclusion in O & M Manual see Section 15010.
B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data.
C. Include directions for resetting all pneumatic and electronic controls.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum ten years experience.

1.8 WARRANTY

A. Provide one year manufacturer's parts warranty from date of acceptance of system.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. VAV Terminal Units

1. General

a) VAV terminal units shall be pressure independent with electric controls.

b) Unit casings shall be a minimum of 20 gauge galvanized steel for units up to 8", 18 gauge for unit sizes 12" and 16 gauge for units over 12".

c) Units shall have round inlets with round or square outlets as shown on drawings and shall have a 2" inlet duct collar for field connection.

d) Damper blade shall be of elliptical shape and operate on a 45° arc. Blade shall be a minimum of 16 gauge galvanized with heavy duty extruded neoprene gasket to seal off air leakage not to exceed 2% of the terminal rated CFM at 3" of inlet static pressure. Blade shaft shall pivot on corrosion free oil lite bearings. 90° rotation, single blade dampers are not acceptable.

e) Entire terminal unit shall be factory assembled with electric controls. Metal assemble shall be mechanically sealed and fastened.

f) Flow measuring taps and flow chart shall be furnished with each unit for ease of field setting or changing of air flows. All controls shall be easily accessible for field adjustments without having to remove any of the terminal casing or any access panels.

g) Sound data shall be compiled from testing in an ADC independent certified laboratory and in accordance with ARI standard 880.

2. Controls

a) Manufacturer shall factory mount DDC controls supplied by the controls contractor.

b) The unit shall have a Differential pressure airflow sensor which traverses the duct using the equal cross sectional area or log-linear traverse method along two perpendicular diameters located across the inlet. The sensor will provide a differential pressure signal amplified to equal 3 times the velocity pressure with an accuracy of at least ±10% throughout the range of 350 to 2600 fpm inlet duct velocity.

3. Accessories

a) Hot water heating coil:

1) Coil shall be mounted in a minimum 20 gage galvanized steel casing with slip and drive discharge connections, and factory mounted on the base unit as shown on the equipment drawings, Coils shall have:

2) Aluminum fins bonded to the copper tubes by mechanical expansion.
3) Number of coil rows and circuits shall be selected to provide performances as required by the plans.
4) Up to 4 rows as shown on equipment drawings or designed on the equipment schedule. Right or left-hand fittings with sweat connection sizes as indicated on equipment drawings.

4. Approved Manufacturers
   a) Price
   b) Titus
   c) Krueger
   d) Prior Approved Equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design air flow to 25 percent nominal air flow Set units with heating coils for minimum 30 percent full flow.

END OF SECTION 15841

SECTION 15851- DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install diffusers, registers, and grilles connected to ductwork as described in Contract Documents
   2. Quality of grilles installed in metal doors

B. Related Sections
   1. Section 15051 - General Mechanical Requirements

1.2 MAINTENANCE

A. Extra Materials - Leave tool for removing core of each different type of grille for building custodian.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Ceiling Return, Exhaust, And Transfer Grilles
   1. Finish - Off-white baked enamel
   2. 1/2 inch spacing.
   3. Approved Manufacturers And Models -
      a. Carnes - RSLA
      b. J & J - S90H
      c. Krueger - S85H
      d. Metalaire - SRH
      e. Price - 535
      f. Titus - 355RL or 355 SL
      g. Tuttle & Bailey - T70D
      or equal by
      h. Agitair
      i. Anemostat
      j. Barber Colman
      k. Environmental Air Products
      l. Air Control Products
      m. Nailor

B. Ceiling Diffusers
   1. Finish - Off-white baked enamel
   2. Approved Manufacturers And Models -
      a. Carnes - SKSA
      b. J & J - R-1400
      c. Krueger - SH
      d. Metalaire - 5500S
      e. Price - SMD-6
      f. Titus - TDC-6
      g. Tuttle & Bailey - MS

or equal by
h. Agitair
i. Anemostat
j. Barber Colman
k. Environmental Air Products
l. Air Control Products
m. Nailor

PART 3 EXECUTION

3.1 INSTALLATION

A. Anchor securely into openings. Secure frames to ductwork by using four sheet metal screws, one per side. Level floor registers and anchor securely into floor.

3.2 ADJUSTING

A. Set sidewall supply register blades at 15 degrees upward deflection.

END OF SECTION 15851

SECTION 15861 - AIR FILTERS

PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. Furnish and install filters used in mechanical equipment.

B. Related Sections
   1. Section 15010 - General Mechanical Requirements

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Make-Up Air Unit Filters
   1. 2 inch thick, medium efficiency, disposable type pre-formed pleated design, having at least 4.5 sq ft of filtering media per sq ft of face area.
   2. Media shall be reinforced non-woven cotton fabric, treated with adhesive similar to 'Vyclad B' and continuously laminated to supporting steel wire grid conforming to configuration of pleats.
   3. Media pack shall be sealed in a chipboard frame or beverage board.
   4. Filters shall have rated average efficiency of 25 to 30 percent on ASHRAE Test Standard 52-76 and be capable of operating with variable face velocities up to 500 FPM without impairing efficiency.
   5. Initial resistance shall not exceed 0.30 inches w.g. at 500 FPM or 0.14 inch w.g. at 300 FPM. Filter shall be listed Class 2 by UL.
   6. Approved Manufacturers -
      a. DP2-40 by Air Guard
      b. E35H by Eco-Air Products Inc
      c. HC Type 40 by Envopleat
      d. Type 30/30 by Farr Co
      e. Mark 80 by Serv-Aire

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide ample access for filter removal.

3.2 FIELD QUALITY CONTROL

A. Inspection - At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

END OF SECTION 15861

SECTION 15910 – DDC CONTROLS

PART 1 – GENERAL

1.1 GENERAL SCOPE AND RELATED WORK

A. All Work required by these Controls Specifications, Schedules and Drawings shall be coordinated and provided by the single Contractor referenced in these Specifications as the **Controls Contractor**.

B. If the Controls Contractor believes there are conflicts or missing information in the Contract Documents then the Contractor shall promptly request clarification and instruction from the Engineer before proceeding.

C. The Controls Contractor shall have visited the Project site and obtained information as necessary prior to submittal of the bid to ensure that prevailing physical conditions and Project arrangements that may be material to the performance of the Work have been ascertained and accommodated in the bid. No claims for additional payments will be accepted due to the Contractor's failure to complete this survey.

D. If, in order to complete the Work of the Controls Contract, private and/or public telephone lines and connections, including ISDN lines and/or Internet Service Provider support and connections, are required then these shall be provided by the Owner to the Controls Contractor, at the Owner's direct cost, in a timely manner.

E. Related Work: The Controls Contractor's work shall be scheduled, coordinated and integrated with the associated work of other related trades and Divisions including but not necessarily be limited to:
   1. Division 01 – General Requirements
   2. Division 15 – Mechanical

F. Functional Applications:
   1. The Control Systems scope shall comprise the following primary elements:
      a. Building Controls and Automation.
      b. Energy Management Requirements.
      c. Integration and interfacing as required with the associated work of the Mechanical and Electrical trades.

1.2 DEFINITIONS: The following definitions, abbreviations and acronyms may be used in these Controls System Specifications:

A. Controls Systems: The total functionally integrated configuration of fully operational applications and elements, including all installations, equipment, software, programming, database entries, schedules, sequences and associated materials, to be provided by this Controls Contractor and to be interfaced to the associated work of other related trades as required by the Controls Contract.

B. Controls Contractor: The single Contractor contracted to provide all the contracted Controls Systems work. This Contractor shall be the primary supplier,

installer, verification agent and ongoing service provider for the Controls Systems.

C. Controls Systems Networks: The total digital on-line real-time configuration of digital processing units, Servers, PCs, Network Engines, Operator Workstations, panels, sub-panels, controllers and associated elements together with their associated devices. These may be provided as one or more independent or integrated sub-networks, LAN, WAN and the like as required by the Contract Documents.

D. Node: A programmable digital information processing entity existing on the Networks. Nodes shall include PCs, Servers, Network Engines, distributed processor field panels, intelligent controllers and end-devices, active communications devices and the like.

E. Controls Systems Integration: The functional and operational interconnection of Controls Systems applications, elements and Nodes and the associated work of other trades in compliance with all relevant and applicable codes, standards and ordinances so as to provide coherent operational Controls Systems as required by the Contract Documents.

F. Analog: A continuously variable system or value not having discrete levels. Typically to operate within a defined range of limiting values.

G. Binary: A two-state system or status where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level with each level separated by a physical deadband. Digital Inputs and Digital Outputs are examples.

H. Control Sequence: A pre-programmed arrangement of control elements, software algorithms, logical computation, target values and limits as required to attain the specified operational control objectives.

I. PC: The term “PC” shall mean a Personal Computer or Server manufactured by a recognized major PC manufacturer as approved by the Architect.

J. Wiring: The term “Wiring” and its derivatives when used in these Specifications shall mean the Controls Systems wiring and terminations. Wiring may only be in copper, fiber or by wireless interconnection as approved by the Architect.

K. Software: The term “Software” and its derivatives shall mean all of the programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the Controls Systems industry for the Project specific real-time, on-line, integrated monitoring and control configurations.

L. Protocol: The term “Protocol” and its derivatives shall mean a defined set of rules and standards governing the on-line exchange of data between Network Nodes in quasi real-time.

M. The use of words in the singular in these Specifications shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.

N. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in these Specifications are for general information only and are to assist in the reading and interpretation of these

Specifications. They do not form a formal part of the Specification content and may not be consistent or complete in their use throughout the Specifications.

O. Provide: The term "Provide" and its derivatives shall mean to supply, install in place, connect, calibrate, test, verify, Warrant, document and supply the services as required for fully functional operation at the Controls Contractor's cost

P. Furnish: The term "Furnish" and its derivatives shall mean supply, at the Controls Contractor's cost, to the designated third party trade contractor for installation. The Controls Contractor shall subsequently connect furnished items to the Controls Systems, calibrate, test, verify, Warrant and document.

Q. Install: The term "Install" and its derivatives shall mean receive at the job site and install in place ready for functional testing and verification as specified.

R. User Definable: An attribute of an on-line defined System item or function which may be easily changed, added or deleted by an authorized Operator.

S. The term "Normal Work Day" shall be designated by the Owner as the hours during which the Project facility will be occupied and will operate with all normal activities ongoing.

T. The terms "Download" and "Upload" shall mean to transfer information from one Node to another across the Network.

U. Server: A Network computer that serves as the communications controller and database for the field control panel Nodes and the Operator Workstation terminals, as an alarm monitoring and control workstation, as a point of integration for related sub-systems and as a central database fileserver.

V. Off-line: A condition in which a Controls Application Node is not in real-time digital communication with the Server or other Application Nodes. In the off-line mode, the Node shall continue to make access decisions and process alarms according to the information stored at its local database.

W. Reset: A command or feedback signal that indicates that a monitored point has returned to its normal state having previously transferred to the alarm or trouble state.

X. Tamper: A condition within the circuitry of a monitored point which indicates that the electrical integrity of that sensing circuit has been compromised.

Y. Trouble: A condition within the circuitry of a monitored point, which indicates that an equipment malfunction, and/or single break, a single fault or a wire-to-wire short exists.

Z. The following definitions, abbreviations and acronyms may be used in these Specifications:

1. Core Abbreviations

ADA	Americans Disability Act
ADC	Analogy to Digital Converter
AFF	Above Finished Floor
AHJ	Authorities Having Jurisdiction (at the Project site)
AI	Analog Input
AN	Application Node (Active Processing Monitoring/Control Node)
AO	Analog Output

AWG American Wire Gauge
CA Commissioning Agent
CPU Central Processing Unit
DAC Digital to Analog Converter
DI (Binary) Digital Input
DO (Binary) Digital Output
DOE Department Of The Environment (US)
EMI Electromagnetic Interference
FAS Fire Detection and Alarm Annunciation System
GUI Graphical User Interface
HOA Hand-Off-Auto
ID Identification
I/O Input/Output
ISP Internet Service Provider
IT Information Technology
LAN Local Area Network
LCD Liquid Crystal Display
LED Light Emitting Diode
LEED Leadership in Energy and Environmental Design
LV Low Voltage
NC Normally Closed
NIC Not In Contract
NO Normally Open
OWS Operator Workstation
PC Personal Computer
RAM Random Access Memory
RF Radio Frequency
RFI Radio Frequency Interference
RH Relative Humidity
ROM Read Only Memory
SPDT Single Pole Double Throw
SPST Single Pole Single Throw
STP Shielded Twisted Pair (Wiring)
TBD To Be Determined
TCP/IP Transmission Control Protocol/Internet Protocol
TP Twisted Pair (Wiring)
UPS Uninterruptible Power Supply
USGBC US Green Building Council
UTP Unshielded Twisted Pair (Wiring)
VAC Volts, Alternating Current
VDC Volts, Direct Current
VDU Video Display Unit
WAN Wide Area Network

2. Controls Definitions and Abbreviations:

a. Direct Digital Control: The operation of the digital computational algorithms, values and pre-defined arrangements included in the software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with tuning parameters, target values, limits, deadbands, logical and arithmetic functions, constant value terms, timing factors, status and alarm conditions and the like.

b. Abbreviations:

CFM	Cubic Feet Per Minute
DDC	Direct Digital Control
MCC	Motor Control Center
OAH	Outdoor Air Humidity
OAT	Outdoor Air Temperature
RTD	Resistance Type Temperature Detector
SVG	Scalar Vector Graphic
TTD	Thermistor Type Temperature Detector
VAV	Variable Air Volume
VFD	Variable Frequency Drive

1.3 CONTROLS SYSTEMS DESCRIPTION

A. The Controls Contractor's work shall consist of the provision of all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and items required by the Contract that are required for the functional turn-key operation of the complete and fully functional Controls Systems.

B. Provide a complete, neat and workmanlike installation. Use only employees who are qualified, skilled, experienced, manufacturer trained and familiar with the specific equipment, software and configurations to be provided for this Project.

C. The Controls Contractor shall employ qualified and experienced Controls Systems, Software, Application Engineering, Installation and Project Supervision personnel to provide the specific solutions required to meet the Project requirements and who are available to undertake this work as scheduled.

D. Manage and coordinate the Controls Systems work in a timely manner in consideration of the Project master schedules. Coordinate cooperatively with the associated work of the other trades so as to assist the progress and not impede or delay the work of associated trades.

E. The Controls Systems as provided shall incorporate, at minimum, the following integral features, functions and services:

1. All automated monitoring, supervision, control, information storage and presentation as required by these Specifications.

2. Operator information on all supervised building arrangements including but not limited to current status and value, historical archived information, summaries, analysis, displays, reports and operator control and management functions as required by the Specifications.
3. The detection, annunciation and management of all alarm and non-expected conditions as required by the Specifications.
4. The diagnostic monitoring and reporting of system functions, Nodes and communication networks.
5. Administrative functions necessary for the definition, back-up and restoration of all Controls Systems project specific and general databases.
6. Interfaces between individual elements and the systems and networks provided by other trades as required by the Contract Documents.
7. All other Controls Systems functions as required by the Contract Documents.

F. The Controls Systems as provided shall incorporate the facilities for the systems to be remotely monitored and controlled by Snow College.

G. Control system shall be Johnson Controls Metasys Web-Based Extended Architecture, no exceptions, furnished and installed by the local Johnson Controls Branch office.

1.4 QUALITY MANAGEMENT PROGRAM

A. General Requirements:
1. The Controls Contractor shall be a recognized national manufacturer, installer and service provider of Controls Systems.
2. The Controls Contractor shall have a Main or Branch Office within a **150-mile** distance of the Project jobsite that offers complete maintenance and support services on a 24 hour, 7-day-a-week, 365 days per year basis. This office shall manage the work for this Project. This office shall have direct access to or inventory of spare parts and all necessary test and diagnostic equipment required to install, commission and service the Controls Systems provided.
3. The Controls Systems architectures shall consist of the products of manufacturers regularly engaged in the production of Controls Systems and shall be these manufacturer's latest standard of design and release for these products at the time of bid.
4. The software and firmware residing in the Nodes and on the networks shall be updated to the latest currently available manufacturer's revision at the start of Warranty.

B. Workplace Safety And Materials Management
1. Provide a safety program in compliance with the Contract Documents.
2. The Controls Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.

3. The Contractor and its employees and subtrades shall comply with State and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that cover their scope of work and that their employees receive the training as required by the OSHA having jurisdiction for at minimum each topic listed in their Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractor's company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be use in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Contractor's Quality Assurance Program
1. Maintain a legible copy on-site, accessible to the Owner and the Architect upon request, of at minimum the following documentation:
   a. The Controls Contract Documents including all approved Change Orders.
   b. All Controls Contract related written Requests For Information and responses.
   c. All approved Controls Systems Shop Drawings and other submittals.
   d. A copy of the Controls Systems Project Schedule.
   e. Primary Controls Systems related correspondence and minutes.
   f. A record of daily on-site manpower deployment.
   g. Safety and related records.
   h. Other records as pertinent and required by the Contract Documents.
2. **Project Manager**: Provide a competent and experienced Controls Systems Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional management service for the work. The Project Manager shall attend scheduled Project trade meetings as necessary and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor. At minimum, the Project Manager shall:

a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
b. Prepare monthly progress reports.
c. Manage the financial aspects of the Controls Contract.
d. Coordinate with the Architect and with other construction trades as necessary to ensure the progress and coordination of the Contract work.
e. Manage the arrangements for storage of materials, tools and other relevant Controls Contractor assets on site.
f. Be responsible for the work and actions of the Controls Contractor's workforce on site.

D. Controls Systems Integration Support:
1. The Controls Contractor subsystems shall be functionally integrated and interfaced both with each other and to the associated work of other trades to a performance detail as required by the Controls Contractor's Contract Documents and to the long term operational benefit of the Owner's final Project as required by the Specifications.
2. To achieve this integration the Controls Contractor shall employ integration specialist designers and installers and shall utilize the latest proven industry standards and techniques available to the Contractor that are executed to provide efficient and cost effective solutions.
3. The Controls Contractor shall be the single point of coordination, management and performance responsibility for the Controls Systems including design, installation, programming, training, commissioning, documentation and long-term on-site service and shall coordinate with the Owner and other trades as necessary to ensure the scheduled completion of the work.

1.5 REFERENCES

A. All work shall conform to the following Codes and Standards, as applicable to the Contracted Work at the Project job site and to the relevant Authorities Having Jurisdiction at the Project site. In the case of conflict or discrepancy, the latest and most stringent regulation or code shall apply.
1. **Core Standards And Codes**:
a. National Electrical Code (NEC) and applicable local Electrical Codes.
b. Underwriters Laboratories (UL) and Underwriters Laboratories of Canada (ULC) listing and labels.
c. UL 864 UUKL Smoke Control.
d. UL 864 UOJZ Fire Protection Signaling Systems.
e. NFPA 70 – National Electrical Code.
f. NFPA 92A and 92B Smoke Purge/Control Equipment.
g. Factory Mutual (FM).
h. American National Standards Institute (ANSI).
i. National Electric Manufacturer's Association (NEMA).

j. American Society of Mechanical Engineers (ASME).
k. Institute of Electrical and Electronic Engineers (IEEE).
l. American Standard Code for Information Interchange (ASCII).
m. Electronics Industries Association (EIA).
n. Occupational Safety and Health Administration (OSHA).
o. American Society for Testing and Materials (ASTM).
p. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
q. Americans Disability Act (ADA).
r. Uniform Building Code (UBC).
s. National Building Code (NBC) of Canada.
t. NEMA 250 – Enclosures For Electrical Equipment (1,000 V Maximum).
u. NFPA 101 – Life Safety Code.
v. IESNA – Illumination Engineering Society of North America.
w. UL 50 – Cabinets and Boxes.

2. **Controls and Related Standards And Codes**:
   a. UL 916 Energy Management.
   b. NFPA 90A – Standard For The Installation Of Air Conditioning And Ventilating Systems.
   c. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
   d. Air Movement and Control Association (AMCA).
   e. ANSI/ASHRAE Standard 135-2001 (BACnet).
   f. ANSI/EIA 709 Control Network Protocol Specification (LonTalk).
   g. ASHRAE/IESNA 90.1, 1999.

1.6 WORK BY OTHERS

A. The demarcation of work and responsibilities between the Controls Contractor and other related trades shall be as generally outlined in the INTER-TRADE RESPONSIBILITY MATRICES herein. Refer also to other parts of the Specifications for details and clarifications.

B. Refer to Part 1.2 herein for detail definition of terms summarized for convenience only as below:
   1. **Provide** means to supply, install on-site, test, verify and document.
   2. **Furnish** means to supply to others for installation on-site then terminate, test and verify.
   3. **Install** means to install on-site the item supplied by others.

C. CC = Controls Contractor
   MC = Mechanical Contractor
   EC = Electrical Contractor

CORE INTER–TRADE RESPONSIBILITY MATRIX						
WORK		PROVIDE	FURNISH	INSTALL	LV WIRE & PIPE	LV POWER & CONDUIT
1.	CC Nodes, equipment, housings, enclosures and panels and power from EC panels.	CC			CC	EC
2.	CC software, firmware and project specific software configurations and database entries.	CC				
3.	CC low voltage and communication wiring	CC			CC	
4.	CC conduits and raceway	CC			CC	
5.	Control Relays	CC			CC	
6.	Concrete and/or inertia equipment pads and seismic bracing	MC				
7.	CC network routers, bridges, hubs and associated cabling.	CC			CC	

BUILDING CONTROLS INTER-TRADE RESPONSIBILITY MATRIX						
WORK		PROVIDE	FURNISH	INSTALL	LV WIRE & PIPE	LV POWER & CONDUIT
1.	VAV Box and Terminal Unit Nodes		CC	MC	CC	EC
2.	Automatic dampers		CC	MC	CC	
3.	Manual valves	MC				
4.	Automatic valves		CC	MC	CC	
5.	VAV boxes	MC				
6.	Pipe insertion devices and taps including thermowells, flow and pressure stations, etc.		CC	MC	CC	
7.	Current Switches.	CC			CC	
8.	Power Distribution System monitoring interfaces		CC	EC	CC	EC
9.	CC interface with Chiller control package	CC			CC	EC
10.	Chiller controls interface to CC	MC			CC	EC
11.	Chiller and BoilerFlow Switches	MC		MC	CC	
12.	Boiler control package	MC			CC	EC
13.	Water treatment system	MC			MC	EC
14.	Variable Frequency Drives		EC	EC	CC	EC

15.	Refrigerant monitors		MC	CC	CC	EC
16.	Computer Room A/C Unit site-mounted controls		MC	CC	CC	EC
17.	Fan Coil Unit controls	CC			CC	EC
18.	Unit Heater controls	CC			CC	EC
19.	Packaged Rooftop Unit (RTU) space mounted controls		CC	CC	CC	
20.	Packaged RTU field-mounted controls	CC			CC	
21.	Cooling Tower Vibration Switches	MC			CC	EC
22.	Cooling Tower Level Control Devices	CC			CC	EC
23.	Cooling Tower makeup water control devices	MC			CC	EC
24.	Starters, HOA switches	EC			CC	EC
25.	Control damper actuators	CC			CC	
26.	LV Lighting Control Relays And Switches	CC			CC	EC
27.	Addressable Lighting Control Modules And Panels	CC			CC	EC
28.	Photo and Occupancy Sensors	EC			EC	EC
29.	Operable Lighting Breaker Panels	CC			CC	EC

1.7 SUBMITTALS

A. **Core Controls Systems Shop Drawings, Product Data and Samples**:

1. The Controls Contractor shall submit an Index with submittal dates for all shop drawings ready for review and acceptance by the Architect. Allow 5 working days for the review of this Index.
2. Submittals shall be in defined packages as agreed with the Architect. Each package shall be complete and shall only reference itself and previously submitted packages. Allow 10 working days for the review of each package by the Architect.
3. Equipment, installations, programming and systems requiring approval of local AHJ must comply with their regulations and be approved by them. Filing shall be at the expense of the Controls Contractor. Provide a copy of all related correspondence and final approved permits to the Owner.
4. The Controls Contractor shall correct any errors or omissions individually noted by the Architect in each first submittal review, as required by the Architect and then resubmit for second review. Any required third or subsequent reviews of the same submittal shall be at the cost of the Controls Contractor
5. Provide at minimum the following basic submittals:

a. Controls Systems network architecture and riser diagrams including all Nodes, devices, interfaces and interconnections.
b. Schematics, sequences and logic diagrams.
c. Descriptions and/or product data sheets for all equipment, materials, software, firmware components and items to be furnished and provided. Information shall be Project specific and not general advertising.
d. The estimated detailed Bill of Material for the Project.
e. Details of all coordinated interfaces between both Controls Systems Applications and the associated work of other trades.
f.. Point lists for all physical and virtual (software) points to be provided at minimum including for each Point the Tag, Type, Range, Units Descriptor, Address, Project specific attributes and the like.
g. Include in the Points list details of the physical terminations and interconnections for each end device on the networks including the associated Node, cable terminations, termination location and referenced sequences, special functions to be applied and cross-referenced drawings. All field wiring tags shall be cross-referenced between drawings.
h. Information specifically required by AHJ.
i. Details of the training to be provided including outlines for each session.
j. Details of the commissioning sheets and procedures proposed.
k. Details of telephone line, ISP and associated requirements to be provided by the Owner, at its cost, in order for the Contractor to complete the work.

B. **Additional Controls Submittals**: Provide the following additional submittals:
1. Control damper Schedule including a separate line for each damper and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Blade Type, Bearing Type, Seals, Duct Size, Damper Size, Mounting and Actuator Type.
2. Control Valve Schedules including a separate line for each valve and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close Off Pressure, Capacity, Valve CV, Calculated CV, Design Pressure, Actual Pressure and Actuator Type.
3. Room Schedule including a separate line for each VAV box and terminal unit indicating minimum/maximum cfm, pickup gain, box area and bias setting.

1.8 RECORD DOCUMENTATION

A. Core Controls Systems Operation and Maintenance Manuals And Record Drawings:

1. Provide three (3) copies of the Operation and Maintenance Manuals and Record Drawings to the Architect prior to final commissioning and completion of the Controls Systems installation work. The entire record documentation content shall also be provided on Compact Disc media and shall include the following:
   a. Table of Contents.
   b. System record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
   c. Manufacturer's product data sheets for all products including software.
   d. Operator and Maintenance Manuals.
   e. Archive copy of all site-specific databases and sequences.
   f. Network diagrams showing and describing all Nodes, devices, interconnections and interfaces.
   g. Wiring termination schedules.
   h. Interfaces to all third-party products and work by other trades.
   i. As-built equivalents of all shop drawing submittals.
2. The field installation Record Documentation should be complied in a Point/System/Integrated Operation format to reflect the composite testing and commissioning processes.

B. **Additional Controls On-Line Record Documentation**: After completion of all the tests and adjustments, the Contractor shall install the following additional information on the operating on-line control system:
   1. As-built record drawing files.
   2. Detailed catalog data on all installed system components with address and phone number of factory repair service.

1.9 WARRANTY

A. Standard Material and Labor Warranty:
   1. Provide a one year labor and material Warranty on Controls Contract work provided under this Contract.
   2. If within twelve (12) months from the date of acceptance of the Controls Contract work and following receipt of written notice from the Owner the product is found to be defective in operation, workmanship or materials, then the product shall be promptly replaced, repaired or adjusted at the option of the Controls Contractor at the cost of the Controls Contractor.
   3. Maintain an adequate supply of materials available directly to the Project site such that replacement of key parts, including programming, may be promptly carried out. Warranty work shall be done during the Controls Contractor's normal business hours.
   4. Maintain an on-site record of all work done, all items removed from site, all items returned to site, all new replacement items installed and all remedial programming and database entry work undertaken including

software revisions installed. Maintain a record of all calibrations required as a result of Warranty service.

PART 2 – PRODUCTS

2.1 CONTROLS SYSTEM ARCHITECTURE

A. **General**

1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
2. The Operator Workstations, Servers and principal network computer equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels – not "Clones" assembled by a third-party subcontractor.
3. Provide licenses for all software residing on and used by the Controls Systems and transfer these licenses to the Owner prior to completion.
4. The networks shall, at minimum, comprise, as necessary, the following:
   a. Operator Workstations – fixed and portable as required by the Specifications.
   b. Network computer processing, data storage and communication equipment including Servers and digital data processors.
   c. Routers, bridges, switches, hubs, modems, interfaces and the like communication equipment.
   d. Active processing network Application Nodes including programmable field panels and controllers together with their power supplies and associated equipment.
   e. Addressable elements, sensors, transducers and end devices.
   f. Third-party equipment interfaces as required by the Contract Documents.
   g. Other components required for a complete and working Control Systems as specified.
5. The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards, the requirements of the AHJ at the site and to meet all requirements of the Contract Documents.

B. **Network**

1. The Controls Systems shall incorporate primary Tier 1 network(s). At the Controls Contractor's option, they may also incorporate multiple and integrated secondary Tier 2 and tertiary Tier 3 networks.
2. The networks shall utilize only copper and optical fiber communication media as appropriate and to comply with the applicable codes, ordinances and regulations and the AHJ. They may also utilize digital wireless technologies if required by the Project and approved by the Architect and the AHJ.

2. The Owner shall provide all private and public telephones lines, ISDN lines and Internet Service Provider services and connections as necessary for the Controls Contractor to complete the work as contracted at the Owner's direct cost. The Controls Contractor shall identify the specific requirements in a shop drawing submittal.

C. **Third-Party Interfaces**

1. Controls Contractor shall integrate real-time data from building systems by other trades and databases originating from other trades as specified and required by the Contract Documents and Part 3 herein
2. The Controls Systems shall include necessary hardware, equipment and software to allow data communications between the Controls Systems and building systems supplied by other trades.
3. The other trade contractors supplying other associated systems and equipment will provide their necessary hardware and software at their cost and will cooperate fully with the Controls Contractor in a timely manner and at their cost to ensure complete functional integration.
4. The Controls Contractor shall not be responsible for the execution or the scheduling of the work of other trades or Divisions.

2.2 OPERATOR WORKSTATIONS

A. The existing Snow College Operator Workstation (OWS) shall provide the primary means of operator communication with the Controls Systems and shall be used for monitoring, operations, engineering, management, archiving, audit, reporting and other related functions. The OWS shall comprise PC and related facilities that have as their primary function the Operator Interface functionality for the associated Application(s). Refer to Part 3 herein for details of OWS types, uses and locations.

B. The OWS shall consist of fixed and portable units as scheduled in Part 3 of this Specification. The fixed units shall consist of installed PC or Server based configurations. The portable units shall consist of digital Hand-Held, PC Laptop or similar designed units, complete with keypad or similar entry/selection device and complete with display and communication arrangements with Application Nodes.

C. All OWS, including PC's, Servers and printers shall comply with all codes and standards associated with the installations including the requirements of the AHJ at the site. Supply additional equipment, software or facilities as necessary.

D. Each PC laptop shall, at **minimum**, consist of:

1. Pentium Processor 1.4GHz, 40GB Hard Drive, 256MB RAM, DVD-CDRW, 14.1" SXGA, Windows 2000.

E. All OWS shall operate independently and concurrently without interference and under individual user password or approved equivalent operator access protection.

F. OWS functionality shall be designated for specific tasks and for specific users. OWS shall also be readily re-designated to provide OWS back-up to other system OWS.

G. Portable OWS shall operate under user password protection and using subsets of the fixed OWS programming arrangements with common point and device designations and designed to meet the requirements of their individual Application.

H. The OWS and Servers shall be provided with all required and installed operating system, Browser, management, end user and Application specific software and database support facilities, including the associated original manufacturer software licenses, as part of the base work and price of the Controls Contract. All software shall be to the original manufacturer's latest revision level at the time of delivery to Project site.

I. Transfer all Controls Systems software licenses to the Owner, at no additional cost to the Owner, before the time of acceptance for the Work. Include, as part of this project, two (2) additional copies of the M5 software package.

J. The Controls Contractor will use the OWS, Server and associated equipment as necessary for the purposes of setting up, calibrating and verifying the Work. This equipment and facilities shall be delivered to site and installed by the Contractor as late as is feasible in the scheduling of the Work and shall comprise the latest versions of these products available at the time of delivery.

2.3 OPERATOR INTERFACES

A. General

1. The Controls Systems Operator Interfaces shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the displays by authorized users at the OWS.
2. User access shall be protected by a flexible and Owner redefinable software-based password access protection. Password protection shall be multi-level and partitionable to accommodate the varied access requirements of the different user groups to which individual users may be assigned. Provide the means to define unique access privileges for each individual authorized user. Provide the means to on-line manage password access control under the control of a project specific Master Password. Provide an audit trail of all user activity on the Controls Systems including all actions and changes.
3. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
    a. User access for selective information retrieval and control command execution.
    b. Monitoring and reporting.
    c. Alarm and non-normal condition annunciation.
    d. Selective operator override and other control actions.
    e. Information archiving, manipulation, formatting, display and reporting.

f. Controls Systems internal performance supervision and diagnostics.
g. On-line access to user HELP menus.
h. On-line access to current as-built records and documentation. At minimum, one (1) copy of all record documentation shall be stored on a designated OWS or Server and be accessible to the Owner.
i. Means for the controlled re-programming, re-configuration of systems operation and for the manipulation of database information in compliance with the prevailing codes, approvals and regulations for the component applications and elements.
j. Means to archive all Controls Systems Contract Project specific configuration databases, software programs and other pertinent operational data such that any component of the software and project specific operational databases may be reloaded on-site from archived data.

4. Provide on-line reports and displays making maximized use of simple English language descriptions and readily understood acronyms, abbreviations, icons and the like to assist user understanding and interpretation. All text naming conventions shall be consistent in their use and application throughout the Controls Systems. Submit proposed naming arrangements for approval prior to data entry.

B. All devices, including OWS, Servers and Application Nodes, required to support and drive the Operator Interfaces shall support multiple independent user terminals through a theoretical unlimited number of Browsers. Support shall be configured for a minimum of 10 users for all Applications and features provided

2.4 CONTROLS SYSTEMS APPLICATIONS – General

A. General

1. The Controls Systems Application Nodes (AN) shall include all monitoring, control and data handling Nodes including programmable field panels and controllers.
2. AN shall be programmable and governed by the requirements of their applicable codes, approvals and regulations for their Application.
3. The AN shall be designed, packaged, installed, programmed and commissioned in consideration of their specific service and prevailing operating conditions. They shall be proven standard product of their original manufacturer and not a custom product for this Project.
4. A failure at an AN shall not cause failures or non-normal operation at any other system AN other than the possible loss of active real-time information from the failed AN.
5. Ancillary AN equipment, including interfaces and power supplies, shall not be operated at more than 80% of their rated service capacity.
6. AN shall comply with FCC Part 15 subpart J Class A emission requirements.

7. AN shall maintain all programming in non-volatile or battery backed memory and shall automatically resume normal monitoring and control following the restoration of stable electrical power after a power outage.

B. Power Fail/Auto Restart:

1. Provide for the automatic orderly and predefined shutdown of the impacted Controls Systems and all associated subsystems following total loss of power to parts or all of the Controls Systems.
2. Provide for the automatic orderly and predefined startup of parts or all of the impacted Controls Systems following the restoration of stable power. Archive and report time and details of power restoration.
3. Provide for the orderly and predefined scheduling of controlled return to normal, automatically time scheduled, operation of controlled equipment as a result of the auto restart processes.
4. Maintain conformal and synchronized real-time clock operation in all Applications during periods of power outage for a minimum of 72 hours.

C. Controls Systems Application Integration

1. The Controls Application shall be the core system Application for the managed supplemental reporting of specified alarms and status changes from the following Applications.
   a. Building Mechanical Controls

2.5 CONTROLS SYSTEMS APPLICATION - SPECIFICS

A. General

1. The Controls Systems shall be designed and implemented entirely for use and operation on the Internet and the Owner's Intranet. This functionality for operational access shall extend down to the field panel and field point level.
2. The primary Controls Systems Nodes (AN) shall be fully IT compatible nodes operating over the industry standard IT infrastructure provided for the Project. The Controls Contractor shall coordinate with the IT infrastructure support staff or trade contractors to ensure compatibility and performance of the operation of the Controls Systems over the LAN/WAN made available for its shared use.
3. The Controls Systems Tier 1 network shall be configured on IT industry standard off-the-shelf technologies compatible with other building systems and Project network arrangements.
4. All aspects of the Controls Systems Operator Interface shall be provided to operate through an IT industry standard Web Browsers such as Internet Explorer or Netscape or approved equivalent.
5. The Web Browser based Operator Interface provided shall incorporate complete tool sets, operational information displays, multi-Window displays and other interactive aids to assist interpretation and ease of use. Simple HTML based web page displays are not acceptable.

6. The Web Browser based Operator Interface provided shall not require the procurement or licensing of any special or proprietary software from the Controls Contractor or its suppliers for the Controls Systems OWS.
7. As required for the functional operation of the Controls Systems, the Controls Contractor shall provide all necessary digital processor programmable Server(s). These Server(s) shall be utilized for Controls Systems Application configuration, for archiving, reporting and trending of data, for Operator transaction archiving and reporting, for network information management, for alarm annunciation, for Operator Interface tasks, for Controls Application management and the like. These Server(s) shall utilize IT industry standard data base platforms such as Microsoft SQL Server and Microsoft Data Engine (MSDE) or approved equal.
8. Provide a fully distributed processing, on-line, real-time, direct digital control Controls Systems Application in compliance with all applicable codes and as approved by the Authorities Having Jurisdiction (AHJ) at the Project site. All communication between Controls Application Nodes shall be digital only.
9. All Controls Systems Application facilities and features shall be accessible via Enterprise Intranet and Internet Browser with user ID or Password access control for user access.
10. The Controls Systems Application shall support auto-dial/auto-answer communications to allow Controls Systems Nodes to communicate with other remote Controls Systems Nodes via standard telephone lines. Refer to drawings for type of line to be used, DSL or voice grade. Where no preference is indicated then DSL will be provided. The lines shall be provided by the Owner at the Owner's cost.
11. The Controls Systems Application network shall utilize an open architecture capable of each and all of the following:
    a. Utilizing standard Ethernet communications and operate at a minimum speed of 10/100 Mb/sec.
    b. Connecting via BACnet at the Tier 1 level in accordance with ANSI/ASHRAE Standard 135-2001.
    c. Connecting via LonMark as per ANSI/EIA 709 (LonWorks) to LonMark FTT-10 transceivers at the Tier 2 level.
    d. Connecting via N2 Protocol at the Tier 2 level.
12. Downloading and Uploading:
    a. Provide the capability to generate and modify the Controls Systems Application software-based sequences, database elements, associated operational definition information and user-required revisions to same at any designated Workstation together with the means to download same to the associated Controls Systems Application Node.
    b. The Controls Systems Application software tool provided for the generation of custom and database definitions shall be resident in

both the Controls Systems Application Node and Controls Systems Application Server(s).

c. Provide the capability to upload Controls Systems Application operating software information, database items, sequences and alarms to designated Server(s).

d. The functions of this Part shall be governed by the codes, approvals and regulations applying to this Controls Systems Application as provided.

13. The Controls Systems Application Portable OWS shall operate identically and have equal functionality to the Fixed OWS. All Operator access into the Controls Systems from portable OWS shall be the same Browser format and functionality as provided for the Fixed OWS.

B. Operator Interface

1. The Operator Interface provided shall include the functionality to selectively combine data and information from any system element or component in the Controls Systems Application on a single Browser window display panel at the Operator's option. This shall include both current information and historical data stored on the Server(s).
2. The Controls Systems Application OWS shall operate on Microsoft® Windows 2000 or other approved platform.
3. Each Controls Systems Application fixed and portable OWS shall be on-line configurable for specific functionalities and associated groups of system points and elements.
4. Navigation Trees:
   a. Provide the capability to display multiple navigation trees that aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the Controls Systems networks.
   b. Provide the capability for the Operator to add custom trees. The Operator shall be able to define any logical grouping of systems or points and arrange them on the tree in any selected order. Provide the capability to nest groups within other groups. Provide at minimum for 5 levels of nesting.
   c. The navigation trees shall be "dockable" to other displays in the Operator interface including graphic displays. The trees shall appear as part of the display and may be individually detached and minimized to the Windows task bar or closed. Provide for a single keystroke to reattach the navigation tree to a primary display.
5. Divisible Display Windows:
   a. Provide for the operator to divide the display area within a single Browser window into multiple display panels. The content of each display panel can be any of the standard summaries and graphics provided in the Controls Systems Application.
   b. Provide each display panel with minimize, maximize and close icons.

6. Alarms:
   a. Alarms shall be routed directly from primary Controls Systems Application Nodes to the existing District's OWS. The alarm management portion of the Controls Systems software shall, at minimum, provide the following functions:
      1. Log date and time of alarm occurrence.
      2. Generate a "Pop-Up" window on the Browser display panel, with audible alarm, informing the Operator that an alarm has been received.
      3. Allow an Operator, with the appropriate password, to acknowledge, temporarily silence or cancel an alarm.
      4. Provide an audit trail on hard drive for alarms by recording user acknowledgement, deletion or canceling of an alarm. The audit trail shall include the ID of the user, the alarm, the action taken on the alarm and a time/date stamp.
      5. Provide the ability to direct alarms to an e-mail address or alpha-numeric pager. This must be provided in addition to the pop-up window described herein. Controls Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
      6. Provide for any attribute of any object in the Controls Systems to be designated to report as an alarm.
   b. The Controls Systems Application shall annunciate systems diagnostic alarms indicating system failures and non-normal operating conditions.
   c. The Controls Systems Application shall annunciate controls alarms at minimum as required by Part 3.
   d. Provide the on-line means to display alarms within the Browser windows by date/time of occurrence, priority class, point designation, value or other defined text keywords.
7. Operator Transaction Archiving:
   a. Provide the means to automatically archive all Operator activities on the Controls Systems Application and for the recall of same for reporting.
   b. Provide the means to sort and report archived activities by Operator, date/time, activity type and system area.
   c. Provide access protection to preclude the unauthorized removal or tampering with archived records.
   d. Provide management support facilities for the deletion and re-initializing of archived record logs under Master Password control or equal means.
8. Reports:
   a. Reports shall be generated and directed to one or more of the following: User interface displays, printers archived at the Owner's defined option. As a minimum, the Controls Systems Application shall provide the following reports:

1. All points in the Controls Systems Application.
2. All points in a specific Controls Systems AN.
3. All points in a user-defined group of points.
4. All points currently in alarm.
5. All points locked out.
6. All Controls Systems Application schedules.
7. All user defined and adjustable variables, schedules, interlocks, diagnostics, systems status reports and the like.

b. Provide all applicable original manufacturers standard reports for the Controls Systems.

c. Provide any custom reports as specified in Part 3.

9. Dynamic Color Graphics:

a. Provide a graphic editing tool that allows for the creation and editing of graphic files. It shall be possible to edit the graphics directly while they are on line, or at an off line location for later downloading to the AN.

b. Provide a complete user expandable symbol library containing all of the basic symbols used to represent components of a typical system. Implementing these symbols in a graphic shall involve dragging and dropping them from the library to the graphic.

10. Schedules:

a. Provide multiple schedule input forms for automatic time-of-day scheduling and override scheduling of operations. At a minimum, the following spreadsheet types shall be accommodated:

1. Weekly schedules.
2. Temporary override schedules.
3. Special “Only Active If Today Is A Holiday” schedules.
4. Monthly schedules.

b. Schedules shall be provided for each group, system and sub-system in the Controls Systems Application. It shall be possible to include all or any commandable points residing within the Controls Systems in any custom schedule. Each point shall have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system. Scheduling and rescheduling of points shall be accomplished easily via the system schedule spreadsheets.

c. Multiple monthly calendars for a 12-month period shall be provided that allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

11. Historical Trending And Data Collection:

a. Trend and store point history data for all actual and virtual (software) points and values as required by the Owner.

b. The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.
c. At a minimum, provide the capability to perform statistical functions on the historical database:
1. Average.
2. Arithmetic mean.
3. Maximum/minimum values.
4. Range – difference between minimum and maximum values.
5. Standard deviation.
6. Sum of all values.
7. Variance.

12. Operator Access Security (Combined Password and User ID):
a. Provide for Operator access into the Controls Systems via the use of on-line Owner defined software Password and User Identification (ID) pairs, unique for each Operator and unique throughout the Controls Systems Application, to supplement standard password access control.
b. Stored password/user ID definitions shall be stored in encrypted formats whether at the Controls Server or at the AN.
c. Password logins shall not be echoed on any screen or printer except during Master Password definition processes. An Operator defining a password shall be required to re-enter to confirm authenticity.
d. Operator access privileges shall be definable in terms of functions and Project areas.
e. As part of the access privileges definition for each user the Owner shall be able to define at minimum the following:
1. Access times by day.
2. Permanent or temporary, with expiry date, password.
3. Number of incorrect access attempts allowed before the password is disabled.
4. Whether or not the Operator is able to redefine their own password.
5. A field for the Operator's e-mail address.
6. A field for the Operator's contact phone number.
7. Definition of the Operator's access privilege functionalities including viewing only, full control, selected functions, etc.

C. *C*ontrols Application Nodes (AN):

1. Controls AN shall provide both standalone and networked direct digital control of mechanical and electrical building systems as required by the Specifications. The primary AN shall support a minimum of 1,000 field points together with all associated features, sequences, schedules, applications as required for fully functional distributed processing operations.

2. A dedicated AN shall be configured and provided for each primary HVAC system (air handler, chiller, boiler, etc.) and each Terminal HVAC system (VAV box, Unit Heater, Fan Coil Unit, Cabinet Heater, Heat Pump, Fan Powered Box, CV Box, etc.).
3. Each AN shall retain program, control algorithms, and setpoint information for at least 72 hours in the event of a power failure and shall return to normal operation upon stable restoration of normal line power.
4. Each AN shall monitor and report its communication status to the Controls Systems Application. The Controls Systems shall provide a system advisory upon communication failure and restoration.
5. As indicated in Part 3 or in the drawings, for each primary HVAC system, provide means of indication of monitored and controlled equipment performance and setpoints at or adjacent to the AN.
6. For each primary HVAC system, provide a means to adjust setpoints and start/stop equipment at or adjacent to the AN.
7. Provide a means to prevent unauthorized personnel from accessing setpoint adjustments and equipment control definitions at the AN.
8. The AN shall provide the functionality to download and upload configuration data, both locally at the AN and via the Controls Application networks.
9. The AN shall perform the functional monitoring of all Controls Application variables, both from real hardware points, software variables, and controller parameters such as setpoints.
10. The primary AN shall manage and direct all information traffic on the Tier 1 network, between the Tier 1 and Tier 2 networks and to the Server(s).
11. All AN on the Tier 1 network shall be equipped with all software and functionality necessary to operate the complete user interface, including graphics, via a Browser connected to the Node on the network or directly via a local port on the AN.
12. The AN shall be capable of direct connection to multiple field busses using different protocols simultaneously as indicated below. Should the AN not support multiple field busses then install multiple AN in parallel to achieve this functionality.
    a. An RS-485 serial field bus such as MSTP or the manufacturer's proprietary field bus.
    b. A LON field bus for supervision and control of LON based controllers that conform to the Lon Talk standard.
13. The AN shall integrate data from both field busses into a common and conformal object structure. Data from both field busses shall appear in common displays throughout the Operator Interface in the same format. Conformal formatting shall be provided for each type of data not dependent on the type of field bus from which the data originated.
14. The AN shall be designed, packaged, installed, programmed and commissioned in consideration of their specific service and prevailing operating conditions. They shall be proven standard product of their original manufacturer and not a custom product for this Project.

15. A failure at an AN shall not cause failures or non-normal operation at any other system AN other than the possible loss of active real-time information from the failed AN.
16. Ancillary AN equipment, including interfaces and power supplies, shall not be operated at more than 80% of their rated service capacity.
17. Each AN shall retain program, control algorithms, and setpoint information in non-volatile memory in the event of a power failure, and shall return to normal operation upon restoration of power.
18. Each An shall report its communication status to the Application. The Application shall provide a system advisory upon communication failure and restoration.
19. The AN shall incorporate the ability to download and upload configuration data, both locally at the AN and via the Application communications network.
20. The AN shall be provided with a permanently-mounted local graphic terminal where required in the definitions of Part 3 of this Specification. The local graphic terminal shall provide dynamic graphical representation of the associated system status, with the ability for the Operator to enter commands with proper password protection.
21. Each primary Controls Systems AN shall be provided with the necessary un-interruptible power facilities to ensure its continued normal operation during periods of line power outages of, at minimum, 1 minute duration. This normal functionality shall include all normal software processing, communication with powered field devices and network communications with other powered Controls Systems AN, Servers and OWS.

D. Special Software:

1. **Event Messaging**: Provide for the automatic execution of user-defined messages on the occurrence of each predefined real-time event including equipment/point status change, approaching limit or alarm, time of day and the like. Direct annunciation to Owner defined OWS pager or e-mail address as required.
2. **Indoor Air Quality**: Provide monitoring of outside air, return air and supply air CO2 concentration. Calculate and maintain fresh air requirements. Adjust outdoor air intake to ensure return air CO2 high level limit is not exceeded.
3. **Optimum Start/Stop**: Provide software to start equipment on a sliding schedule based upon indoor and outdoor conditions. Determine the minimum time of HVAC system operation needed to satisfy the space environmental requirements. The program shall also determine the earliest possible time to stop the mechanical systems. The optimum start/stop program shall operate in conjunction with, and be coordinated with, the scheduled start/stop and night setback programs.
4. **Auto Alarm Lockout**: Provide for scheduled and automatic lockout of alarm annunciation from equipment during non-normal operating conditions including shutdown, emergency power operation, filter alarm and the like.

5. **Energy Metering**: Provide software to monitor and totalize consumption as measured by the defined pulse meters.
6. **Event Initiated Programs and Custom Logic**: Provide software to define custom logic sequences that reside in the AN. This software shall also reside in the AN and be accessible to the standard operator Interface via the Browser.
7. **System Restart**: Upon restoration of AC power to an AN, automatically restart all equipment and restore all loads to the state as required. Provide appropriate time delays to prevent demand surges or overload trips.
8. **Heavy Load Delays**: Provide software to achieve protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical or other defined loads.
9. **Runtime Totalization**: Automatically sample, calculate and store runtime hours for binary input and output points as listed in the point schedule of this specification.
10. **Analog/Pulse Totalization**: Sample, calculate and store consumption totals on a daily, weekly or monthly basis for user-selected analog and binary pulse input-type points.
11. **Binary Totalization**: Provide totalization for binary event counters.

2.6 CONTROL SYSTEMS FIELD DEVICES

A. Input Devices:

1. Additional devices

a. Materials: (e.g. Stainless Steel, Waterproof, etc.)
b. Rating: (e.g. Compliance Standard, Enclosure Rating, etc.)
c. Mounting: (e.g. Pipe Insertion, Wall, flush, etc.)
d. Range: (e.g. Working Range)
e. Accuracy: (e.g. ± percent full scale)
f. Protection: (e.g. Overpressure, short circuit, etc.)
g. Output: (If applicable, e.g. 4-20mA, etc.)
h. Special: (Special characteristics e.g. fail open, approved mfr., etc.)

2. Air Low Differential Pressure Switch

a. Rating: NEMA 1
b. Mounting: Duct Insertion.
c. Range: 0.05” to 5.0” WC, complete with field adjustable setpoint.
d. Protection: Overpressure to 1 PSIG
e. Output: Form C Contact, minimum 50VA
f. Special: Automatic reset, provide complete installation kit including static pressure tips, tubing, fittings and air filters.

3. Air Low Differential Pressure Sensor

a. Rating: NEMA 1
b. Mounting: Duct Insertion

c. Range: 0.05” to 5.0” WC
d. Protection: Overpressure to 1 PSIG
e. Output: 0-10vDC, 4-20mA
f. Special: Provide complete installation kit including static pressure tips, tubing, fittings and air filters.

4. Air High Differential Pressure Switch
a. Rating: NEMA 1
b. Mounting: Duct Insertion
c. Range: 1” to 10” WC, complete with field adjustable setpoint
d. Protection: Overpressure to 1 PSIG
e. Output: 2 Form C Contacts, minimum 360VA
f. Special: Manual reset, provide complete installation kit including static pressure tips, tubing, fittings and air filters.

5. Water Differential Pressure Switch
a. Materials: Brass bellows.
b. Mounting: Pipe mounted.
c. Range: 2-26 PSI, 1.2 PSI fixed differential.
d. Protection: 120 PSI Differential overpressure, 180 PSI static pressure.
e. Output: Form C contacts, 50 VA
f. Special: Pipe taps and shut off valves provided by Div. 15.

6. Temperature Sensors
a. Materials: Nickel element in a copper tube.
b. Mounting: Duct/Pipe, Room.
c. Range: -50ºF to 250ºF, 55ºF to 85ºF
d. Accuracy: 0.1%
e. Output: Resistive 1000ohms @ 70ºF
f. Special: Duct Element Holder, Brass Well Assembly, Room Mounting Bracket and Cover.

7. Air Flow Switch

8. Water Flow Switch

9. Current Switch
a. Materials: Encased copper.
b. Rating: 600vAC.
c. Mounting: Split Core.
d. Range: 1.5amps to 50 amps.
e. Action: Trip point adjustment.
f. Output: SPST, N.O.
g. Special: Status LED

10. Current Transducer
a. Mounting: Field Mounted.
b. Range: 60 Hz nominal.
c. Accuracy: +/-2% full scale.
d. Protection: 250 A max current.
e. Output: 4-20mA.

11. Static Pressure Transducer

a. Rating: NEMA 1.
b. Mounting: Duct Insertion, Pipe Insertion.
c. Range: 0-25 in. water column unidirectional, 0- +/- 5 in. water column bidirectional.
d. Accuracy: +/-1% full scale.
e. Protection: 10 PSIG.
f. Output: 4-20mA, 0-5 VDC, 0-10 VDC.

12. Differential Pressure Transducer

a. Rating: NEMA 1.
b. Mounting: Duct Insertion, Pipe Insertion.
c. Range: 0-25 in. water column unidirectional, 0- +/- 5 in. water column bidirectional.
d. Accuracy: +/-1% full scale.
e. Protection: 10 PSIG
f. Output: 4-20mA, 0-5 VDC, 0-10 VDC.

13. Gas Flow Monitoring

a. Materials:
b. Rating:
c. Mounting: Pipe
d. Range: 50:1
e. Accuracy: +/-1%
f. Protection: 175psi, -40ºF to 140ºF
g. Output: 0-10vDC, 4-20mA, N2
h. Special:

14. Override Request Switch

a. Materials: Bakelite.
b. Rating: 10amps @ 120vAC.
c. Mounting: Wall.
d. Output: SPDT Momentary Contact.
h. Special: Provide with cover plate.

15. End Switches

16. Low Temperature Switches

17. High Temperature Switches

18. Thermostats

B. Output Devices

1. Electric/Pneumatic Transducers
2. Controls Relays
   a. Materials: Gold Flash.
   b. Rating: 10amps @ 120-277vAC.
   c. Mounting: Standard Electrical Box.
   d. Protection: NEMA 1 Housing.
   e. Output: SPDT, DPDT.
   f. Special: Provide LED for position indication. Provide with HOA switch, except when used in Smoke Control applications.

C. Controlled Devices

1. Ball Valve

a. Materials:
b. Rating:
c. Mounting:
d. Range:
e. Accuracy:
f. Protection:
g. Output:
h. Special:

2. Butterfly Valve
3. Globe Valve – <u>all modulating hydronic control valves shall be globe type.</u>
4. Control Damper
5. Electric Damper Actuators:
   a. Rating: NEMA 2 Enclosure.
   b. Mounting: Direct mount.
   c. Stroke: 90 seconds end to end full stroke, 15 seconds return to normal for spring return.
   d. Protection: Electronic stall protection.
   e. Control Input: 0-10 VDC or 0-20 mADC.
   f. Power: Nominal 24 VAC.
   g. Torque: Size for minimum 150% of required duty.
   h. Duty Cycle: rated for 65,000 cycles.
   i. Special: Output position feedback, manual override, field selectable rotational/spring return direction, field adjustable zero and span.
6. Electric Valve Actuators.
   a. Rating: NEMA 1 Enclosure.
   b. Mounting: Direct mount.
   c. Control Input: 0-10 VDC or 0-20 mADC.
   d. Power: Nominal 24 VAC.
   e. Protection: Stall protection.
   f. Torque: Size for minimum 150% of required duty.
   g. Special: Output position feedback, manual override, field selectable direction, field adjustable zero and span. For spring return provide field selectable spring return direction.

D. Other Controls Devices

1. Electric Thermostats

PART 3 – EXECUTION

3.1 INSTALLATION PRACTICES:

A. **Controls Systems Wiring**

1. All conduit raceways, wiring, accessories and wiring connections required for the installation of the Controls Systems shall be provided by the Controls Contractor except as shown on the Electrical Trade documents. All wiring shall comply with the requirements of applicable portions of the

Electrical Trade work and all local and national electric codes and the requirements of the AHJ.

2. All Controls Systems wiring materials and installation methods shall comply with the original equipment manufacturer recommendations and standards.
3. The sizing type and provision of cable, conduit, cable trays and raceways shall be the design responsibility of the Controls Contractor.
4. Class 2 Wiring
   a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5ft. from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines.
5. Class 2 signal wiring and 24VAC power may be run in the same conduit. Power wiring 120VAC and greater shall not share the same conduit with Class 2 signal wiring.
6. Perform circuit tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:
   a. All circuits are continuous and free from short circuits and grounds.
   b. All circuits are free from unspecified grounds; that resistance to ground of all circuits is no less than 50 megaohms.
   c. All circuits are free from induced voltages.
7. Provide complete testing for all cables and wiring. Provide all equipment, tools, and personnel as necessary to conduct these tests.
8. Provide for complete grounding of all signal and communication cables, panels and equipment so as to ensure integrity of Controls Systems operation. Ground cabling and conduit at panel terminations. Do not create ground loops.

B. **Line Voltage Power Sources**
1. 120-volt AC circuits for the Controls Systems shall be taken by the Controls Contractor.
2. Circuits used for the Controls Systems shall be dedicated to these Controls Systems and shall not be used for any other services.
3. Controls DDC terminal unit controllers may use 120-volt AC power from motor power circuits.

C. **Controls Systems Raceways**
1. All wiring shall be installed in conduit or raceway except as noted elsewhere in the Specification. Minimum conduit size 3/4”.
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the supporting surface.

4. UL/ULC Listed Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls and for final connection to equipment.

D. **Penetrations**

1. Firestopping for all penetrations used by dedicated Controls Systems conduits and raceways shall be by other trades.
2. All openings in fire proofed or fire stopped components shall be closed by other trades using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls, shall be in sleeves, conduit or enclosed raceway.
4. No penetrations through building structural elements, slabs, ceilings and walls shall be made before receipt of written approval from the Architect.

E. **Controls Systems Identification Standards**

1. Node Identification: All nodes shall be identified by a permanent label fastened to the outside of the enclosure. Labels shall be suitable for the node environmental location.
2. Cable shall be labeled at every termination with cross-referencing to record documentation.
3. Raceway Identification: Exposed covers to junction and pull boxes of the FMS raceways shall be identified at primary points.
4. Wire Identification: All low and line voltage wiring shall be identified by a number, as referenced to the associated shop and record drawing, at each termination.
5. Wires and cabling shall not be spliced between terminations. Cable shields shall be single end grounded – typically at the panel end outside the panel.
6. Suggested color coding, for use at the Contractors option, are:
   a. Analog Input Cable Yellow
   b. Analog Output Cable Tan
   c. Binary Input Cable Orange
   d. Binary Output Cable Violet
   e. 24 VAC Cable Gray
   f. General Purpose Cable Natural
   g. Tier 1 Comm Cable Purple
   h. Other Tier Comm Cable Blue**]**

F. **Field Panel And Device Installations And Locations**

1. The Controls Systems panels, enclosures and cabinets shall be located as coordinated with the Architect at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. All field devices shall be installed per the manufacturer recommendation and in accessible locations as coordinated with the Architect.
3. Panels to be located in damp areas or areas subject to condensation shall be mounted with wall standoffs.

4. Conduit configurations entering or leaving panels and devices shall be such as to preclude condensation traps.

G. **Controls Specific Installation Requirements**

1. The Mechanical Trade Contractor shall install all in-line mechanical devices including temperature wells, pressure taps, duct smoke detectors, airflow stations, etc.
2. Controls DDC terminal unit controllers may use 120-volt AC power from motor power circuits.
3. The Mechanical Contractor shall install all in-line devices including control valves, dampers, etc.
4. Input flow measuring devices shall be installed in compliance with ASME Guidelines.
5. Outside Air Sensors:
   a. Sensors shall be mounted on a wall selected to minimize solar radiant heat impact or be located in a continuous intake flow adequate to monitor outside air conditions accurately.
   b. Sensors shall be installed with a rain shield and perforated cover.
6. Water Differential Pressure Sensors:
   a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
   b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
   c. The transmitters shall be installed in an accessible location wherever possible.
7. Medium to High Differential Water Pressure Applications (Over 21” wg):
   a. Air bleed units, bypass valves and compression fittings shall be provided.
8. Differential Air Pressure Applications (-1” to +1” wg):
   a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
   b. The interior tip shall be inconspicuous and located as shown on the drawings.
9. Duct Temperature Sensors:
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
   b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
   c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists, such as a mixed air plenum, utilize an averaging sensor.
   d. The sensor shall be mounted to suitable supports using factory approved element holders.
10. Low Temperature Limit Switches:
   a. Install on the discharge side of the first water or steam coil in the air stream.

b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

11. Air Differential Pressure Status Switches:
    a. Install with static pressure tips, tubing, fittings and air filter.
12. Water Differential Pressure Status Switches:
    a. Install with shut off valves for isolation.
13. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
14. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
15. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI.

3.2 TRAINING:

A. The Controls Contactor shall provide the following training services for the Owner's Representatives at common sessions:
    1. Four hours of on-site orientation by a Field Engineer who is fully knowledgeable of the specific installation details of the Project. This orientation shall, at a minimum, consist of a review of the Project as-built documentation, the Controls Systems software layout and naming conventions plus a walk through of the Project to identify panel and device locations and to answer site questions.
    2. On-Site training for Owner Representatives. This training shall consist of:
        a. **One** day training covering basic Controls System operation, system reporting and alarm management.
        c. **One** day training of scheduling and point trending.

3.3 VERIFICATION:

A. Fully test and verify all aspects of the Controls Systems Contract work on a point/system/integrated operational basis for all points, features and functions specified.
B. Acceptance Check Sheet
    1. Prepare a check sheet that includes all points and functions of the Work.
    2. Submit the check sheet to the Architect for approval 10 days prior to testing.

3. Complete the check sheets for all items and functions of the Work. Initial each entry with time/date as record of having fully calibrated and tested the Work. Submit to the Architect as record.
4. The Architect will use the check sheets as the basis for Acceptance Testing with the Controls Systems Contractor.

C. Provide all necessary specialist labor, materials and tools to demonstrate to the Architect that the Controls Systems have been verified and are operating in compliance with the Controls Systems Contract. Prepare a list of noted deficiencies signed by both the Architect and the Controls Contractor.

D. Promptly rectify all listed deficiencies and submit in writing to the Architect a signed report that this has been done.

E. The Architect will retest the deficiencies in conjunction with the Controls Contractor at the Architect's option.

3.4 PROJECT SPECIFIC REQUIREMENTS:

A. Schedule of Operator Workstations (OWS) – **Not Applicable**

ID	TYPE	LOCATION	FUNCTION	NOTES

B. Controls Application:

PART 4 - SEQUENCES

4.1 MAU-1

Make-Up Air Unit #1 serves the Nail Salon. This unit consists of a supply fan, power exhaust fan, gas heat, DX cooling, and return air bypass damper. The unit shall be started and stopped by a predetermined schedule from the NAE. The unit shall also have a temporary over-ride start switch. Interlock with exhaust fans EF-4 through EF-6, so make-up air unit will run when any of the exhaust fans are running.

Once enabled, a local ASC shall modulate the gas heat and DX cooling in sequence to maintain space temperature.

There are several associated exhaust fans that serve this same area. The desire is to maintain a slightly negative pressure in the space. As exhaust fans are started and stopped, the local ASC shall modulate the return air bypass damper, and power exhauster to maintain the space static pressure at -0.01" (adj).

4.2 MAU-2

Make-Up Air Unit #2 serves the Art Studio area. This unit consists of a supply fan, power exhaust fan, gas heat, DX cooling, hot water coil and return air bypass damper. The unit shall be started and stopped by a predetermined schedule from the NAE. The unit shall also have a temporary over-ride start switch in space. Interlock with exhaust fans EF-1 through EF-3, so make-up air unit will run when any of the fans are running.

Once enabled, a local ASC shall modulate the gas heat, DX cooling and hot water reheat coil in sequence to maintain space temperature. When OAT is above 55°, the local ASC shall enable the hot water valve to act as the 1st stage of heating. When OAT is below 55°, the gas heat shall be enabled and used as the 1st stage of heating and the hot water coil as the 2nd stage. The DX cooling shall remain off until OAT rises above 65°. These setpoints are initial setpoints only and can be adjusted once the system parameters have been established.

There are several associated exhaust fans that serve this same area. The desire is to maintain a slightly negative pressure in the space. As exhaust fans are started and stopped, the local ASC shall modulate the return air bypass damper, and power exhauster to maintain the space static pressure at -0.01” (adj).

4.3 VAV BOXES W/ REHEAT COILS

The occupied/unoccupied mode of each VAV box is programmed at the central controller for individual occupied/unoccupied schedules. The occupied/unoccupied modes are determined by the central controller or the after hours push button. If the space temperature is equal to or greater than the cooling temperature setpoint, the box controller will modulate the box damper to maintain the space temperature sensor setpoint. The VAV box controller shall calculate the required air quantities subject to preprogrammed maximum and minimum velocity settings.

On a fall in space temperature lower than the cooling temperature setpoint, the box will control to the minimum velocity ventilation setting. On a continued fall in temperature equal to the heating temperature setpoint, the box controller shall open the reheat coil valve to satisfy the space temperature heating setpoint. If the heating water valve is fully open and the space is below setpoint, then the VAV damper shall modulate open to a maximum of 100% of full flow. The reverse occurs on a rise in space temperature greater than its heating temperature setpoint.

In the unoccupied mode, all space temperature setpoints shall be set to 10° F below the occupied temperature setpoint.

4.4 EXHAUST FANS

The ATC contractor shall furnish and install all required controls and interlock wiring per the exhaust fan equipment schedule. Provide DDC controllers and relays where necessary. At a minimum, the status of each exhaust fan shall be monitored through the BMS. Provide a wall switch for each new exhaust fan. Interlock with associated make-up air unit, so exhaust fans can not run without make-up air.

4.5 NETWORK APPLICATION ENGINE (NAE)

The ATC contractor shall furnish and install a new NAE to replace the existing Johnson Controls Companion Panel. All existing ASC's connected to the Companion Panel shall be reconnected to the new NAE. Any new or additional programming required as part of this conversion shall be included in this contract.

END OF SECTION 15910

SECTION 15960 - AIR SYSTEM TEST AND BALANCE

PART 1 - GENERAL

1.1 SCOPE:

A. Includes -
   1. Testing, balancing and adjusting of the following systems:
      a. Supply and Return Air
      b. Exhaust Air
      c. Relief Air
   2. Test Report bound in Operating and Maintenance Manuals.
   3 Contractor shall make changes in pulleys, belts, motors and dampers or add dampers as required for correct balance as recommended by Air Balance & Testing Agency at no additional cost to Owner.

1.2 RELATED SECTIONS:

A. Division 01 General and Sections 15010 and 15051 are part of this Section.

1.3 AGENCY:

A. Contractor shall procure services of an independent Air Balance & Testing Agency which specializes in balancing and testing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.
B. Agency shall provide proof of having successfully completed at least five projects of similar size and scope and be a certified AABC or NEBB agency. Work by this Agency shall be done under direct supervision of a qualified registered professional heating and ventilating engineer employed by Agency. Agency shall maintain an office within 75 miles of project.
C. Instruments used by Agency shall be accurately calibrated and maintained in good working order.
D. If requested, conduct tests in presence of Engineer.
E. Agency shall be approved in writing by the Engineer. Neither Engineer or anyone performing other work on this Project under Division 15 shall be permitted to do this work.
F. Contractor shall award test and balance contract to the approved agency upon receipt of his contract to proceed to allow Agency to schedule this work in cooperation with other Sections involved and comply with completion date.
G. Balancing agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two copies of the Air Balancing Test Report.
H. Engineer will choose and direct spot balancing of one zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire project.
I. Rebalancing shall be done in presence of Engineer and subject to his approval.
J. Spot balance and rebalance shall be performed at no additional cost to Owner.
K. Approved Balancing Agencies
   1. Bonneville Test and Balance
   2. BTC Services

3. Certified Test and Balance
4. Danis Test and Balance
5. Intermountain Test and Balance
6. RS Analysis
7. Technical Specialties

PART 3 - EXECUTION

3.1 PREPARATION

A. Begin air balance and testing upon completion of the mechanical installation of air conditioning, ventilation, heating, exhaust systems, and controls including installation of all specialties and devices.

3.2 PROCEDURES:

A. Before any adjustments are made, the system is to be checked for items such as dirty filters, filter leakage, major duct sections, zones, etc.
B. Contractor shall place exhaust and ventilating systems and equipment into full operation and continue their operation during each working day of testing and balancing.
C. Air Balance & Testing Agency shall perform tests specified, compile test data, and submit four copies of complete test data to Contractor for forwarding to Engineer for evaluation and approval.
   1. Approved copies of report shall be bound in Operations & Maintenance Manuals. See Division 15010 General.
D. Systems shall be completely balanced and all reports submitted to Engineer prior to test run and final inspection.
E. System performance shall be checked when outside weather is at or near design conditions, if practicable. Heating and/or cooling thermometers or sensors shall be placed in the areas served by each fan system. Temperature readings shall be taken at half hour intervals, and further adjustments or corrections made as required to obtain uniform temperatures. All occupied spaces shall be checked for drafts and noises caused by the make-up and exhaust systems, and any unsatisfactory conditions corrected.
F. Balancing shall be performed during normal project working hours when project construction foreman is present on the job site to provide access and see his mechanical sub contractor is available to operate system and make necessary corrections.

3.3 STANDARDS:

A. Balance shall be preformed in complete accordance with the following standards as applicable to the agency certification:
   1. HVAC Systems Testing, Adjusting, and Balancing, SMACNA 1983.
   2. Testing, Balancing, and Adjusting of Environmental Systems, SMACNA 1974.
   3. Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, NEBB 1983.
   4. AABC National Standards, Fourth Edition 1982.
   5. Procedural Standard for Measuring Sound and Vibration, NEBB 1977.

B. Balancing Agency's National Certification shall warrant the system balance and performance. A copy of guarantee certificate shall be included in each test and balance report.

3.4 TESTING PROCEDURE:

A. Air Balance & Testing Agency shall perform following tests and balance system in accordance with following requirements:
B. Test and adjust blower rpm to design requirements.
C. Test and record motor full load amperes.
D. Make Pitot Tube tranverse of main supply and obtain design cfm.
E. Test and record system static pressures, suction, and discharge.
F. Test and adjust system for design cfm air.
G. Test and adjust system for design cfm outside air.
H. Test and record entering air temperatures (db heating and cooling).
I. Test and record entering air temperatures (wb cooling).
J. Test and record leaving air temperatures (db heating and cooling).
K. Test and record leaving air temperatures (wb cooling).
L. Adjust main supply and return air ducts to proper design cfm, + or - 5%.
M. Adjust zones to proper design cfm, supply and return, + or - 5%.
N. Test and adjust each diffuser and grille to design requirements. Individual air outlets, when one of three or more are serving one space, may have a tolerance of 10% from the average.
O. Identify each diffuser and grille as to location and area served.
P. Identify and list size, type, and Manufacturer of diffusers, grilles and testing equipment. Use Manufacturer's rating on equipment to make required calculations.
Q. In readings and tests of diffusers and grilles include required cfm and fpm velocity & test cfm and fpm after adjustments.
R. In cooperation with Section 15 900, set adjustments of automatically operated dampers to operate as specified, indicated, or noted.
S. Adjust diffusers and grilles to minimize drafts.

3.5 EXHAUST AIR SYSTEMS:

A. Systems are to be adjusted to same tolerance as supply systems. Each space is to be checked to see that it is positive, neutral or negative as indicated by quantities of supply and exhaust air shown on contract documents. Any discrepancies shall be investigated and corrected, and the proper pressure relationship established.
B. Building pressure shall be checked at outside doors, relief air damper adjusted as required to leave building neutral or under slight positive pressure.

3.6 REPORT

A. Report shall include:
   1. Record test data on AABC standard forms or facsimile thereof.
   2. A set of black and white or blue line prints with all air openings marked to correspond with data sheets and with temperature clearly marked.
   3. Show on final report the percent of design CFM to the actual CFM of each diffuser represents.

4. The certified report shall include for each air handling system the data listed below:
   a. Equipment
      1) Installation data
         a) Manufacturer and model
         b) Size
         c) Arrangement, discharge, and class
         d) Motor hp, voltage, phase, cycles, and full load amps
         e) Location and local identification data
      2) Design data
         a) Data listed in schedules on drawings and specifications.
      3) Fan recorded (test) data
         a) cfm
         b) Static Pressure
         c) rpm
         d) Motor operating amps
         e) Motor operating bhp
   b. Duct systems
      1) Duct air quantities (maximum and minimum) - main, submains, branches, outdoor (outside) air, total air, and exhaust.
         a) Duct size(s)
         b) Number of Pitot tube (pressure) measurements.
         c) Sum of velocity measurements (Note: Do not add pressure measurements)
         d) Average velocity
         e) Recorded (test) cfm
         f) Design cfm
      2) Individual air terminals
         a) VAV box number and maximum and minimum settings.
         b) Terminal identification (supply or exhaust, location and number designation)
         c) Type size, manufacturer and catalog identification
         d) Applicable factor for application, velocity, area, etc., and designated area
         e) Design and recorded velocities - fpm
         f) Design and recorded quantities - cfm
         g) % of design recorded quantity- cfm represents

END OF SECTION 15960

SECTION 15970 - WATER SYSTEM TEST AND BALANCE

PART 1 GENERAL

1.1 SUMMARY

A. Provide hot water, chilled water and condenser water system testing & balancing.

1.2 SUBMITTALS

A. Quality Assurance - Agency will submit four copies of complete test data to Architect for evaluation and approval including neatly typed listing of items required by Contract Documents.
B. Closeout Submittals - Agency will submit approved copies of water test and balance report for inclusion in Operations & Maintenance Manual.

1.3 QUALITY ASSURANCE

A. Qualifications - Work by Agency will be performed under direct supervision of qualified Heating and Ventilating Engineer employed by Agency.

1.4 SEQUENCING

A. Test and balance subcontract will be awarded to Agency upon contractor's receipt of Notice to Proceed to allow Agency to schedule this work in cooperation with work of other Sections involved and to comply with completion date.
B. Schedule testing & balancing to begin upon completion of cooling and heating systems including installation of all specialties and devices. Begin work of this Section after heating, ventilating, and cooling systems and equipment are in full operation and continue their operation during each working day of testing and balancing. Agency shall be same as is performing work under section 15994.

PART 2 PRODUCTS -
(Not Used)

PART 3 EXECUTIONS -

3.1 FIELD QUALITY CONTROL

A. Site Tests
1. Instruments used by Agency will be accurately calibrated and maintained in good working order.
2. Balance & Testing Agency will provide technicians with following instruments for field use
   a. One set of pressure gauges and fittings
   b. Dry bulb thermometer
   c. Wet bulb thermometer
   d. Thermocouple unit and thermocouples
   e. Set of balancing cock adjustment wrenches

f. Portable field flowmeter

3. If requested, conduct tests in presence of Architect.
4. Preparation of System - Phase I
   a. Open valves to full position including coil stop valves, close bypass valves, and return line balancing cocks.
   b. Remove and clean strainers.
   c. Examine water in system to determine if it has been treated and is clean.
   d. Check pump rotation.
   e. Check expansion tanks to make sure they are not air bound and system is full of water.
   f. Check air vents at high points of water systems to make sure they are installed properly and are operating freely. Make certain air is removed from circulating system.
   g. Set temperature controls so coils are calling for full heating or cooling.
   h. Check operation of automatic valves.
   i. Check and set operating temperature of boilers and chiller to design requirements.
   j. Perform air balance before beginning water balance.
5. Performance of Testing & Balancing - Phase II
   a. Set pumps to proper gpm delivery.
   b. Adjust flow of hot water through boilers, chilled water through chiller and condensing water thru chiller and cooling tower.
   c. Check leaving water temperatures, return water temperatures, and pressure drop through boilers and chiller. Reset to correct design temperatures.
   d. Check water temperature at inlet side of coils. Note rise or drop of temperatures from source.
   e. Balance each water coil.
   f. Upon completion of flow readings and coil adjustments, mark settings and record data.
6. Performance of Testing & Balancing - Phase III
   a. After making adjustments to coils, recheck settings at pumps, chiller, cooling tower and boilers. Readjust if required.
   b. Install pressure gauges on each coil, then read pressure drop through coil at set flow rate on call for full heating and cooling.
   c. Check and record the following items at each heating element -
      1) Inlet water and air temperatures
      2) Leaving water and air temperatures
      3) Pressure drop of each coil
      4) Pressure drop across bypass valve
      5) Pump operating suction and discharge pressures and final TDH
      6) Mechanical specifications of pumps
      7) Rated and actual running amperage of pump motor

END OF SECTION 15970

DIVISION 16
ELECTRICAL

16001 ELECTRICAL GENERAL PROVISIONS
16070 ELECTRICAL CONNECTIONS FOR EQUIPMENT
16080 DEMOLITION
16110 CONDUIT RACEWAYS
16120 CONDUCTORS AND CABLES (600V AND BELOW)
16135 ELECTRICAL BOXES AND FITTINGS
16136 SUPPORTING DEVICES
16140 WIRING DEVICES
16155 MOTOR STARTERS

SECTION 16001 - ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical work is indicated on drawings and/or specified in Division 16 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items.

	ITEM	SECTION
1.	Electrical General Provisions	16001
2.	Electrical Connections for Equipment	16070
3.	Demolition	16080
4.	Conduit Raceways	16110
5.	Conductors and Cables	16120
6.	Electrical Boxes and Fittings	16135
7.	Supporting Devices	16136
8.	Motor Starters	16155
9.	Motor and Circuit Disconnects	16170
10.	Grounding	16452

B. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus and systems required as a portion of this work.

C. Visit the site during the bidding period to determine existing conditions affecting electrical and other work. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.3 DEFINITION OF TERMS

A. The following terms used in Division 16 documents are defined as follows:

1. "Provide": Means furnish, install and connect, unless otherwise indicated.
2. "Furnish": Means purchase and deliver to project site.
3. "Install": Means to physically install the items in-place.
4. "Connect": Means make final electrical connections for a complete operating piece of equipment.

1.4 RELATED SECTIONS:

A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

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B. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications, apply to all Division 16 sections.

C. Miscellaneous Metal Work:

1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor controls centers, etc. See Division 5, Metals for material and installation requirements.

D. Painting:

1. Provide surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, poles, surface metal raceways, etc. See Division 9, Finishes for material and installation requirements.

1.5 WORK FURNISHED AND INSTALLED UNDER ANOTHER SECTION REQUIRING CONNECTIONS UNDER THIS SECTION:

A. Provide electrical service, make requisite connections and perform operational test. Items furnished and installed under other sections and connected under this section, include but are not limited to the following:

1. Electric motors.
2. Package mechanical equipment: fans, fan coil units, pumps, boilers, duplex compressors, etc.
3. Duct mounted smoke detectors.

1.6 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:

A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose, and function of the Contract Documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

1.7 QUALITY ASSURANCE:

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refers to the latest edition of such publications adopted and published prior to submittal of the bid proposed, unless noted otherwise herein. Such codes or standards are considered a part of this specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications. Perform work in accordance with applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:

1. National Electric Code (NEC).
2. International Building Code (IBC).
3. International Fire Code (IFC).
4. International Mechanical Code (IMC).

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C. Standards: Comply with the following standards where applicable for equipment and materials specified under this Division.

1.	UL	Underwriters' Laboratories
2.	ASTM	American Society for Testing Materials
3.	CBN	Certified Ballast Manufacturers
4.	IPCEA	Insulated Power Cable Engineers Association
5.	NEMA	National Electrical Manufacturer's Association
6.	ANSI	American National Standards Institute
7.	ETL	Electrical Testing Laboratories

D. All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

E. Comply with requirements of State and Local Ordinances. If a conflict occurs between these requirements and the Contract Documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the Contract Documents which may be in excess of the aforementioned requirements, and not contrary to same.

F. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.

G. Employ only qualified craftsmen with at least three years of experience. Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices. Provide a competent superintendent to direct the work at all times. Any person found incompetent shall be discharged from the project and replaced by satisfactory personnel.

H. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.8 SUBMITTALS:

A. SHOP DRAWINGS AND PRODUCT DATA:

1. After the Contract is awarded but prior to manufacture or installation of any equipment, prepare complete Shop Drawings and Brochures for materials and equipment as required by each section of the specification. Submit 8 complete sets for review. All sets of shop drawing material shall be bound. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to insure proper clearance for installation of equipment. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawing and/or Brochure is submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data

2. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly

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understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.

3. Certifications shall be written or in the form of rubber stamp impressions as follows:

4. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Signed_____.

Position_____ Date

5. Observe the following rules when submitting the Shop Drawings and Brochures.

a. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be returned for resubmittal.

b. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs, which describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

1.9 GUARANTEE:

A. Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes. Without additional charge, replace any work or materials, which develop defect, except from ordinary wear and tear, within one year from the date of substantial completion. Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

PART 2 – PRODUCTS

2.1 GENERAL:

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A. Products are specified by manufacturer name, description, and/or catalog number. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer who will issue interpretation and/or additional instructions to Bidders before the project is bid.

2.2 MANUFACTURERS:

A. Provide products of manufacturers specified. Manufacturers catalog numbers and descriptions establish the quality of product required. Substitutions will be considered if a duplicate written application (2-copies) is at the office of the Architect/Engineer eight (8) working days prior to the day of the bidding. The application shall include the following: 1) A statement certifying that the equipment proposed is equal to that specified; that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.

B. Any conflict arising from the use of substituted equipment shall be the responsibility of the Contractor, who shall bear all costs required to make the equipment comply with the intent of the contract documents.

C. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.

D. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued.

E. Provide only equipment specified in the Contract Documents or approved by addendum.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.

B. Since the drawings of floor, wall, and ceiling installation are made at small scale; outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable

C. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus.

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D. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

3.2 CLEAN:

A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.

3.3 POWER OUTAGES:

A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the Owner. Include all costs for overtime work in bid.

B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.

C. Keep all outages to an absolute minimum.

3.4 STORAGE AND PROTECTION OF MATERIALS:

A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.5 ROOF PENETRATIONS:

A. Where raceways penetrate roofing or similar structural area, provide appropriate roof jack coordinate with the roofing contractor and the Architect in order to match the vent with the roof construction. The jack shall be sized to fit tightly to raceway for weather-tight seal, and with flange extending a minimum of 9" under roofing in all sides or as required by the roof type of construction. Completely seal opening between inside diameter of roof flashing and outside diameter of penetrating raceways. Coordinate all work with work required under roofing section of specifications.

3.6 FIRE PENETRATION SEALS:

A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs, and similar structures. Where applicable, provide 3M fire barrier sealing penetration system, and/or IPC Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps, and other accessories as required. All materials to comply with UL 1479 (ASTM E-814). Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

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3.7 FINAL REVIEW:

A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

END OF SECTION 16001

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SECTION TITLE - 16070 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connection for equipment includes final electrical connection of all equipment having electrical requirements. Make final connections for all owner furnished equipment. See other applicable portions of specification for building temperature control wiring requirements.

B. Refer to Division-15 sections for motor starters and controls furnished integrally with equipment; not work of this section.

C. Refer to Division-15 section for control system wiring; not work of this section.

D. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE: Comply with applicable portions of NEC as to type products used and installation of electrical power connections.

B. UL LABELS: Provide electrical connection products and materials, which have been UL-listed and labeled.

PART 2 – PRODUCTS

2.1 GENERAL:

A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. Crimp on or slip-on type splicing materials (insulation displacement type) designed to be used without wire stripping are not acceptable. See Section 16110, Conduit Raceways; Section 16140 Wiring Devices: and Section 16120 Wire and Cable for additional requirements. Provide final connections for equipment consistent with the following:

B. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.

C. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

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PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.

C. Coordinate installation of electrical connections for equipment with equipment installation work.

D. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings to Architect before proceeding with rough-work.

E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.

F. Refer to basic materials and methods Section 16120, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 16070

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SECTION 16080 – DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Special Provisions, Division 1 and Division-2A Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to demolition.

1.2 DESCRIPTION OF WORK:

A. Extent of major items of demolition work is indicated by drawings. Other demolition work shall be performed as required to maintain system operation.

B. The intent of the drawings is to indicate major items affected and not to show every device, outlet, fixture, etc. affected by demolition work.

C. The drawings do not necessarily reflect as-built conditions. The contractor shall visit the jobsite prior to bidding to determine the overall scope of demolition work.

D. Refer to sections of other Divisions for applicable requirements affecting demolition work.

E. Refer to Section 16001 for requirements with regard to power outages affecting the operation of existing electrical systems.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE:

1. Comply with applicable portions of NEC as to methods used for demolition work.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Repair damage to building and equipment. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting of structural members shall not be permitted.

2.2 PATCHING AND REPAIR

A. The Contractor is responsible for all demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (painted, etc.) to match the adjacent materials, finishes and colors.

B. Hard surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it shall be the responsibility of this contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, etc.

C. The method of patching and repair shall follow good construction practices and all finished surfaces shall match materials and finish wherein the demolition occurred.

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2.3 EXISTING EQUIPMENT

A. The following is a part of this project and all costs pertaining thereto shall be included in the base bid.

B. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply, unless otherwise specified.

C. The existing electrical devices, conduit and/or equipment that for any reason obstructs construction shall be relocated. Provide conduit, wiring, junction boxes, etc. as required to extend existing circuits and systems to relocated devices or equipment.

D. When installing equipment in the existing building, it shall be concealed.

E. All existing electrical equipment and systems in portions of the building not being remodeled shall be kept operational, in service and in working condition throughout the entire construction period. Restore any circuits and systems interrupted. Provide temporary panels, temporary wiring and conduit, etc. as required.

F. Maintain circuit integrity and continuity of all existing circuits and systems that interfere with or are interrupted by remodel work unless those circuits are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduit, etc. as required.

G. Existing raceways shall be used where possible, except as noted. All circuits, conduit and wire that are not used in the remodeled area shall be removed back to the panelboard, where it shall be labeled a spare with circuit number indicated.

H. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.

I. Any and all equipment having electrical connections that require disconnecting and reconnection at the same or another location throughout the course of construction shall be included as part of this contract.

END OF SECTION 16080

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SECTION 16110 - CONDUIT RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to electrical raceways and specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the following:

1. Electrical Metallic Tubing
2. Flexible Metal Conduit
3. Intermediate Metal Conduit
4. Liquid-tight Flexible Metal Conduit
5. Rigid Metal Conduit

1.3 QUALITY ASSURANCE:

A. MANUFACTURERS: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. STANDARDS: Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components, which have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.

C. SUBMITTALS: Not required.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING:

A. GENERAL:

1. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".

B. RIGID METAL CONDUIT (RMC): FS WW-C-0581 and ANSI C80.1.

C. INTERMEDIATE STEEL CONDUIT (IMC): FS WW-C-581.

D. ALUMINUM CONDUIT: Not acceptable.

E. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:

1. Provide fully threaded malleable steel couplings; raintight and concrete tight

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where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

F. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.

G. EMT FITTINGS:

1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.

H. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;

1. Zinc-coated steel.

I. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1, and Style A.

J. LIQUID TIGHT FLEXIBLE METAL CONDUIT:

1. Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).

K. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.

L. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.2 CONDUIT; TUBING; AND ACCESSORIES:

A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.

2.3 SEALING BUSHINGS:

A. Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

2.4 CABLE SUPPORTS:

A. Provide OZ cable supports for vertical risers, type as required by application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with the following:

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1. BRANCH CIRCUITS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:
   a. Install in electric metallic tubing (EMT); In areas exposed to weather, moisture, or physical damage, install in GRC or IMC.

B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.

C. Install raceway in accordance with the following:

1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and connections to motors, equipment, and surface mounted cabinets unless exposed work is indicated on the drawings. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.

2. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.

D. Comply with NEC for requirements for installation of pull boxes in long runs.

E. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandril and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.

F. Replace all crushed, wrinkled or deformed raceway before installing conductors.

G. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.

H. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.

END OF SECTION 16110

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SECTION 16120 - CONDUCTORS AND CABLES (600V AND BELOW)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to conductors and cables specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.

B. Types of conductors and cables in this section include the following:

1. Copper Conductors (600V)
2.

C. Applications for conductors and cables required for project include:

1. Branch Circuits

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables which have been UL-listed and labeled.

B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.

C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

1.4 SUBMITTALS: Not Required.

PART 2 - PRODUCTS

2.1 COPPER CONDUCTORS (600V):

A. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide proper selection to comply with project's installation requirements and NEC standards. Provide conductors in accordance with the following:

1. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG. Provide stranded conductors for #8 AWG and larger.

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B. Provide color and coding of conductors as follows:

120/208V	277/480V
A-Phase - Black	A-Phase - Brown
B-Phase - Red	B-Phase - Purple
C-Phase - Blue	C-Phase - Yellow
Neutral - White	Neutral - Gray
Ground - Green	Ground - Green

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.

B. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.

C. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Nonmetallic jacketed cables of small size may be pulled directly by conductors by forming them into a loop to which pull wire can be attached; remove insulation from conductors before forming the loop. Larger sizes of cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.

D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension,

E. Follow manufacturer's instructions for splicing and cable terminations.

3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:

A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions. Submit record in triplicate of megohmmeter readings to Architect/Engineer.

B. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION 16120

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SECTION 16135 - ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to electrical wiring boxes and fittings specified herein. See Section 16110, Raceways, for additional requirements.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical box and electrical fitting work is indicated by drawings and schedules.

B. Types of electrical boxes and fittings in this section include the following:

1. Outlet Boxes
2. Junction Boxes
3. Conduit Bodies
4. Bushings
5. Locknuts
6. Knockout Closures
7. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134,1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings which have been UL-listed and labeled.

1.4 SUBMITTALS: None required

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

A. WEATHERPROOF OUTLET BOXES:

1. Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, with face plate gaskets and corrosion-resistant fasteners.

B. JUNCTION AND PULL BOXES:

1. Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

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C. CONDUIT BODIES:

1. Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

D. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS:

1. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable steel conduit bushings and offset connectors, of types and sizes to suit respective uses and installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. GENERAL:

1. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

2. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

3. Provide coverplates for all boxes. See Section 16140, Wiring Devices.

4. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.

5. Provide knockout closures to cap unused knockout holes where blanks have been removed.

6. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Do not install boxes above ducts or behind equipment. Install recessed boxes with face of box or ring flush with adjacent surface. Seal between switch, receptacle and other outlet box openings and adjacent surfaces with plaster, grout, or similar suitable material.

7. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them.

8. Provide electrical connections for installed boxes.

END OF SECTION 16135

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SECTION 16136 - SUPPORTING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to supports, anchors, sleeves, and seals, specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of supports, anchors, and sleeves is indicated by drawings and schedules and/or specified in other Division-16 sections. See Section 16110, Raceways, for additional requirements.

B. Work of this section includes supports, anchors, sleeves and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hole conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, threaded rods and all associated accessories.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies". Provide electrical components which are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

A. GENERAL:

1. Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

A. Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

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C. Install hangers, supports, clamps and attachments to support piping properly from building structures. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. For pre-and post tensioned construction, use pre-set inserts for support of all electrical work. Do not use toggle bolts, moly bolts, wood plugs or screws in sheetrock or plaster as support for any equipment or raceway.

D. RACEWAYS:

1. Support raceways, which are rigidly attached to structure at intervals not to exceed 8 feet on center, minimum of two straps per 10-foot length of raceway, and within 12" of each junction box, coupling, outlet or fitting. Support raceway at each 90-degree bend. Support raceway (as it is installed) in accordance with the following:

NUMBER OF RUNS	3/4" TO 1-1/4" 0	1-1/2" & LARGER 0
1	Full straps, clamps or hangers.	Hanger
2	Full straps, clamps or hangers.	Mounting Channel
3 or more	Mounting Channel	Mounting Channel

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.

END OF SECTION 16136

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SECTION 16140 - WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems, which are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this section include the following:

1. Receptacles

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of electrical wiring devices. Provide electrical wiring devices which have been UL listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

A. FABRICATED WIRING DEVICES:

B. GENERAL:

1. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA Stds. Pub No. WD 1.

2. Provide wiring devices (of proper voltage rating) as follows:

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MFGR.	RECEPTACLE	SWITCHES 1-POLE	3-WAY	4-WAY	W-PILOT
Hubbell	HBL5352	HBL 1221	HBL 1223	HBL1224	HBL1221-PL
Bryant	5352	1221	1223	1224	1221-PL
Pass Seymour	5352	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	5362	1221	1223	1224	
Cooper	5352	1221	1273	1224	1221-PL

3. Provide devices in colors selected by Architect. Provide red devices on all emergency circuits.

MANUFACTURER

C. GROUND-FAULT INTERRUPTER:

1. Provide general-duty, duplex receptacle, ground-fault circuit interrupters; feed-thru types, capable of protecting connected downstream receptacles on single circuit; grounding type UL-rated Class A, Group A, 20-amperes rating; 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; color as selected by Architect. Provide Hospital grade where required elsewhere by specification or drawings. Provide units of one of the following:

   a. P&S/Sierra
   b. Hubbell
   c. Leviton
   d. Square D

D. WEATHER-PROTECTING DEVICE ENCLOSURES:

1. Where required for compliance with NEC 410-57 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers which provide complete protection with the cord and cap inserted into the wiring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

   a. Intermatic WP1020 or WP1030
   b. P&S WIUC10C or WIUC20c

PART 3 – EXECUTION

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.

B. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris. Mark each device box (for each type of wiring device) with a permanent ink felt tip marker, indicating the circuit to which the device is connected. Example: "CKT A-1".

C. Provide separate neutral conductor from panel to each GFI receptacle.

D. Install GFI receptacles for all receptacles installed outdoors.

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3.2 PROTECTION OF WALL PLATES AND RECEPTACLES:

A. At time of substantial completion, replace those items which have been damaged, including those stained, burned and scored.

3.3 GROUNDING:

A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated.

3.4 TESTING:

A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 16140

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SECTION 16155 - MOTOR STARTERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-16 Basic Materials and Methods section, and is part of Division-16 sections making reference to motor starters specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of motor starter work is indicated by drawings and schedules.

B. Types of motor starters in this section include the following:

1. AC Fraction Horsepower Manual Starters
2. AC Line Voltage Manual Starters

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA Standards as applicable to wiring methods, construction and installation of motor starters. Comply with applicable requirements of UL 508, "Electric Industrial Control Equipment", pertaining to electrical motor starters. Provide units, which have been UL-listed and labeled.

1.4 SUBMITTALS:

A. PRODUCT DATA: Submit manufacturer's data on motor starters.

B. SHOP DRAWINGS: Submit dimensioned drawings of motor starters showing accurately scaled equipment layouts.

PART 2 - PRODUCTS

A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):

1. Crouse-Hinds Co.
2. Eaton Corp., Cutler Hammer Products
3. General Electric Co.
4. Siemens Energy and Automation
5. Square D Co.
6.

B. MAINTENANCE STOCK, FUSES: For types and ratings required, furnish additional fuses, amounting to one unit for every 10 installed units, but not less than 5 units of each, for both power and control circuit fuses.

2.2 MOTOR STARTERS:

A. GENERAL: Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated which comply with manufacturer's standard materials, design and construction in accordance with published information and as required for complete installations.

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B. THERMAL OVERLOAD UNITS: Provide thermal overload units, sized to actual running full load current, not to motor plate current. Size heaters for mechanical equipment after air and water balancing have been completed.

C. AC FRACTIONAL HP MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide manual, single-phase, 1 and 2 pole, 300 volt AC max, fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with one piece thermal overload relay with field adjustment capability of plus or minus 10 percent of nominal overload heater rating; for protection of AC motors of 1 HP and less. (For manually controlled motors in excess of 1 HP, see Line Voltage Manual Starters specified herein). Provide starter with quick-make, quick-break trip free toggle mechanisms, green pilot lights, and with lock-off toggle operated handle. Mount surface units in NEMA 1 enclosures, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location unless noted otherwise. Provide flush mounted units with coverplate to match wiring device coverplates.

D. AC LINE VOLTAGE MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide line voltage manual starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt AC max; equip with pushbutton operator, low voltage protection feature, and green pilot light. Provide starters with trip free mechanism such that contacts will open under load and remain open until thermal element has cooled, and unit is reset. Mount surface units in NEMA 1 enclosure, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location, unless noted otherwise. Provide overlapping trim for flush mounted units.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS:

A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install fuses in fusible disconnects, if any. Mount chart inside each starter indicating heater type, size, and ampere ratings available.

C. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each starter cabinet. Include mechanical equipment designation, horsepower and voltage.

3.2 ADJUST AND CLEAN:

A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL:

A. Subsequent to wire/cable hook-up, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION 16155

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